10.2 DE TILLA GULCH

10.2.1 Background and Summary of Impacts

10.2.1.1 General Information

The proposed De Tilla Gulch SEZ has a total area of 1,522 acres (6.2 km^2) and is located in Saguache County in south-central Colorado (Figure 10.2.1.1-1). In 2008, the county population was 6,903, while the four-county region surrounding the SEZ—Alamosa, Chafee, Saguache, and Rio Grande Counties—had a total population of 51,974. The largest nearby town, which is located about 50 mi (80 km) to the south, is Alamosa with a 2008 population of 8,745. The village of Saguache is located about 8 mi (12 km) west of the SEZ on U.S. 285, which runs along the northwest side of the SEZ. The SLRG Railroad serves the area. The nearest public airport is the Saguache Municipal Airport near the town of Saguache. Santa Fe, New Mexico, lies about 160 mi (257 km) to the south, and Denver, Colorado, is located about 130 mi (209 km) to the northeast.

An existing 115-kV transmission line is accessible to the SEZ. It is assumed that an existing transmission line could potentially provide access from the SEZ to the transmission grid (see Section 10.2.1.2). There were no pending solar project applications within the SEZ as of February 2010.

The proposed De Tilla Gulch SEZ lies in the northwestern portion of the San Luis Valley, part of the San Luis Basin, a large, high-elevation, basin within the Rocky Mountains. The San Juan Mountains to the west and the Sangre de Cristo Range to the east form the rim of the basin. The land within the proposed SEZ is flat and intersected with dry streambeds that run to the southeast. No developments exist on the land, which is currently used for grazing, nor is there any standing surface water. Scrubland vegetation reflects the arid climate, which produces an annual average rainfall of about 8 in. (20 cm). Large groundwater reserves underlie the area in several aquifers. Little commercial or industrial activity exists in the surrounding area, while agricultural areas lie to the east and to the south.

The proposed De Tilla Gulch SEZ and other relevant information are shown in Figure 10.2.1.1-1. 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 USFWS-designated critical habitat for threatened and endangered species, ACECs, SRMAs, and NLCS lands (see Section 2.2.2.2 for the complete list of exclusions). Although these classes of restricted lands were excluded from the proposed De Tilla Gulch SEZ, other restrictions 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.

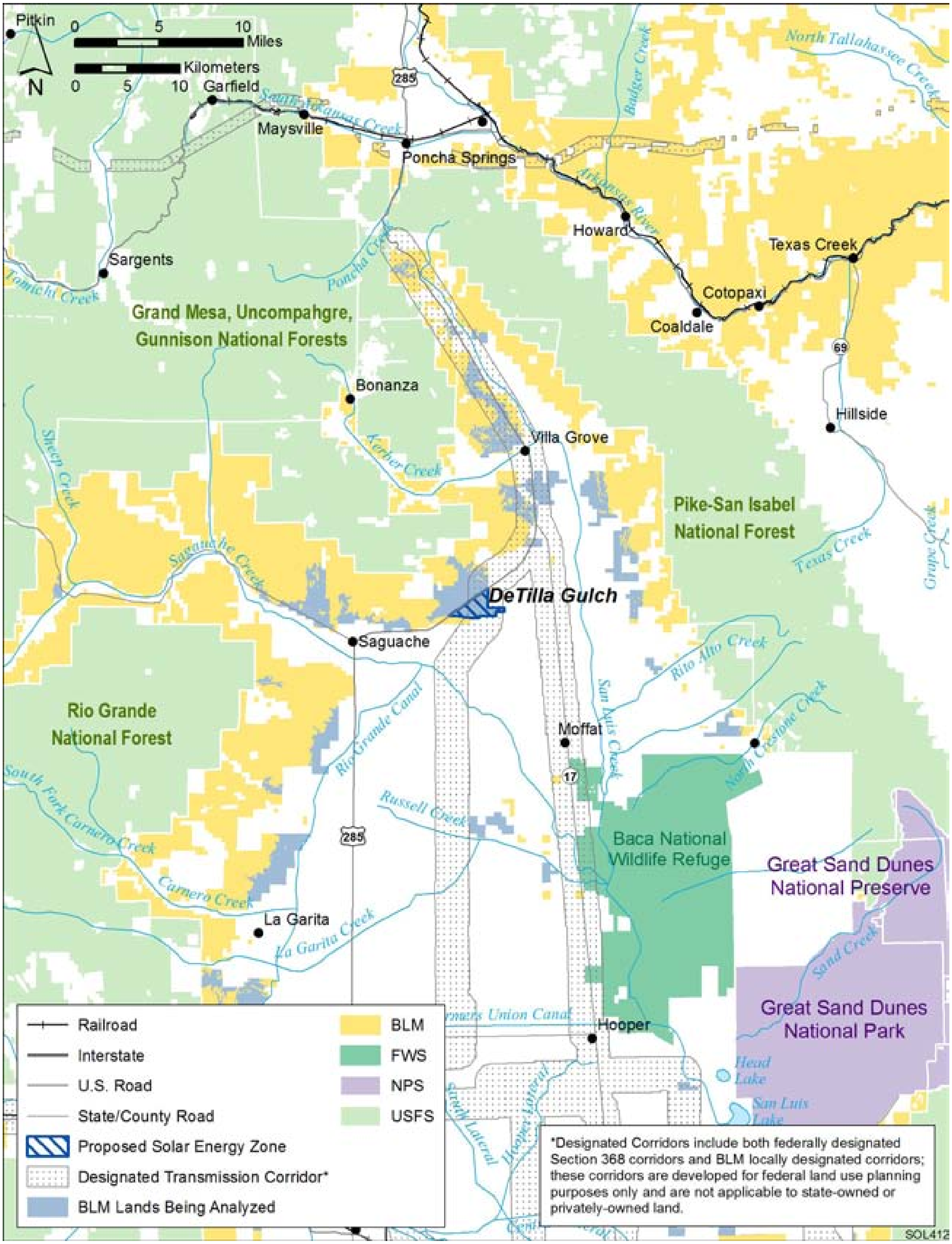

FIGURE 10.2.1.1-1 Proposed De Tilla Gulch SEZ

10.2.1.2 Development Assumptions for the Impact Analysis

Maximum development of the De Tilla Gulch SEZ is assumed to be 80% of the total SEZ area over a period of 20 years, a maximum of 1,217 acres (5 km^2). These values are shown in Table 10.2.1.2-1, along with other development assumptions. Full development of the De Tilla Gulch SEZ would allow development of facilities with an estimated 135 MW of electrical power if power tower, dish engine, or PV technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated total of 243 MW of power capacity if solar trough technologies were used, assuming 5 acres/MW (0.09 km^2/MW) of land required.

Availability of transmission from SEZs to load centers will be an important consideration for future development in SEZs. A 115-kV transmission line crosses the SEZ. It is possible that this existing line could be used to provide access from the SEZ to the transmission grid, but the 115-kV capacity of that line may not be adequate for 135 to 243 MW of new capacity (note: a 500-kV line can approximately accommodate the load of one 700-MW facility). At full build-out capacity, new transmission and or upgrades of existing transmission lines may be required to bring electricity from the proposed De Tilla Gulch SEZ to load centers; however, at this time the location and size of such new transmission facilities is unknown. Generic impacts of transmission and associated infrastructure construction and of line upgrades for various resources are discussed in Chapter 5. Project-specific analyses would need to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

TABLE 10.2.1.2-1 Proposed De Tilla Gulch SEZ—Assumed Development Acreages, Maximum Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Development 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 Corridor[d]
1,522 acres and 1,217 acres[a]	135 MW[b] 243 MW[c]	Adjacent (U.S. 285)	Adjacent and 115 kV	0 acres and 0 acres	Adjacent/Through[e]

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

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

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

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

[e] A BLM locally designated corridor covers about two-thirds of the proposed De Tilla Gulch SEZ.

For purposes of analysis in this PEIS, it was assumed that no additional acreage would be disturbed for transmission line access, because an existing 115-kV transmission line crosses the SEZ. A BLM locally designated corridor also runs through the SEZ, as shown in Table 10.2.1.2-1. Access to an existing transmission line was assumed, without additional information on whether this line would be available for connection of future solar facilities. If a transmission line were constructed in the future to connect facilities within the SEZ to a different off-site grid location from the one assumed here, site developers would need to determine the impacts from construction and operation of that line. In addition, developers would need to determine the impacts of line upgrades if they were needed.

Existing road access to the proposed De Tilla Gulch SEZ should be adequate to support construction and operation of solar facilities, because U.S. 285 runs along the northwestern boundary of the SEZ. Thus, no additional road construction outside of the SEZ is assumed to be required to support solar development of the SEZ, as summarized in Table 10.2.1.2-1.

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

In this section, the impacts and proposed SEZ-specific design features assessed in Sections 10.2.2 through 10.2.21 for the proposed De Tilla Gulch SEZ are summarized in tabular form. Table 10.2.1.3-1 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 10.2.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the De Tilla Gulch SEZ are included in Sections 10.2.2 through 10.2.21 and in the summary table. The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in this and other SEZs.

TABLE 10.2.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed De Tilla Gulch SEZ and Proposed SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ could disturb up to 1,217 acres (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.
	Depending on how the SEZ is developed, a fragmented land pattern of the public lands could be created that would be difficult to manage.	None.
	Possible non-mitigatable impacts are related to induced changes to existing land uses on state and private lands.	None.
	A BLM locally designated corridor covers about two-thirds of the SEZ. It is unlikely that solar development could occur under electric transmission lines, thus it appears that either the transmission corridor would have to be modified, or solar development precluded in the area presently included in the transmission corridor.	None.
Specially Designated Areas and Land with Wilderness Characteristics	Portions of the route of the Old Spanish National Historic Trail pass within 0.25 mi (0.4 km) of the SEZ, and the historic setting of the trail would be adversely affected by SEZ development. Development of the SEZ may also affect future management options for the trail.	Pending completion of a study on the significance and definition of management needs (if any) of the 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	One seasonal grazing allotment likely would be cancelled, and 203 AUMs would be lost. The allotment has not been grazed for about 10 years, so there would be minimal impact.	None.
Rangeland Resources: Wild Horses and Burros	None.	None.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Recreation	Any current recreational users would be displaced from the SEZ, but impacts would be minor.	None.
Military and Civilian Aviation	The SEZ is located in an area adjacent to an MTR and is identified as being a consultation area for the DoD. Development of any solar or transmission facilities that impinge into airspace used by the military could be of concern to the military and could interfere with military training activities.	None.
Geologic Setting and Soil Resources	Impacts on solar resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.
Water Resources	Ground-disturbing activities could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Construction activities may require up to 418 ac-ft (515,600 m^3) of water during the peak construction year. Construction activities would generate as much as 45 ac-ft (55,500 m^3) of sanitary wastewater.	Wet-cooling technologies should incorporate water conservation measures to reduce water needs. To the extent possible, land-disturbance activities should avoid impacts that limit infiltration to this important groundwater recharge area.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	Assuming full development of the SEZ, normal operations would use the following amounts of water: • For parabolic trough facilities (243-MW capacity), 174 to 368 ac-ft/yr (0.2 million to 0.5 million m^3/yr) for dry-cooled systems and 1,221 to 3,656 ac-ft/yr (1.5 million to 4.5 million m^3/yr) for wet-cooled systems; • For power tower facilities (135-MW capacity), 97 to 205 ac-ft/yr (0.1 million to 0.3 million m^3/yr) for dry-cooled systems and 679 to 2,031 ac-ft/yr (0.8 million to 2.5 million m^3/yr) for wet-cooled systems; • For dish engine facilities (135-MW capacity), 70 ac-ft/yr (86,300 m^3/yr); and • For PV facilities (135-MW capacity), 7 ac-ft/yr (8,600 m^3/yr). Assuming full development of the SEZ, normal operations would generate up to 3 ac-ft/yr (3,700 m^3/yr) of sanitary wastewater. Assuming 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 38 to 69 ac-ft/yr (47,000 to 85,000 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 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Vegetation[b]	Construction would result in the removal of all vegetation within facility footprints; re-establishment of shrub or grassland communities would be difficult. Invasive plant species, such as black henbane and spotted knapweed, 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 impacts on wetlands near or downgradient from the SEZ, resulting in disruption of surface water flow, changes in groundwater discharge and sedimentation. The results 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 Shrub Steppe, Greasewood Flat, or Grassland habitats and minimize the potential for the spread of invasive species, such as black henbane or spotted knapweed. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides. All ephemeral dry wash habitats should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area shall be maintained around dry washes to reduce the potential for impacts on these habitats on or near the SEZ. Appropriate engineering controls should be used to minimize impacts on riparian, dry wash, and wetland habitats, including downstream occurrences, such as those associated with Saguache Creek or San Luis Creek, resulting from surface water runoff, erosion, sedimentation, altered hydrology, or accidental spills, and fugitive dust deposition to these and nearby upland habitats. Appropriate engineering controls would be determined through agency consultation.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*		Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetlands or springs near or downgradient from the SEZ, such as many of the wetlands south, southwest, or southeast of the SEZ, including the wetland complexes associated with Saguache and San Luis Creeks, that are associated with groundwater discharge.
Wildlife: Amphibians and Reptiles[b]	Small impacts on amphibian and reptiles could occur from development on the SEZ. No amphibian species occur on the SEZ. Impacts on amphibians are not expected because of the absence of surface waters within the SEZ.	Ephemeral drainages within the SEZ should be avoided to the extent practicable. Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition on aquatic, riparian, and wetland habitats associated with Saguache Creek, San Luis Creek, Rio Grande Canal, and wetland areas located within the area of indirect effects.
Wildlife: Birds[b]	Unmitigated localized impacts on land birds from habitat disturbance and long-term habitat reduction/fragmentation could be small. Impacts on shorebirds, wading birds, and waterfowl are not expected because of the absence of surface waters within the SEZ. 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. Prairie dog colonies (which could provide habitat or food resources for some bird species) should be avoided to the extent practicable.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Wildlife: Birds[b] *(Cont.)*		Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats on aquatic, riparian, and wetland habitats associated with Saguache Creek, San Luis Creek, Rio Grande Canal, and wetland areas.
Wildlife: Mammals[b]	Unmitigated localized impacts on small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/fragmentation would be small. Impacts on American black bear, bighorn sheep, and cougar are expected to be small. The SEZ occurs within the overall range of elk, winter range, and severe winter range of elk; overall range and winter range of mule deer; and overall range, winter range, and winter concentration area of pronghorn; however, impacts on these mammals are expected to be small.	Prairie dog colonies should be avoided to the extent practicable to reduce impacts on species such as desert cottontail and thirteen-lined ground squirrel. The extent of habitat disturbance should be minimized within elk severe winter range and pronghorn winter concentration area. Construction should be curtailed during winter when big game species are present. Where big game winter ranges intersect or are within close proximity to the SEZ, motorized vehicles and other human disturbances should be controlled (e.g., through road closures).
Aquatic Biota[b]	Removal of vegetation and disturbance of surface soils to construct solar energy facilities would likely increase the amount of sediment in nearby wetland areas, negatively affecting aquatic biota, although population effects would be small. Contaminants such as fuels, lubricants, or pesticides/herbicides could have a considerable impact on water quality and aquatic biota. Because of the distance to perennial streams, ponds, or reservoirs, the potential to introduce contaminants is small.	Sediment and erosion controls should be implemented along intermittent drainages that drain toward Saguache or San Luis Creeks.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Aquatic Biota[b] *(Cont.)*	Waterborne sediments originating in the SEZ would not affect aquatic habitats in Kerber Creek (where the presence of Rio Grande cutthroat trout populations has been documented) because Kerber Creek is a different drainage. Withdrawing water from the San Luis or Saguache Creeks or from other perennial surface water features for power plant cooling water, washing mirrors, or other needs, could affect water levels, and, as a consequence, the aquatic organisms in those streams.	
Special Status Species[b]	The following special status species could be affected by development on the SEZ: (1) ESA-listed species: southwestern willow flycatcher; (2) ESA-candidate species: Gunnison's prairie dog; (3) species under review for listing under the ESA: Gunnison sage-grouse, (4) BLM-designated sensitive species: Rio Grande chub, ferruginous hawk, mountain plover, big free-tailed bat, and pale Townsend's big-eared bat; (4) state-listed species: bald eagle, (5) rare species: Bodin milkvetch, Colorado larkspur, Fendler's Townsend daisy, helleborine, James' cat's-eye, least moonwort, mountain whitlow-grass, Philadelphia fleabane, prairie violet, Rocky Mountain blazing star, Southern Rocky Mountain cinquefoil, Wahatoya Creek larkspur, western moonwort, Wright's cliff-brake, hoary skimmer, sphinx moth, American peregrine falcon, short-eared owl, Botta's pocket gopher, common hog-nosed skunk, and plains pocket mouse. All direct and indirect impacts on these species are considered small.	Pre-disturbance surveys should be conducted within the SEZ 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 on occupied habitats is not possible, translocation of individuals from areas of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies. Avoiding or minimizing impacts on grassland habitat on the SEZ could reduce impacts on three special status species.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		Coordination with the USFWS and CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and Gunnison sage-grouse, species that are either a candidate or under review for listing under the ESA. Coordination would identify 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 on consultation with the USFWS and CDOW.
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 area (the Great Sand Dunes WA, 19 mi [31 km] southeast of the proposed SEZ), but the potential impacts 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.	None.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Air Quality and Climate *(Cont.)*	*Operations:* Positive impact due to avoided emissions of air pollutants from combustion-related power generation: 0.5 to 0.9% of total SO_2, NO_x, Hg, and CO_2 emissions from electric power systems in the State of Colorado (up to 564 tons SO_2, 650 tons NO_x, 0.004 tons Hg, and 421,000 tons CO_2).	
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 lines and access roads within the transmission line and road viewsheds. The SEZ is located 0.25 mi (0.4 km) from the route of the Old Spanish National Historical Trail at the route of closest approach. Because of the short distance, strong visual contrasts could be observed from points on the trail farther from the SEZ. The SEZ is 10 mi (16 km) at the point of closest approach northwest of the Baca NWR. Weak to moderate contrasts could be observed from the northern portions of the NWR. The community of Saguache is located within the power tower (650 ft [198.1 m]) viewshed of the SEZ, indicating potential visibility of sufficiently tall power tower receivers. Landforms would likely screen lower-height facility components. Vegetation and buildings would likely screen views toward the SEZ from some locations in Saguache. The community of Moffat is located within the viewshed of the SEZ, although slight variations in topography and vegetation may provide some screening. Weak levels of visual contrast would be expected.	The development of power tower facilities should be prohibited within the SEZ.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads, especially U.S. 285, which is immediately adjacent to the SEZ, and CO 17, approximately 3 mi (5 km) east of the site. Travelers on U.S. 285 might briefly observe strong levels of visual contrast while approaching and passing the SEZ.	
Acoustic Environment	*Construction:* For construction of a solar facility located near the eastern SEZ boundary, estimated noise levels at the nearest residence located about 0.3 mi (0.5 km) from the SEZ boundary would be about 56 dBA, which is higher than typical daytime mean rural background level of 40 dBA. However, an estimated 52 dBA L_{dn} at this residence 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 eastern SEZ boundary, the predicted noise level would be about 47 dBA at the nearest residence, 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 45 dBA L_{dn} would be estimated for the nearest residence, 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 residence would be 57 dBA, which is fairly higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 58 dBA L_{dn}, which is a little higher than the EPA guideline of 55 dBA L_{dn} for residential areas.	Noise levels from cooling systems equipped with TES should be managed so that levels of off-site noise are 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.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Acoustic Environment *(Cont.)*	If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residence would be about 51 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 48 dBA L_{dn} at this residence would be below the EPA guideline of 55 dBA L_{dn} for residential areas.	Dish engine facilities within the proposed De Tilla Gulch SEZ should be located more than 1 mi (1.6 km) from nearby residences to the east and the south of the SEZ (i.e., the facilities should be located in the western area of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could be warranted to reduce noise impacts at nearby sensitive receivers.
Paleontological Resources	The potential for impacts on significant paleontological resources in the De Tilla Gulch SEZ is unknown. A more detailed look at the geological deposits of the SEZ and a paleontological survey are needed.	None.
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 or features, and traditional cultural properties, and to see if any are eligible for listing in the NRHP. Further investigation is needed to determine the possibility of the Old Spanish National Historic Trail crossing through a portion of the SEZ. The northern half of a high-potential segment of the Old Spanish National Historic Trail located approximately 16 mi (26 km) to the southeast of the SEZ would be within the viewshed if a solar facility were installed, regardless of technology type. A high-potential segment 11 mi (18 km) west of the SEZ would not likely be visually affected by solar energy development because of intervening topography. Indirect impacts on cultural resources, such as vandalism or theft, are unlikely since the SEZ is small in size and is readily accessible.	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 in the San Luis Valley.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
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 culturally significant locations within the valley 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.
Socioeconomics	Loss of grazing area could result in the loss of 94 jobs and $1.6 million in income; a loss of $1,560 annually in grazing fees. *Construction:* 85 to 1,129 total jobs; $4.7 million to $61.9 million income in ROI. *Operations:* 4 to79 annual jobs; $0.1 million to $2.6 million annual income in ROI.	None.
Environmental Justice	Because there are no minority or low-income populations as defined by CEQ guidelines within the 50-mi (80-km) radius, there will be no impacts on minority and low-income populations.	None.
Transportation	U.S. 285 provides a regional traffic corridor that could experience moderate impacts for projects that may have up to 1,000 daily workers with an additional 2,000 vehicle trips per day (maximum). Local road improvements would be necessary in any portion of the SEZ along U.S. 285 that might be developed, so as not to overwhelm the local roads near any site access point(s).	None.

TABLE 10.2.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed De Tilla Gulch SEZ	SEZ-Specific Design Features
Transportation *(Cont.)*	The amount of traffic currently using CO 17 could increase approximately threefold. CR 55 and any other access roads connected to it would require road improvements to handle the additional traffic.	

Abbreviations: AAQS = ambient air quality standards; ACHP = Advisory Council on Historic Preservation; AQRV = air quality-related value; AUM = animal unit month; BLM = Bureau of Land Management; CDOW = Colorado Division of Wildlife; CEQ = Council on Environmental Quality; CO_2 = carbon dioxide; CO = Colorado State Highway; CR = County Road; DOE = U.S. Department of Energy; DoD = U.S. Department of Defense; EPA= U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; MTR = military training route; NO_x = nitrogen oxides; NNL = Natural National Landmark; 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; ROI = region of influence; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO_2 = sulfur dioxide; TES = thermal energy storage; USFS = U.S. Forest Service; USFWS = U.S. Fish and Wildlife Service; 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 De Tilla Gulch SEZ.

[b] The scientific names of all plants, wildlife, and aquatic biota are provided in Sections 10.2.10 through 10.2.12.

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10.2.2 Lands and Realty

10.2.2.1 Affected Environment

The proposed De Tilla Gulch SEZ is relatively small and is largely undeveloped, although there are signs of previous surface disturbances throughout the site, including county and informal roads, sand and gravel removal sites, transmission lines, and a windmill to provide livestock water. Access to the site is very good, with the entire northwest side bordered by U.S. 285 and two county roads providing access to much of the rest of the area. The area is bordered on the east and south by private lands, some of which have been developed for irrigated agriculture. Bordering the northwest side of the area but across U.S. 285 is additional public land managed by the BLM. The overall character of the SEZ and the surrounding lands is undeveloped and rural.

ROWs authorizing different uses have been granted by BLM on the public lands within the SEZ, including two power lines, U.S. 285, a county road, and a fiber optic line. Two 115-kV electric transmission lines cross the SEZ in a north–south direction and a locally designated transmission corridor covers much of the SEZ.

There are currently no active applications for ROWs for solar facilities within the De Tilla Gulch SEZ. There is ongoing interest in developing additional solar energy facilities on private lands in the valley.

10.2.2.2 Impacts

10.2.2.2.1 Construction and Operations

The De Tilla Gulch SEZ is small when compared with other proposed SEZs; however, it would establish an industrial area that would exclude most other existing and potential uses from the site, perhaps in perpetuity. Because the character of the area is currently rural, utility-scale solar energy development would introduce a new and discordant land use to the area. It is also possible that with landowner agreement, state and private lands near the SEZ also could be developed in the same or a complementary manner as the public lands in the SEZ.

Current ROW authorizations on the SEZ would not be affected by solar energy development since they are prior rights. Should the SEZ be designated, the BLM would still have discretion to authorize additional ROWs in the area until solar energy development was authorized, and then future ROWs would have to be compatible with the rights granted for solar energy facilities. Because the area is so small, it is not anticipated that approval of solar energy development would have a significant impact on ROW availability in the area.

The SEZ is isolated from other public lands by the presence of U.S. 285, and it would be possible to create an even more fragmented land pattern depending on how the SEZ is developed. This is complicated further by the presence of a congressionally designated portion of the Old Spanish National Historic Trail just south of the SEZ, which would require that this land be retained and managed by the BLM to protect trail resources.

10.2.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

A BLM-designated transmission corridor covers about two-thirds of the SEZ; this represents a potential conflict for future solar development. Although access to transmission facilities is important for solar energy facilities, placement of transmission facilities within the SEZ would reduce the amount of land available for solar power production. Likewise, if the SEZ were fully developed with solar production facilities, future expansion of transmission facilities would have to be located outside of the area on private lands.

With two 115-kV power lines crossing the SEZ, no new transmission line construction was assessed, assuming that additional project-specific analysis would be done for new transmission construction or line upgrades. No new roads would need to be constructed outside of the SEZ to support development of the SEZ, although existing county roads might need to be upgraded to support construction of solar facilities.

10.2.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified for impacts to lands and realty. 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-mitigatable impacts are related to induced changes to existing land uses on state and private lands. These impacts could not be mitigated by the BLM since it has no authority over the lands that might be affected. There also is potential to reduce the capacity of the existing transmission corridor.

10.2.3 Specially Designated Areas and Lands with Wilderness Characteristics

10.2.3.1 Affected Environment

There are no specially designated areas within the proposed De Tilla Gulch SEZ; however, the SEZ is located on the floor of the San Luis Valley, and numerous specially designated areas are located within the viewshed of the site. No lands with wilderness characteristics have been identified within 25 mi (40 km) of the SEZ.

The BLM-administered Black Canyon WSA is located northeast of the SEZ.

The USFS-administered Sangre de Cristo Wilderness is located along the ridgeline on the east side of the San Luis Valley and numerous USFS roadless areas surround the north end of the Valley.

Great Sand Dunes National Park, Preserve, and designated wilderness administered by the National Park Service are located southeast of the SEZ.

USFWS-administered Baca National Wildlife Refuge is located southeast of the SEZ.

The congressionally designated route of the Old Spanish National Historic Trail parallels the southern border of the SEZ.

The BLM-administered Penitente Canyon SRMA is located southwest of the SEZ.

10.2.3.2 Impacts

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 by individual perception. Development of the SEZ, especially full development, would be visible from large portions of these specially designated areas (see Section 10.2.14 for more information on viewsheds). Figure 10.2.3.2-1 shows the locations of the areas discussed below.

10.2.3.2.1 Black Canyon WSA

The WSA is located about 10 mi (16 km) from the SEZ and is elevated more than 1,000 ft (305 m) above it. The SEZ would be in full view of the WSA, but because of the distance to the SEZ and the intervening irrigation pivot developments, it is likely that development of the SEZ would not have a significant adverse impact on wilderness characteristics of the WSA.

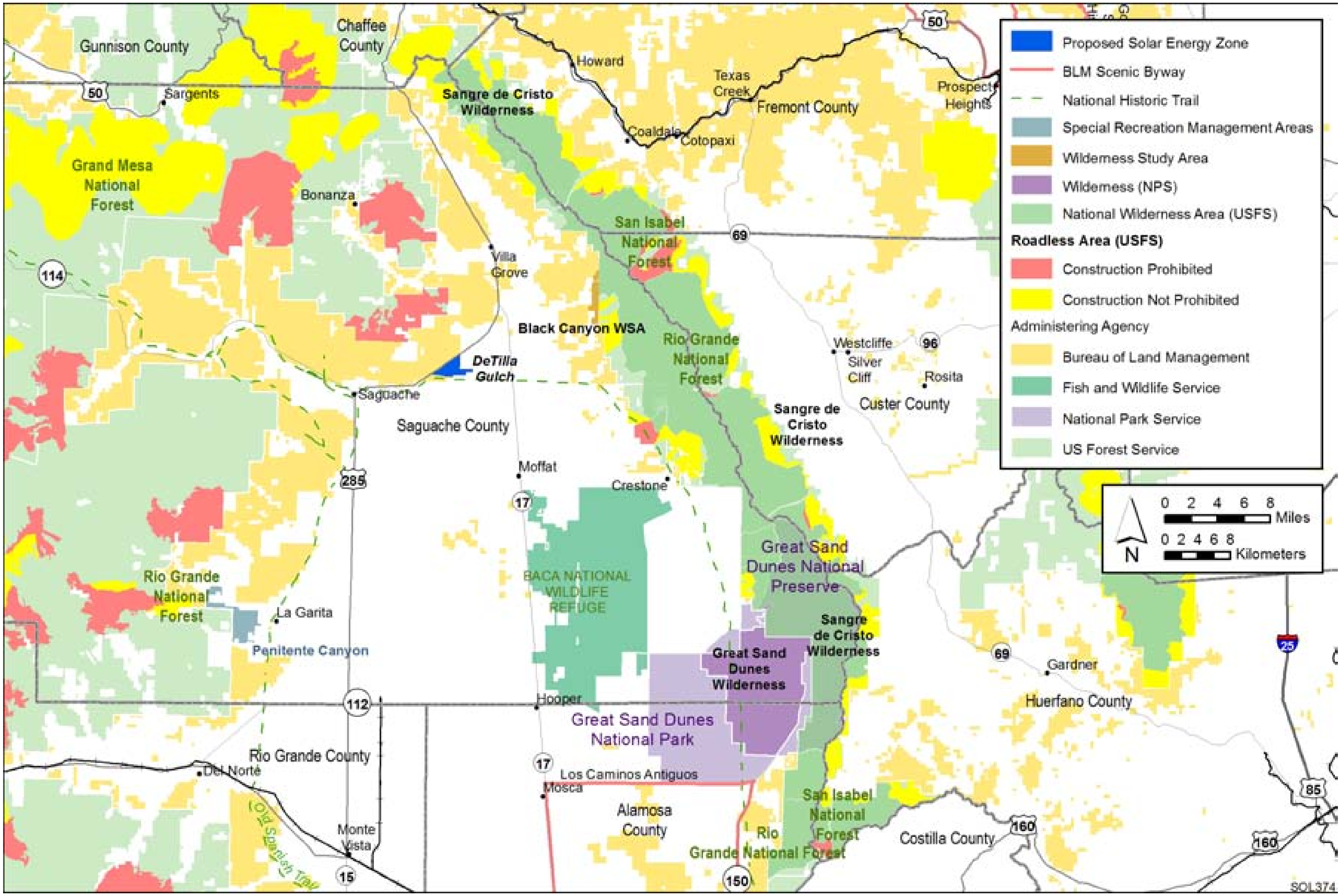

FIGURE 10.2.3.2-1 Specially Designated Areas in the Vicinity of the Proposed De Tilla Gulch SEZ

10.2.3.2.2 USFS-Administered Sangre de Cristo Wilderness and Various Roadless Areas

The designated wilderness crowns the ridgeline on the east side of the San Luis Valley, and the lands on the west side of the ridge have dominating but mostly distant views of the SEZ ranging from 12 to 45 mi (19 to 72 km) away. USFS roadless areas ring the north end of the valley and the SEZ and range from 4 to 25 mi (6 to 40 km) from the SEZ. As shown in Figure 10.2.3.2-1, some of these roadless areas have been identified as being closed to road construction, while some are open for consideration of road construction. Although the SEZ would be visible from portions of both designated wilderness and both types of roadless areas, because of the distance and intervening development in the valley it is anticipated there would not be a significant impact on wilderness characteristics or user experiences. One exception could be the roadless area identified as not being open to road construction just northwest of the SEZ, a large portion of which is within the most visually sensitive zone 0 to 5 mi (0 to 8 km) from the SEZ. This area is somewhat fragmented and is not adjacent to designated wilderness. Depending on the technology employed and the visibility of the SEZ from within the area, visitor use of the roadless area could be affected, but the anticipated impact would be minimal.

10.2.3.2.3 Great Sand Dunes National Park, Preserve, and Wilderness

The national park stretches from 25 to 40 mi (40 to 64 km) from the SEZ. Elevations within the national park vary from high above that of the SEZ to roughly the same elevation. Because of the long distance between the SEZ and the park, although the SEZ may be visible to visitors in portions of the park, it would not provide a dominating view and is expected to have no impact on park visitors or on wilderness characteristics.

10.2.3.2.4 The Baca National Wildlife Refuge

The refuge ranges from as near as 10 mi (16 km) to as far as 30 mi (48 km) from the SEZ. The elevations within the refuge are largely below the elevation of the SEZ, making the SEZ less visible from the refuge. Depending on the solar technology employed, visibility of the SEZ from the refuge would likely be minimal and would therefore be expected to have no effect on the refuge. Because the refuge function is based on availability of water, water use by solar technologies would be a concern (see Section 10.2.9).

10.2.3.2.5 The Old Spanish National Historic Trail

The route of the congressionally designated Old Spanish National Historic Trail passes about 0.25 mi (0.4 km) from the southern border of the SEZ, and solar development of the SEZ would have a major impact on the historic and visual integrity of the trail and on future management of the trail. See Section 10.1.17 for additional information on the trail.

10.2.3.2.6 Penitente Canyon SRMA

This SRMA is located about 25 mi (40 km) southwest of the SEZ. On the basis of visual analysis and depending upon the technologies employed, the SEZ would be visible from portions of the SRMA, but because of the long distance and intervening development in the valley, it is anticipated there would be no impact on use of the SRMA.

10.2.3.3 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 most identified impacts.

Proposed design features specific to the proposed De Tilla Gulch SEZ include the following:

- Pending completion of a study on the significance and definition of management needs (if any) of the Old Spanish National Historic Trail, solar development should be restricted to areas that do not have the potential to adversely affect the setting of the trail.

10.2.4 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 De Tilla Gulch SEZ are discussed in Sections 10.2.4.1 and 10.2.4.2.

10.2.4.1 Livestock Grazing

10.2.4.1.1 Affected Environment

The SEZ includes about 55% of the total acreage of the Crow Allotment, a seasonal allotment that contains a total of 2,783 acres (11 km^2), including 640 acres (2.6 km^2) that are privately owned (BLM 2008b). A windmill on the SEZ previously provided water to support grazing use. A total of 369 AUMs is authorized for the allotment, including 203 AUMs allocated to 2,143 acres (8.7 km^2) of public lands and 166 AUMs allocated to the private land. The allotment has not been grazed by the permittee for about 10 years because of inadequate fencing to control livestock movement.

10.2.4.1.2 Impacts

Should utility-scale solar development occur in the SEZ, grazing would be excluded from the areas developed as provided for in the BLM grazing regulations (43 CFR Part 4100). This would include reimbursement of the permittee for their portion of the value of 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.

The 1,522 acres (6.2 km^2) of public lands in the SEZ make up about 70% of public land in the Crow allotment and contain a water source for the allotment. If full solar development occurred, at a minimum, the federal grazing permit would be modified to remove the public lands in the SEZ from the grazing permit, resulting in the loss of about 142 AUMs and the water source. While it would be possible to continue grazing on the remainder of the public lands in the allotment outside of the SEZ, since the public land in the allotment has not been grazed in recent years, it is likely that the smaller, remaining portion of public land would continue to not be grazed and that the grazing permit eventually would be cancelled, resulting in the loss of all 203 AUMs on the public lands. Section 10.2.19.2.1 provides more information on the economic impact of the loss of grazing on the allotment. Since the permittee has not been grazing the SEZ in recent years, there would be no impact associated with the loss of the 203 AUMs.

10.2.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, could minimize impacts to grazing operations. No additional SEZ-specific design features would be required.

10.2.4.2 Wild Horses and Burros

10.2.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area; there are no wild or feral horses in or in proximity to the proposed De Tilla Gulch SEZ.

10.2.4.2.2 Impacts

Solar energy development of the De Tilla Gulch SEZ would not affect wild horses and burros.

10.2.4.2.3 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.

10.2.5 Recreation

10.2.5.1 Affected Environment

The proposed De Tilla Gulch SEZ is very small and flat and does not possess unique recreational resource values, and it is isolated by U.S. 285 from a larger block of public lands to the northwest. There may be some occasional use of the area by small game hunters. There are no OHV Open Areas or Designated Routes within the SEZ, although there may be some use of dirt roads within the area for backcountry driving.

10.2.5.2 Impacts

Recreational users would be displaced from areas developed for solar energy production But no significant loss of recreation use is expected to occur from solar development in the SEZ.

10.2.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required to protect recreational resources. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would minimize impacts on recreational use.

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10.2.6 Military and Civilian Aviation

10.2.6.1 Affected Environment

The proposed De Tilla Gulch SEZ is located in an area near an MTR and is under Special Use Airspace (SUA). The area is identified in the BLM land records (BLM and USFS 2010) as a consultation area for the DoD.

The area is also located about 8 mi (12 km) from the Saguache Municipal Airport.

10.2.6.2 Impacts

The development of any solar or transmission facilities that impinge into military airspace could be of concern to the military and could interfere with military training activities. However, preliminary input from the military indicates that there are no concerns about the potential impacts of solar development within this SEZ on its activities.

There are no anticipated impacts on the Saguache Airport although the FAA could require special marking of certain types of solar facilities.

10.2.6.3 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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10.2.7 Geologic Setting and Soil Resources

10.2.7.1 Affected Environment

10.2.7.1.1 Geologic Setting

Regional Geology

The proposed De Tilla Gulch SEZ is located in the northern part of the San Luis Valley, an alluvium-filled basin within the Southern Rocky Mountain physiographic province in south-central Colorado (Figure 10.2.7.1-1). 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 (Burroughs 1981; Figure 10.2.7.1-2). The proposed De Tilla Gulch SEZ is located at the northern end of the Alamosa Basin near Saguache. The Alamosa Basin is divided by a north-trending uplifted fault block (the Alamosa horst) that separates two down-dropped fault blocks (grabens): the Monte Vista graben to the west and the Baca graben to the east (Figure 10.2.7.1-3) (Leonard and Watts 1989).

The proposed De Tilla Gulch SEZ likely sits above the Monte Vista graben, where basin fill sediments are estimated to be about 10,000 ft (30,400 m) deep (Figure 10.2.7.1-3) (Leonard and Watts 1989). The uppermost stratigraphic unit is the Alamosa Formation (Pliocene to Holocene), a fluviolacustrine formation consisting of a series of discontinuous blue clays interbedded with water-bearing sands that make up the unconfined and confined aquifers in the region. The Alamosa Formation is about 1,000 ft (1,600 m) thick above the Monte Vista graben. It thins to the west and is cut by channel-fill sands of various drainages in the valley. Underlying the Alamosa Formation are the alluvial sediments of the Los Pinos Formation. The Los Pinos Formation (Oligocene to Pliocene) consists of eastward-thickening sandy gravels interbedded with volcanic rocks (tuffs and tuffaceous siltstones and conglomerates). The Los Pinos gravels are thought to represent coalescing alluvial fans developed along the eastern flank of the San Juan Mountains during an earlier period of uplift and volcanism. Below the Los Pinos Formation are the older volcanic and volcanoclastic rocks and red-colored alluvial sediments of the Conejos and Vallejo Formations (Eocene to Oligocene). These units overlie a basement complex of Precambrian igneous and metamorphic rocks (Burroughs 1974, 1981; Leonard and Watts 1989; Molenar 1988; Brister and Gries 1994).

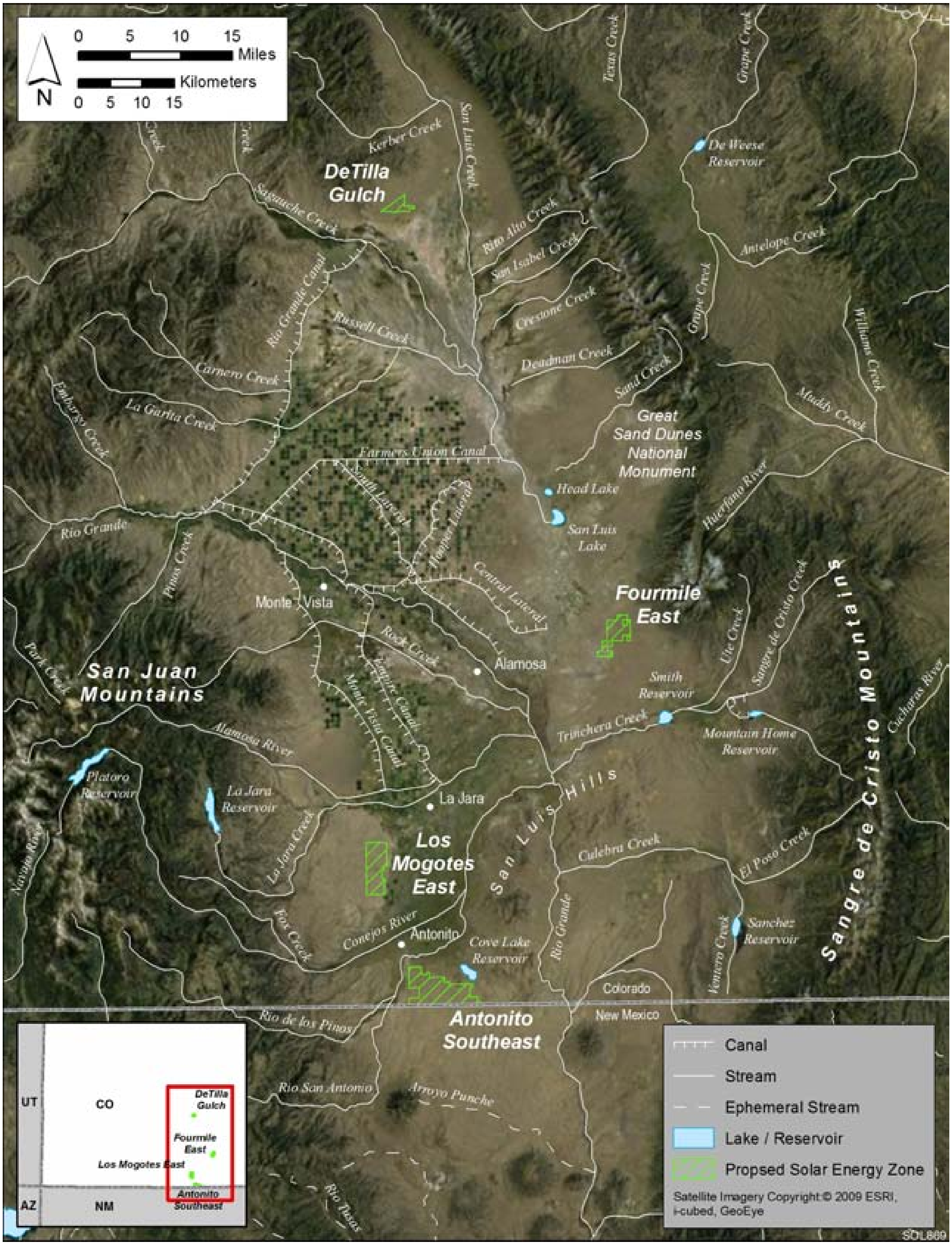

FIGURE 10.2.7.1-1 Physiographic Features of the San Luis Valley

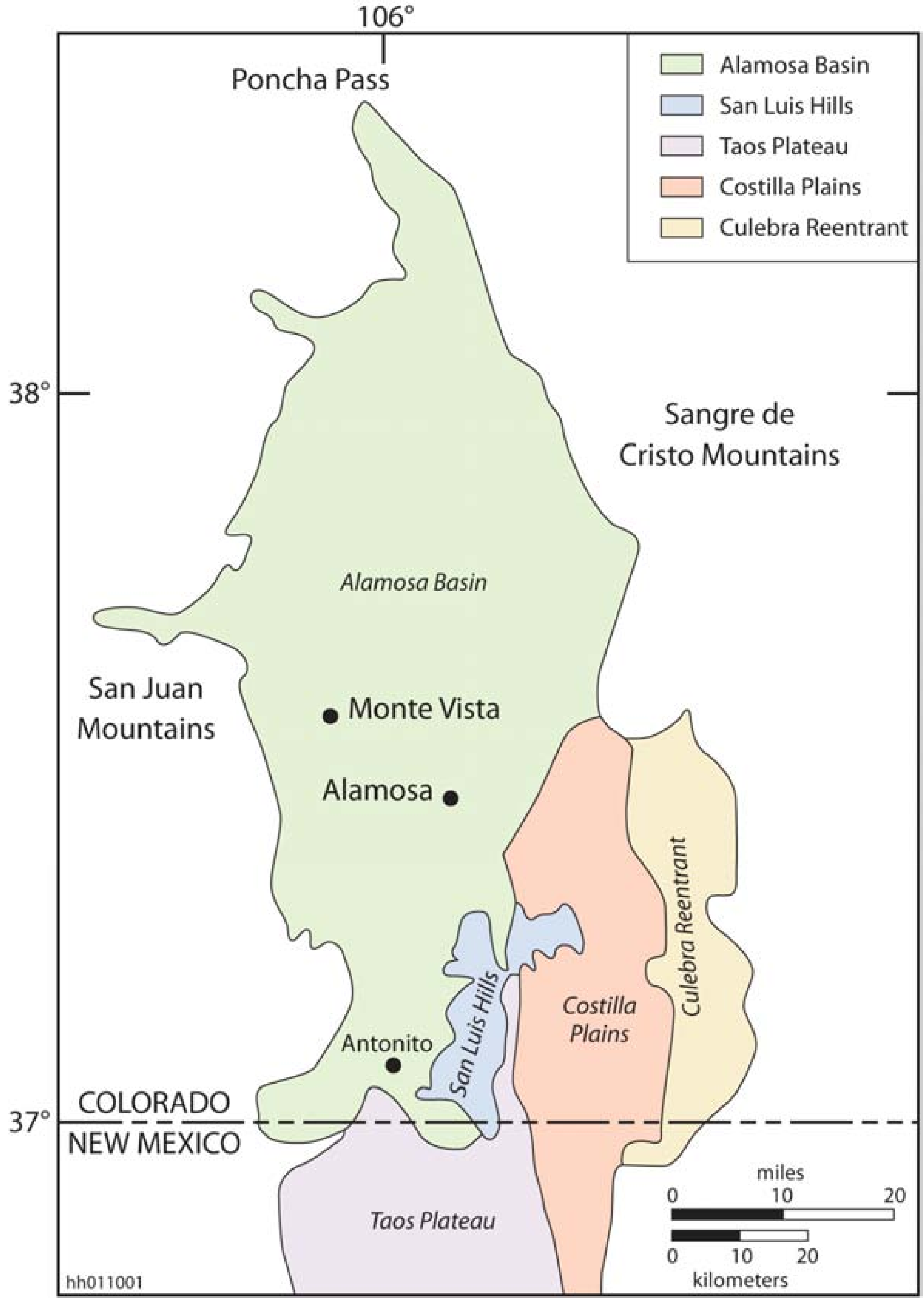

FIGURE 10.2.7.1-2 Physiographic Subdivisions within the San Luis Basin (modified from Burroughs 1981)

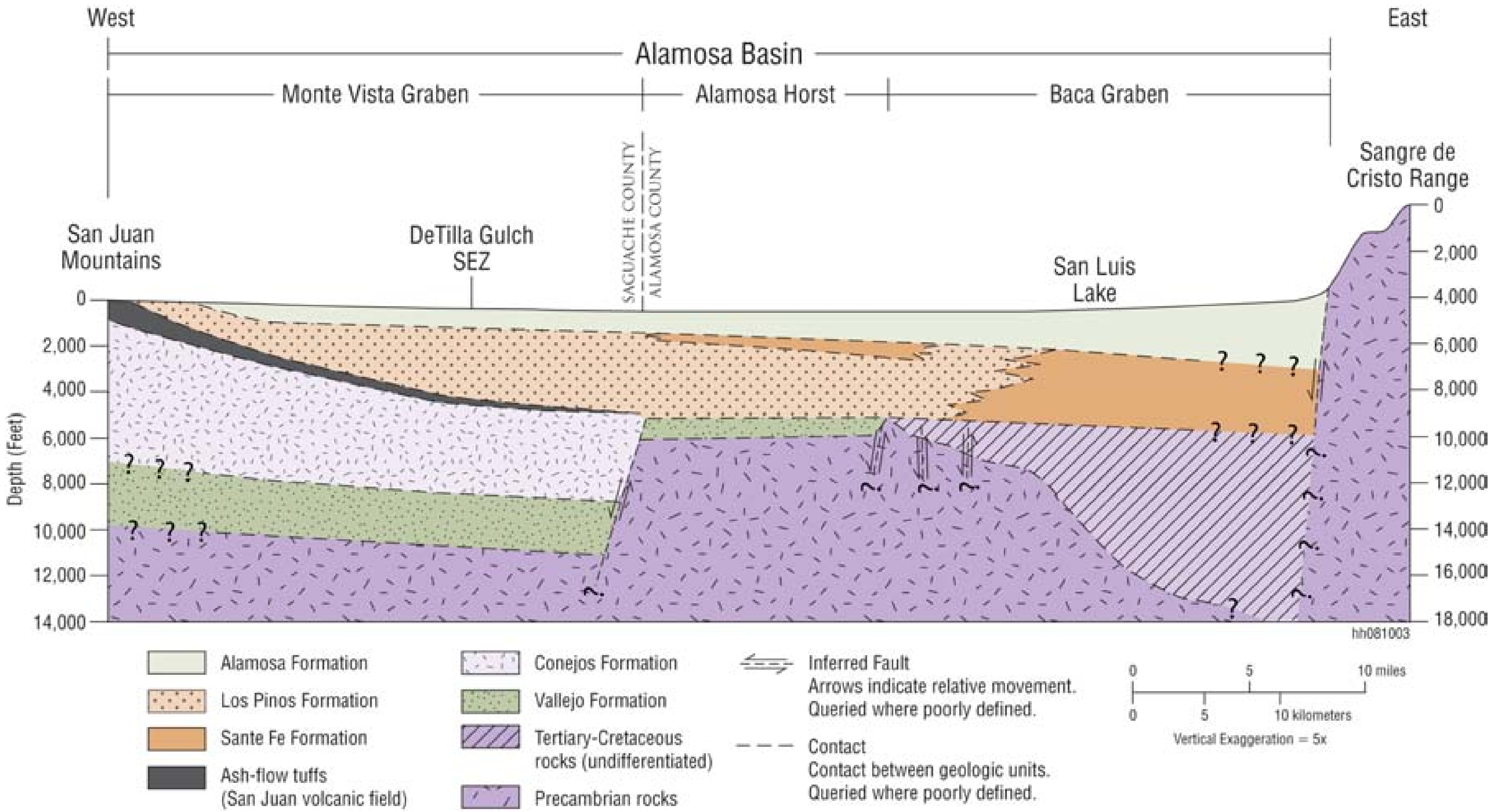

FIGURE 10.2.7.1-3 Generalized Geologic Cross Section (West to East) across the Northern Part of the Alamosa Basin (see Figure 10.2.7.1-6 for Section Location [modified from Leonard and Watts 1989])

Exposed sediments in the San Luis Valley consist mainly of modern alluvial deposits and the fluviolacustrine clays and sands of the Alamosa Formation (Figure 10.2.7.1-4). Eolian 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. 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 acres (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 dune fields of the Great Sand Dunes and the basalt hills and mesas of the San Luis Hills. Playa lakes are present in the north part of the valley (Leonard and Watts 1989; Emery 1979).

The proposed De Tilla Gulch SEZ is located midway between Saguache and San Luis Creeks in Saguache County (Figure 10.2.7.1-1). Its terrain is relatively flat with a very gentle dip to the southeast (Figure 10.2.7.1-5). The land surface is dissected by a series of intermittent streams that flow to the southeast (De Tilla Gulch traverses the southwestern portion of the SEZ). Elevations range from about 7,800 ft (2,377 m) along the northwest-facing boundary to about 7,700 ft (2,345 m) at its southeast corner. The highest point in the area is 7,824 ft (2,385 m) along the SEZ's northwest-facing boundary in section 29 (T45N R9E).

Geologic Hazards

The types of geologic hazards that could potentially affect solar project sites and 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 De Tilla Gulch SEZ. Solar project developers may need to conduct a geotechnical investigation to assess geologic hazards locally and 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).

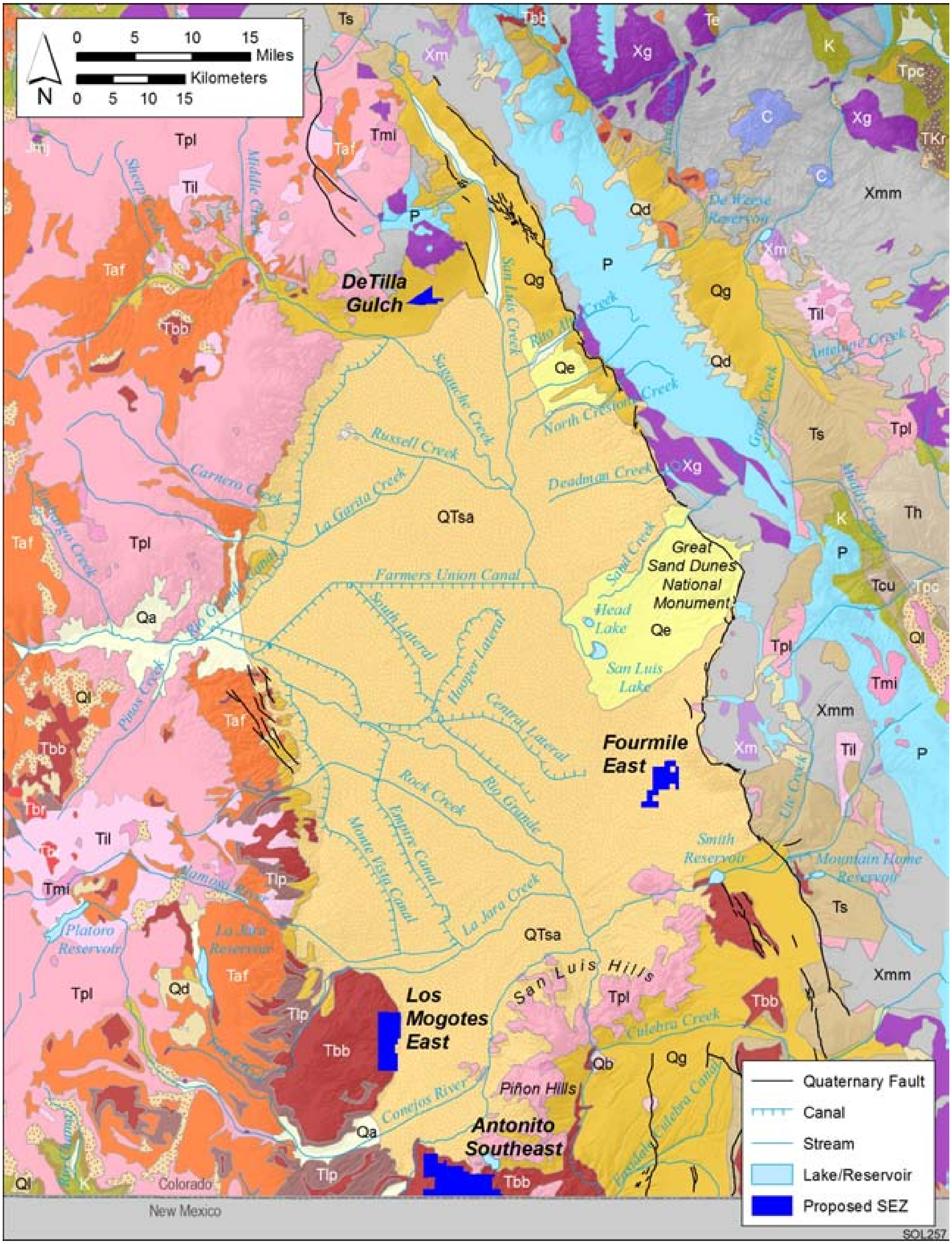

FIGURE 10.2.7.1-4 Geologic Map of the San Luis Valley and Vicinity (adapted from Stoeser et al. 2007 and Tweto 1979)

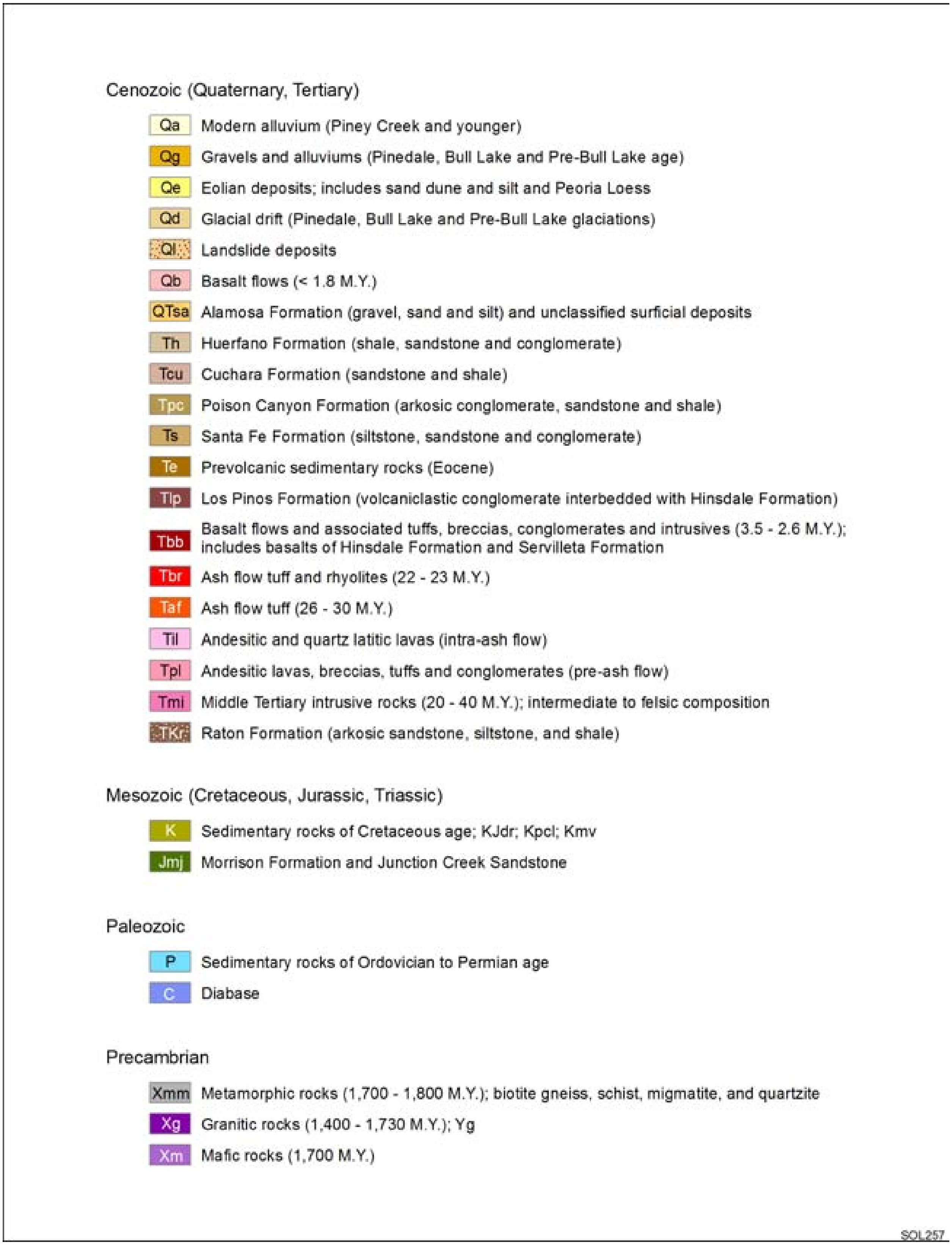

FIGURE 10.2.7.1-4 (Cont.)

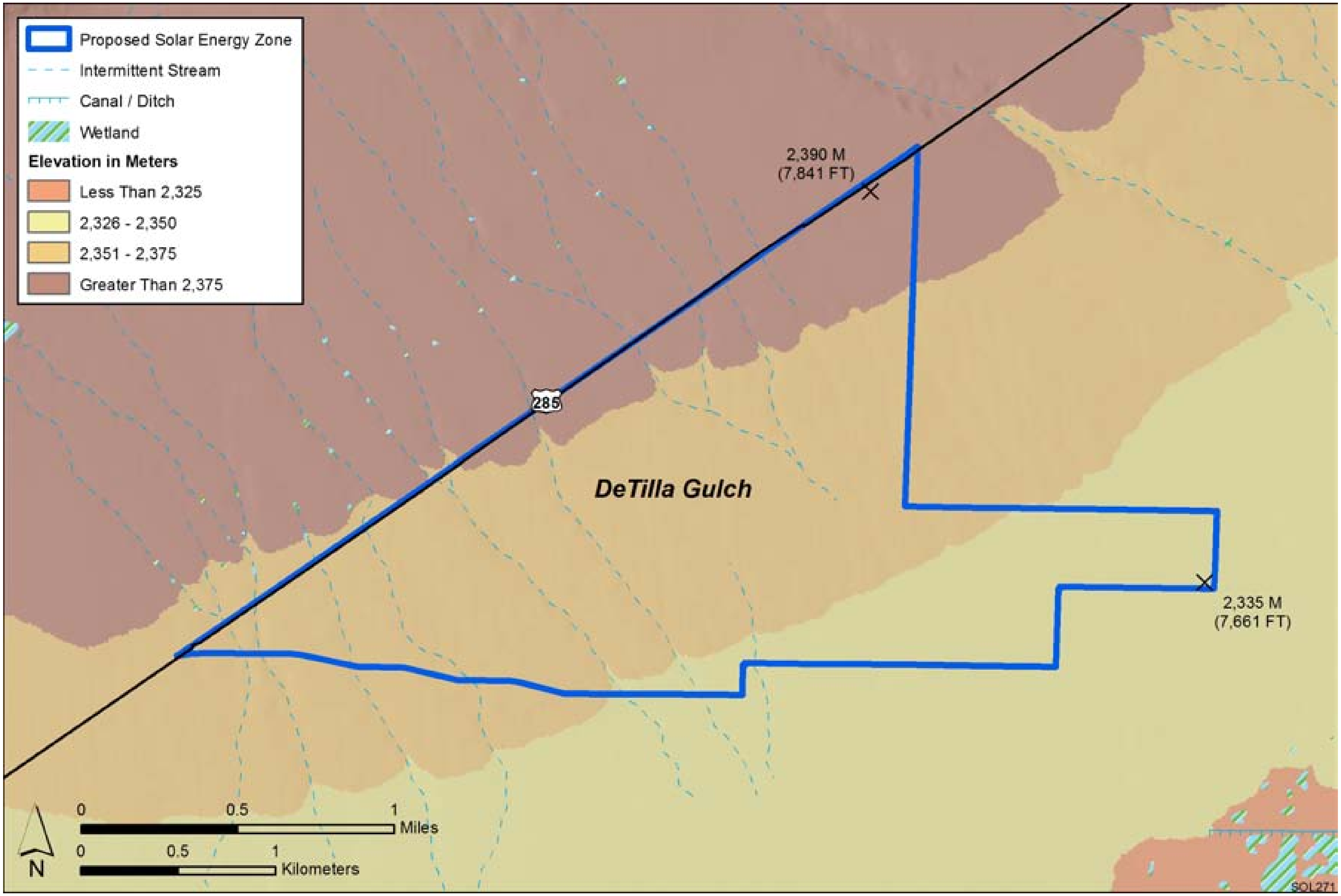

FIGURE 10.2.7.1-5 General Terrain of the Proposed De Tilla Gulch SEZ

No known Quaternary faults occur within the De Tilla Gulch SEZ. The closest Quaternary fault is the Mineral Hot Springs Fault that lies about 4 mi (6 km) to the northeast of the SEZ (Figure 10.2.7.1-6). The Mineral Hot Springs Fault is a north–northwest trending high-angle normal fault that dips to the east. Offsets of middle to late Pleistocene deposits place the most recent movement along the fault at less than 130,000 years (Kirkham 1998a).

The Northern Sangre de Cristo fault system lies about 10 mi (3.2 km) to the east-northeast of the SEZ (Figure 10.2.7.1-6). The Sangre de Cristo fault is a west-dipping, normal fault that forms the structural boundary between the San Luis Basin to the west and the Sangre de Cristo and Culebra Ranges to the east. The deepest part of the San Luis Basin occurs near the Northern Sangre de Cristo fault zone. Offsets of Holocene alluvial fan deposits place the most recent movement along the fault at less than 15,000 years ago; vertical displacements along the fault zone suggest past earthquakes of magnitude 6.8 to 7.1 (Ruleman and Machette 2007; Kirkham 1998b).

The Villa Grove Fault zone is about 8 to 11 mi (13 to 18 km) to the north-northeast of the SEZ, near Villa Grove (Figure 10.2.7.1-6); it is composed of a series of northwest-trending normal faults and fault scarps that straddle San Luis Creek. Offsets of late Pleistocene deposits place the most recent movement along the fault zone at less than 15,000 years. Most of the faults dip to the southwest; however, some of the faults to the west of the creek dip to the east and northeast, forming small horst-and-graben structures (Kirkham 1998c).

The Western Boundary Fault is about 10 mi (16 km) to the north-northwest of the proposed De Tilla Gulch SEZ, near Bonanza; it is a curved, high-angle normal fault with a north-west trend. The fault forms the western rim of the Bonanza caldera and was created as the result of the caldera’s collapse. Movement along the fault is related to continued collapse of the caldera and activity along the Rio Grande rift zone. Offsets of Pleistocene alluvium place the most recent movement along the fault at less than 1.6 million years. Older offsets (Oligocene to Miocene) are confined to the Tertiary intrusive rocks and volcanic flows associated with the caldera. The Lucky Boy Fault is a branch fault of the Western Boundary Fault (Widman 1997a,b).

From June 1, 2000 to May 31, 2010, only five earthquakes were recorded within a 61-mi (100-km) radius of the proposed De Tilla Gulch SEZ. The largest earthquake during that period occurred on December 28, 2003 (it is also the largest recorded earthquake since 1985). It was located about 50 mi (80 km) southeast of the SEZ in the Sangre de Cristo Mountains and registered a magnitude (LgGS[1]) of 3.5 (Figure 10.2.7.1-6). During this period, three (60%) of the recorded earthquakes within a 61-mi (100-km) radius of the SEZ had magnitudes greater than 3.0 (USGS 2010c).

1 Surface wave magnitude (MLg) is an Lg magnitude determined by the USGS. It is based on the amplitude of the Lg surface wave group and is commonly used for small-to-moderate size earthquakes that have mostly continental propagation paths (Leith 2010).

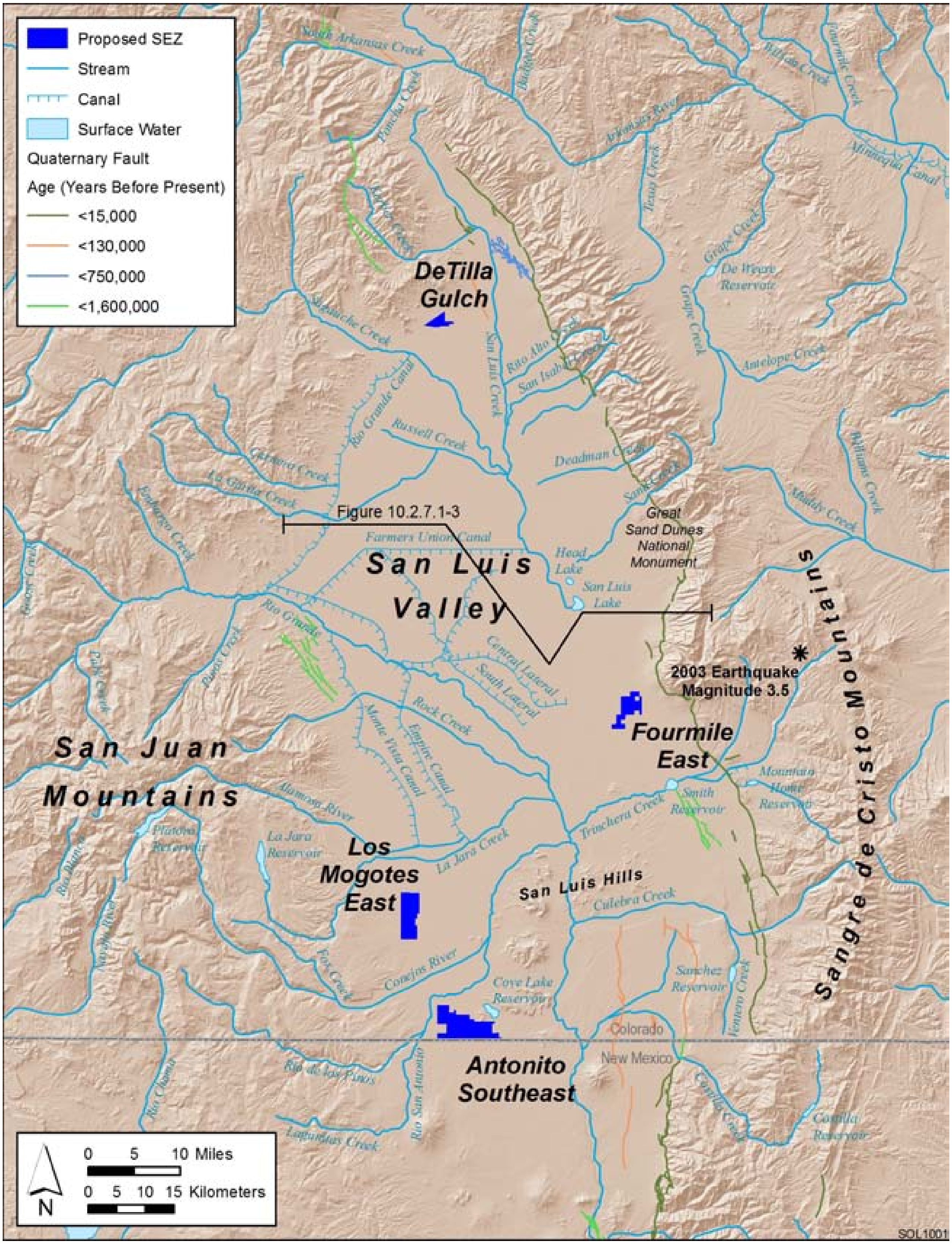

FIGURE 10.2.7.1-6 Quaternary Faults in the San Luis Valley (USGS and CGS 2009; USGS 2010c)

Liquefaction. The proposed De Tilla Gulch 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 to the west of the San Luis Valley comprise 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 from 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 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 on 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 De Tilla Gulch SEZ include those associated with soil compaction (restricted infiltration and increased runoff), expanding clay soils (destabilization of structures), and hydro-compactable or collapsible soil (settlement).

Disturbance of soil crusts and desert pavement on soil surfaces (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 10.2.9.1.1 provides further discussion of flood risks within the De Tilla Gulch SEZ.

10.2.7.1.2 Soil Resources

Soils within the proposed De Tilla Gulch SEZ are gravelly to gravelly sandy loams of the Rock River and Graypoint Series, which together make up about 75% of the soil coverage at the site (Figure 10.2.7.1-7). Soil map units within the De Tilla Gulch SEZ are described in Table 10.2.7.1-1. Parent material consists of sediments weathered from basalt. Soils are characterized as deep and well drained. Most soils on the site have moderate surface runoff potential and moderate permeability. The natural soil surface is suitable for roads with a slight to moderate erosion 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 eroded by wind per acre each year (NRCS 2009).

Only the Shawa loam is rated as partially hydric.[2] Flooding of soils at the site is not likely and occurs with a frequency of less than once in 500 years. A small portion of soils at the site (about 10%), including the Jodero loam, the Platoro loam, the Shawa loam, and the Villa Grove sandy clay loam, are classified as prime farmland, if irrigated (NRCS 2009).

10.2.7.2 Impacts

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

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

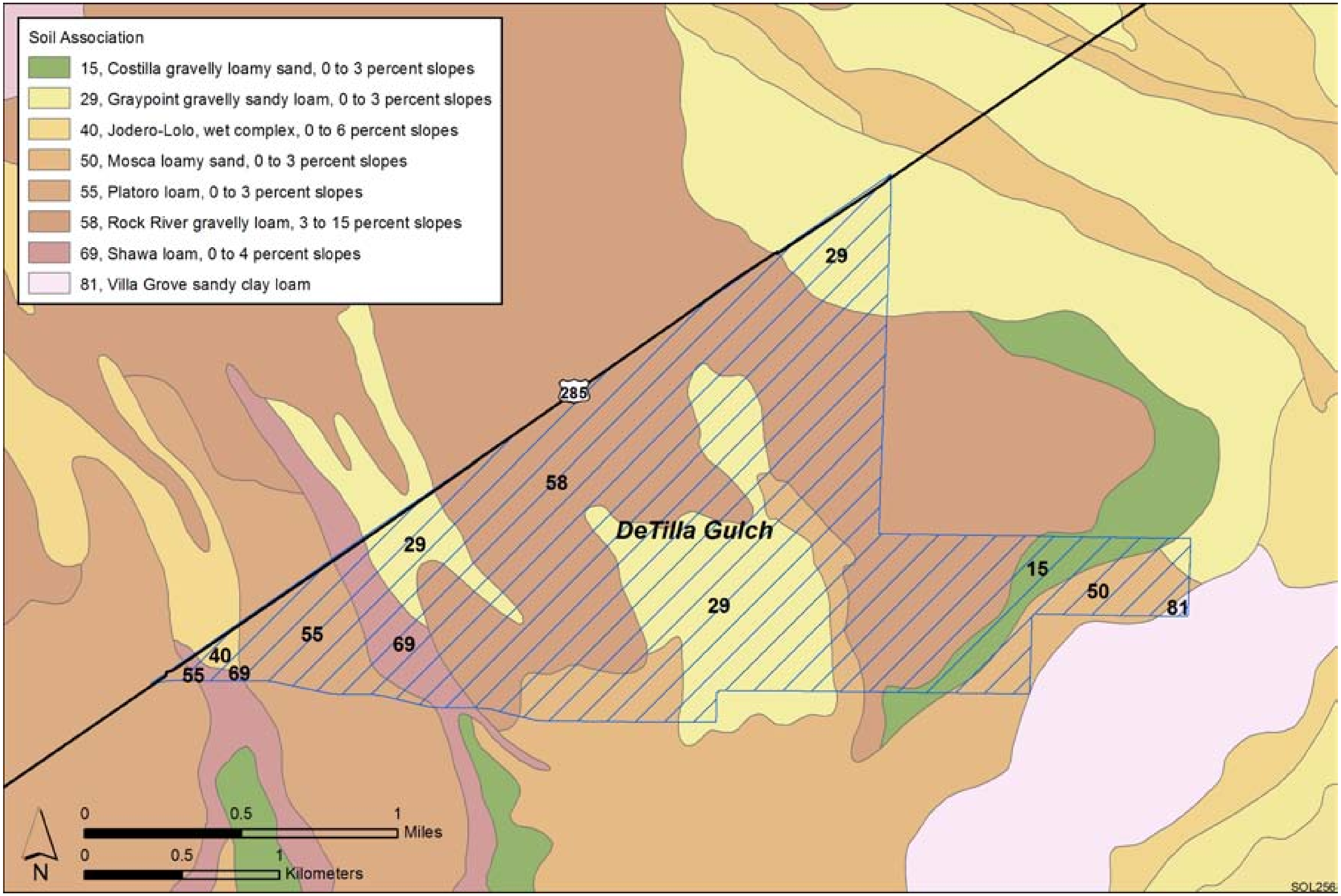

FIGURE 10.2.7.1-7 Soil Map for the Proposed De Tilla Gulch SEZ (NRCS 2008)

TABLE 10.2.7.1-1 Summary of Soil Map Units within the Proposed De Tilla Gulch SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in Acres[b] (% of SEZ)
58	Rock River gravelly loam (3 to 15% slope)	Slight	Moderate (WEG 4)[c]	Nearly level to gently sloping soils on valley side slopes and fans. Parent material consists of calcareous alluvium. Deep and well drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low. Available water capacity is moderate. Used mainly as rangeland. Moderate rutting hazard.	760 (50)
29	Graypoint gravelly sandy loam (0 to 3% slope)	Slight	Moderate (WEG 3)	Level to nearly level soils on broad fans and terraces. Parent material consists of alluvium derived from basalt. Deep and well drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low to moderate. Available water capacity is low. Caving hazard exists. Used mainly as rangeland and irrigated cropland, pasture, and hayland. Farmland of unique importance.[d] Moderate rutting hazard.	381 (25)
50	Mosca loamy sand (0 to 3% slope)	Slight	High (WEG 2)	Level to nearly level soils on fans and floodplains. Parent material consists of alluvium derived from basalt. Soils are deep and well drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low. Available water capacity is low. Used mainly as rangeland and irrigated cropland. Farmland of unique importance. Moderate rutting hazard.	165 (11)
55	Platoro loam (0 to 3% slope)	Slight	Moderate (WEG 6)	Level to nearly level soils on fans and terraces. Parent material consists of alluvium derived mainly from basalt. Deep and well drained, with moderate surface runoff potential and moderately slow permeability. Shrink-swell potential is low to moderate. Available water capacity is moderate. Used mainly as irrigated cropland, irrigated pastureland, and rangeland. Prime farmland, if irrigated[d]. Severe rutting hazard.	89 (6)
69	Shawa loam (0 to 4% slope)	Slight	Moderate (WEG 6)	Level to nearly level soils on fans and low terraces adjacent to streams. Parent material consists of alluvium. Deep and moderately well drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low to moderate. Available water capacity is high. Used mainly as irrigated pastureland, irrigated cropland, and rangeland. Prime farmland, if irrigated. Severe rutting hazard.	62 (4)

TABLE 10.2.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in Acres[b] (% of SEZ)
15	Costilla gravelly loamy sand (0 to 3% slope)	Slight	High (WEG 2)	Level to nearly level soils on fans and terraces. Parent material consists of sandy alluvium. Deep and somewhat excessively drained, with a low surface runoff potential (high infiltration rate) and moderately rapid permeability. Shrink-swell potential is low. Available water capacity is low. Caving hazard exists. Used mainly as rangeland and wildlife habitat, and locally for irrigated crops. Moderate rutting hazard.	55 (4)
40	Jodero-Lolo wet, complex (0 to 6% slope)	Slight	Moderate (WEG 6)	Level to nearly level soils on low terraces along drainageways. Parent material consists of alluvium. Consists of about 45% Jodero loam and 35% Lolo sandy loam. Deep and moderately well to well drained, with moderate surface runoff potential and moderately rapid permeability. Shrink-swell potential is low to moderate. Available water capacity is high. Used mainly as rangeland and for wildlife habitat. Jodero loam is prime farmland, if irrigated. Severe rutting hazard.	8 (<1)
81	Villa Grove sandy clay loam	Slight	Moderate (WEG 5)	Level soils on floodplains. Parent material consists of alluvium. Deep and poorly drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low to moderate. Available water capacity is low. Flooding hazard during snowmelt season. Used mainly as rangeland and locally as irrigated pastureland. Prime farmland, if irrigated. Severe rutting hazard.	2 (<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% 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.

Footnotes continue on next page.

TABLE 10.2.7.1-1 (Cont.)

[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 2, 134 tons per acre per year; WEGs 3 and 4, 86 tons per acre per year; WEG 5, 56 tons per acre per year; and WEG 6, 48 tons per acre per year.

[d] Farmland is of unique importance for the production of food, feed, fiber, forage, or oilseed crops. 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.

Sources: NRCS (2009); USDA (1984).

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

10.2.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified for soil resources at the proposed De Tilla Gulch 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.

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10.2.8 Minerals (Fluids, Solids, and Geothermal Resources)

10.2.8.1 Affected Environment

The San Luis Basin, in which the SEZ is located, is identified as an oil and gas producing region (Burnell 2008); however, there is no current production. 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. There are no current oil and gas leases in the SEZ, but there are numerous closed leases near the SEZ (BLM and USFS 2010b). The area is open for discretionary mineral leasing, including leasing for oil and gas.

There are no mining claims (BLM and USFS 2010a) or active oil and gas leases (BLM and USFS 2010b) in the SEZ, Although public lands around the SEZ have previously been leased for oil and gas, all of the previous leases within several miles of the SEZ have been closed. Lands within the SEZ were closed to locatable mineral entry in June 2009, pending the outcome of this solar energy development PEIS (74 FR 31308–31309).

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 et al. 2008). Several springs and wells have been developed in the northern part of basin, the nearest about 5 mi (8 km) northeast of the SEZ, and another at Moffat, about 8 mi (13 km) southeast of the SEZ. An area about 4 mi (6 km) northeast of the SEZ has been leased previously for geothermal resources but that lease has been closed. No geothermal leasing development has occurred within or adjacent to the SEZ (BLM and USFS, 2010b).

10.2.8.2 Impacts

If the proposed De Tilla Gulch SEZ were 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. Since the area does not contain any mining claims, it is assumed that there would be no impact on locatable mineral production.

Although the San Luis Basin is identified as an oil and gas production area, since there are no active oil and gas leases in the SEZ it is assumed there would be no impacts on these resources if the SEZ was developed for solar energy production. In addition, oil and gas development utilizing directional drilling to access resources under the area (should any be found) also might be allowed.

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 via directional drilling. Because of this option and the lack of current geothermal development within the SEZ, solar energy development of the SEZ is expected have no impact on development of geothermal resources.

If the area is identified as a solar energy development zone, some mineral uses might be allowed. For example, the production of common minerals, such as sand and gravel and mineral materials for road construction, might take place in areas not directly developed for solar energy production.

10.2.8.3 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.

10.2.9 Water Resources

10.2.9.1 Affected Environment

The proposed De Tilla Gulch 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 toward San Luis Lake and referred to as the "closed basin" (see inset of Figure 10.2.9.1-1), while the southern portion of the valley drains to the Rio Grande (Topper et al. 2003; Mayo et al. 2007). The proposed De Tilla Gulch SEZ is located in the northern portion of the San Luis Valley and has surface elevations ranging from 7,670 to 7,835 ft (2,338 to 2,388 m), with a general northwest to southeast 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 northern San Luis Valley are on the order of 8 and 24 in. (20 and 61 cm), respectively (WRCC 2010a). Precipitation and snowfall amounts are much greater in the surrounding mountains and are on the order of 27 and 237 in. (69 and 602 cm), respectively, at elevations greater 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).

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

No permanent surface water bodies are located within the proposed De Tilla Gulch SEZ. Several ephemeral drainages cross the site in a northwest to southeast direction. Sagauche Creek and San Luis Creek are located 4 mi (6 km) to the south and 5 mi (8 km) to the east, respectively (Figure 10.2.9.1-1). Kerber Creek is a tributary of San Luis Creek that drains out of the San Juan Mountains approximately 7 mi (11 km) north of the proposed SEZ that contains copper- and cadmium-contaminated sediments from historic mining operations (Livo et al. 2001). These streams eventually drain to San Luis Lake (closed basin drainage terminus), located 35 mi (55 km) southeast of the proposed SEZ.

Flood hazards have not been identified (Zone D) for Sagauche County (FEMA 2009). Intermittent flooding may occur along the ephemeral washes. The floodplains of Sagauche Creek and San Luis Creek are not located within the proposed SEZ. Discharge in San Luis Creek as it enters the San Luis Valley is typically between 10 and 50 ft^3/s (0.3 and 1.4 m^3/s), with spring floods reaching 100 ft^3/s (2.8 m^3/s) (USGS 2010d; stream gauge 08227000).

The NWI did not identify any wetlands within the proposed De Tilla Gulch SEZ. Several small, artificially impounded palustrine wetlands are located just to the north of the proposed SEZ that are typically dry most of the year. The riparian areas of Sagauche Creek and San Luis

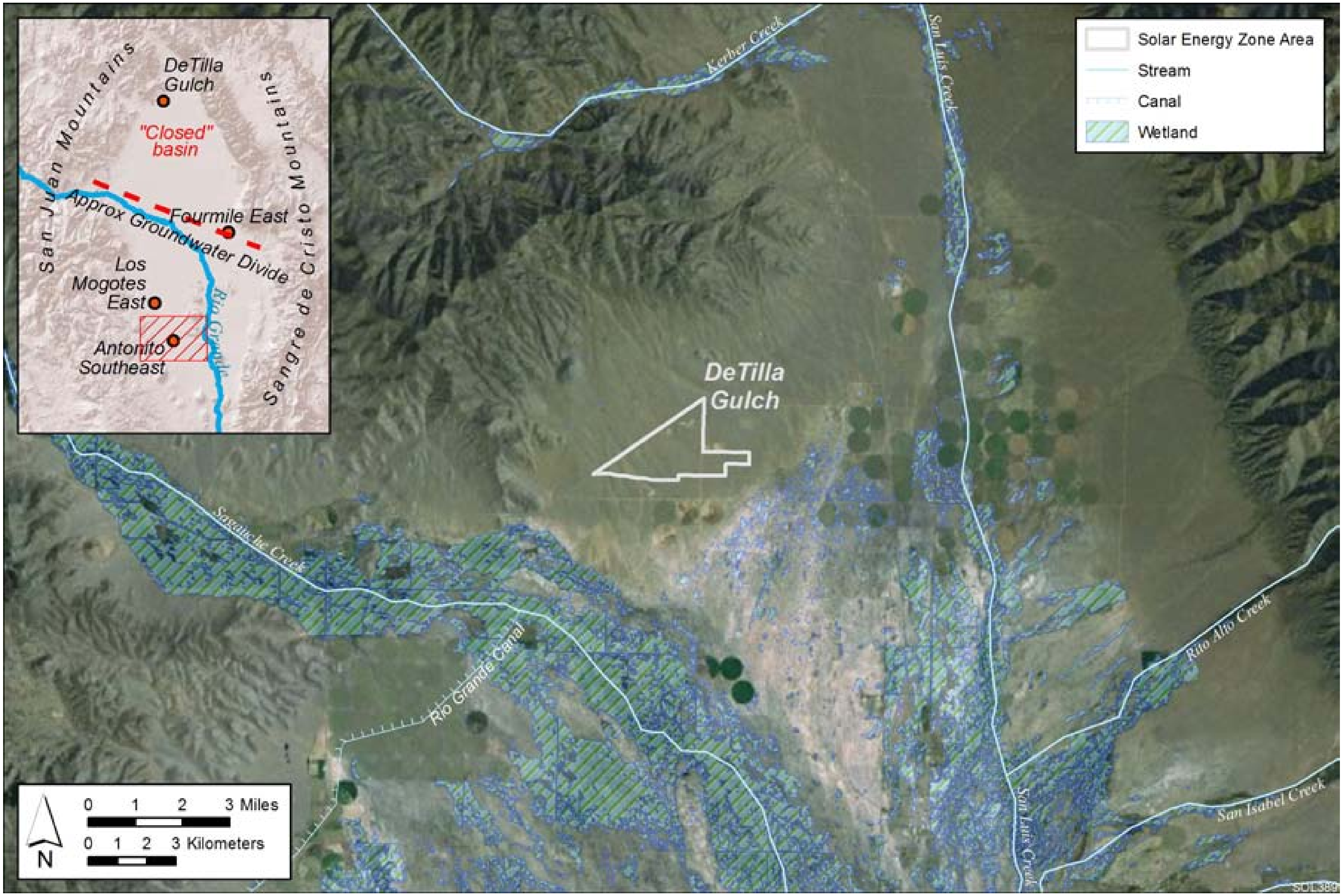

FIGURE 10.2.9.1-1 Surface Water Features in the San Luis Valley

Creek also contain several palustrine wetlands that range from being temporally to seasonally flooded (see Section 10.2.10.1 for further details on these wetlands) (USFWS 2009).

10.2.9.1.2 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 toward San Luis Lake in the northern portion of the valley (referred to as the closed basin) and flows toward the Rio Grande in the southern portion of the valley; however, flow is not separated in the lower confined aquifer, which in general flows toward 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 De Tilla Gulch SEZ lies within a significant recharge area for the aquifers of the San Luis Valley. Recharge sources include the creeks from the San Juan Mountains to the northwest that infiltrate alluvial fans at the base of the mountains and the springs near the headwaters of streams at higher elevations (8,600 to 9,000 ft [2,600 to 2,700 m]), including the headwaters of Proffit Gulch and Asterhouse Gulch. Small dams were also commonly built to intercept water along the creeks in this area, facilitating infiltration. Valleys of the San Luis and Saguache Creeks, located a few miles from the site, are important groundwater recharge zones in the San Luis Valley. In addition, the unconfined aquifer beneath the proposed SEZ may be recharged by groundwater from the underlying confined aquifer (Emery et al. 1973; Colorado DWR 2004).

The proposed De Tilla Gulch SEZ is situated on alluvial fan deposits at the base of the San Juan Mountains. Fan deposits are composed of unconsolidated, poorly sorted sands and gravels of Quaternary age (Topper et al. 2003). The proposed SEZ is located just north of the extent of the confining clay layers that separate the unconfined and confined aquifers for most of the central San Luis Valley (Colorado DWR 2010a); thus groundwater under the proposed SEZ is predominantly under unconfined conditions. The depth of the unconfined aquifer in the vicinity of the proposed SEZ is on the order of 100 to 200 ft (30 to 61 m) (RGWCD 2010; well numbers RGWCD05a and RGWCD10). One monitoring well within the proposed SEZ has a depth to groundwater of 136 ft (41 m); it also showed a trend of groundwater surface elevations that decreased by approximately 0.9 ft/yr (0.3 m/yr) from 1996 to 2006 (USGS 2010b; well number 380651106004501). The general groundwater flow pattern in the unconfined aquifer in the northern portion of the San Luis Valley is from north to south (Topper et al. 2003).

Groundwater quality in the northern portion of the San Luis Valley typically contains TDS concentrations ranging from 250 to 500 mg/L (Mayo et al. 2007), with small areas with TDS values up to 1,000 mg/L near the hot springs located 5 mi (8 km) to the northeast of the proposed De Tilla Gulch SEZ (USGS 2010b; wells 381004105552000 and 381008105550500).

10.2.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals in Saguache County were estimated to be 570,544 ac-ft/yr (704 million m^3/yr), of which about 31% was from surface water sources (streams, springs, and irrigation canals and laterals) and 69% from groundwater. The largest water use category was irrigation, composing 99.7% of the water use in that year; groundwater withdrawals for irrigation totaled 392,894 ac-ft/yr (485 million m^3/yr). An additional 1,390 ac-ft/yr (1.7 million m^3/yr) of groundwater was primarily used for public supply (1,222 ac-ft/yr [1.5 million m^3/yr]), and small portions were used for livestock and mining water (Kenny et al. 2009).

Colorado administers its water rights using the Doctrine of Prior Appropriation as its cornerstone, with water rights being 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 (C.R.S. §§37-92-101 through §§37-92-602) required that surface waters and groundwater be managed together (Colorado DWR 2010b).

The proposed De Tilla Gulch 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 transferring 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[3] to protect senior water rights (typically surface water rights) with respect to any potential depletion 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 required the Colorado Division of Water Resources to 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 & 07CW52, which were 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 coordinating with the Colorado Division of Water Resources, existing water right holders, and potentially some of the water conservation districts that operate in the San Luis Valley that provide augmentation water and will potentially be subdistrict groundwater managers depending upon court decisions that are pending (Colorado District Court 2010; McDermott 2010). The transfer of water rights will most likely involve agricultural surface and groundwater rights, which have been estimated to have a consumptive water use of between 150 and 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

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[3] "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).

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 on court decisions that are expected in the near future regarding groundwater management in the San Luis Valley (Colorado District Court 2010; Colorado DWR 2010c; 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 over approximately 1,000 ac-ft/yr (1.2 million m^3/yr) to be successful in obtaining needed water rights (McDermott 2010).

10.2.9.2 Impacts

Potential impacts on water resources related to utility-scale solar energy development include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at the place of origin and at the time of the proposed activity, while indirect impacts occur away from the place of origin or later in time. Impacts on water resources considered in this analysis are the result of land disturbance activities (construction, final developed site plan, as well as off-site activities such as road and transmission line construction) and water use requirements for solar energy technologies that take place during the four project phases: site characterization, construction, 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).

10.2.9.2.1 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.2.2. The proposed De Tilla Gulch SEZ is located on an important groundwater recharge zone for the San Luis Valley (see Section 10.2.9.1.2); thus the design and construction of utility-scale solar energy facilities should be conducted according to the design features mentioned previously, and should emphasize the need to maximize groundwater infiltration processes.

10.2.9.2.2 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 De Tilla Gulch SEZ include the following:

- 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 100% of the SEZ total area during the peak construction year; and

- Water use requirements for hybrid cooling systems are assumed to be the same order of magnitude as those for systems 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 because activities would be limited in area, extent, and duration. Water needs could be met by trucking water in from an off-site source.

Construction

During construction, water would be used mainly for controlling fugitive dust and for the workforce potable water supply. Because there are no significant surface water bodies on the proposed De Tilla Gulch SEZ, 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 10.2.9.2-1, and could be as high as 418 ac-ft (515,600 m^3). In addition, the generation of

TABLE 10.2.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed De Tilla Gulch SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	373	373	373	373
Potable supply for workforce (ac-ft)	45	18	8	4
Total water use requirements (ac-ft)	418	391	381	377
Wastewater generated				
Sanitary wastewater (ac-ft)	45	18	8	4

[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.

up to 45 ac-ft (55,500 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 259 gpm (980 L/min) to meet the estimated construction water requirements. Existing water rights holders currently withdraw water from wells with comparable yields. 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 under 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 10.2.9.2-2). At full build-out capacity, water needs for mirror/panel washing are estimated to range from 7 to 122 ac-ft/yr (8,600 to 150,500 m^3/yr). As much as 3 ac-ft/yr (3,700 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 option was employed (30 to 60% range assumed) and the power of the system. The differences between the water requirements reported in Table 10.2.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per MW. As a result, the water

TABLE 10.2.9.2-2 Estimated Water Requirements during Normal Operations at Full Build-out Capacity at the Proposed De Tilla Gulch SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	243	135	135	135
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	122	68	68	7
Potable supply for workforce (ac-ft/yr)	3	2	2	<1
Dry cooling (ac-ft/yr)[e]	49–243	27–135	NA[f]	NA
Wet cooling (ac-ft/yr)[e]	1,096–3,531	609–1,961	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	70	7
Dry-cooled technologies (ac-ft/yr)	174–368	97–205	NA	NA
Wet-cooled technologies (ac-ft/yr)	1,221–3,656	679–2,031	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[g]	69	38	NA	NA
Sanitary wastewater (ac-ft/yr)	3	2	2	<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 2009).

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.

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 3,656 ac-ft/yr (4.5 million m^3/yr) (Table 10.2.9.2-2). Water usage for dry-cooling systems would be as high as 368 ac-ft/yr (0.5 million m^3/yr), approximately a factor of 10 times less than that for wet cooling. Water needs for normal operations could be met by trucking in water from an off-site source for low water use technologies (e.g., dish engine or PV) or from groundwater at the site, if it is available (see Sections 10.2.9.1.2 and 10.2.9.1.3). For example, a dish engine facility would require about 70 ac-ft/yr (86,300 m^3/yr), which could be obtained from a groundwater well pumping continuously at 43 gpm (163 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 2,265 gpm (8,575 L/min) would be needed. This pumping rate is on the order of the largest well yields found within the San Luis Valley, as large-capacity irrigation wells are typically on the order of 2,000 gpm (7,571 L/min) or less in this region (RGWCD 2010). It is unclear whether pumping could be maintained at this level without adversely affecting groundwater levels in the surrounding area.

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

Normal operations at the proposed De Tilla Gulch SEZ would produce up to 3 ac-ft/yr (3,700 m^3/yr) of sanitary wastewater (Table 10.2.9.2-2) 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 discharge cooling system blowdown water that would need to be treated either on- or off-site. The quantity of water discharged would range from 38 to 69 ac-ft/yr (47,000 to 85,000 m^3/yr) (Table 10.2.9.2-2). 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 (e.g., dust suppression, 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.

10.2.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed De Tilla Gulch SEZ is located adjacent to U.S. 285, and the nearest transmission line runs through a portion of the SEZ as described in Section 10.2.1.2. 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.

10.2.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources associated with developing solar energy at the proposed De Tilla Gulch SEZ are associated with land disturbance effects to 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 altering groundwater recharge and discharge processes. The proposed SEZ is located on an important groundwater recharge zone for the San Luis Valley, so solar energy facilities should be sited and constructed using methods that emphasize the need to maximize groundwater infiltration processes. In addition, alterations to the natural drainage pattern of the site should be avoided to the extent possible in order to minimize erosion and sedimentation impacts, as well as the disruption of wildlife habitat.

Water in the Rio Grande Basin is managed strictly because of its scarcity, treaty obligations, and its necessity in supporting agriculture in the San Luis Valley. Both surface water and groundwater rights are overappropriated, 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 developments 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 10.2.9.1.3), water requirements for full build-out assuming parabolic trough technology would need to fallow 2,285 acres (9.2 km^2) of agricultural fields with wet cooling and 230 acres (0.9 km^2) if dry cooled, whereas PV technology would only need to fallow 4 acres (0.02 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 projects seeking large amounts of water unfeasible (Gibson 2010; McDermott 2010).

The scarcity and strict management of water resources in the San Luis Valley suggest that utility-scale solar energy developments 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 10.2.9.2-2, technologies using wet cooling would need to use water conservation measures to 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 10.2.9.1.3). Securing water rights in the Rio Grande Basin is a complex and expensive process, so dry-cooled parabolic trough and power tower, dish engine, and PV technologies are the preferable solar energy technologies for the proposed De Tilla Gulch SEZ because of their low water use requirements.

10.2.9.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

Proposed design features specific to the proposed De Tilla Gulch SEZ include the following:

- Wet-cooling technologies should incorporate water conservation measures to reduce water needs;

- To the extent possible, land disturbance activities should avoid impacts that limit infiltration to this important groundwater recharge area;

- 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, and 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 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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10.2.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed De Tilla Gulch 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 only the SEZ. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary 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 transmission lines or access roads because they are not expected to be needed for developments on the De Tilla Gulch SEZ due to the proximity of an existing transmission line and 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. These areas are defined, and the impact assessment approach is described in Appendix M.

10.2.10.1 Affected Environment

The proposed De Tilla Gulch SEZ is located 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*). This ecoregion is 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 low, averaging 8.3 in. (21.0 cm) at Saguache (see Section 10.2.13).

Lands to the north and west lie within the Foothills and Shrublands Level IV ecoregion, which includes sagebrush shrubland, pinyon-juniper woodland, and foothill-mountain grassland. This ecoregion is located within the Southern Rockies Level III ecoregion, which is described in Appendix I. Lands to the south and east lie within the Salt Flats Level IV ecoregion, which consists of shrublands that include shadscale, fourwing saltbush, greasewood, horsebrush, spiny hopsage, rubber rabbitbrush, saltgrass, and alkali sacaton. This ecoregion is located within the Arizona/New Mexico Plateau Level III ecoregion. Large areas of cropland and pasture, supporting sedge riparian communities, and shrub and brush rangeland, supporting low-elevation greasewood communities, occur to the south, east, and southwest. Evergreen forests supporting pinyon-juniper woodlands on lower slopes, and pine, spruce, and fir on upper slopes, occur to the north and northwest.

Land cover types, described and mapped under SWReGAP (USGS 2005), were used to evaluate plant communities in and near the SEZ. Each cover type encompasses a range of similar plant communities. Land cover types occurring within the potentially affected area of the proposed De Tilla Gulch SEZ are shown in Figure 10.2.10.1-1. Table 10.2.10.1-1 provides the surface area of each cover type within the potentially affected area.

Lands within the proposed De Tilla Gulch SEZ are classified primarily as Inter-Mountain Basins Semi-Desert Shrub Steppe. Additional cover types within the SEZ include Inter-Mountain Basins Greasewood Flat, Inter-Mountain Basins Semi-Desert Grassland, and Agriculture.

Winterfat was observed to be the dominant species in some areas of the SEZ in July 2009, while Greene's rabbitbrush (*Chrysothamnus greenei*) and rubber rabbitbrush were dominants in other areas. Co-dominant species observed in various areas of the SEZ included bottlebrush squirreltail (*Elymus elymoides*), green muhly (*Muhlenbergia ramulosa*), blue grama, big sagebrush (*Artemisia tridentata*), chenopodium (*Chenopodium* sp.), needle-and-thread, prairie sagewort (*Artemisia frigida*), prickly pear (*Opuntia* sp.), broom snakeweed, and globemallow (*Sphaeralcea* sp.). Sensitive habitats on the SEZ include 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.

The area surrounding the SEZ, within 5 mi (8 km), includes 34 cover types, which are also given in Table 10.2.10.1-1. The predominant cover types are Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Greasewood Flat, and Agriculture.

The NWI does not identify any wetlands within the De Tilla Gulch SEZ (Figure 10.2.10.1-2). However, numerous ephemeral dry washes occur within the SEZ. 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. Many small wetlands occur near the SEZ to the northwest, primarily located along streams (USFWS 2009). These wetlands are classified as artificially impounded palustrine wetlands with sparse plant communities that are temporarily flooded, indicating that surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface. Springs are located at the base of the mountains to the northwest. Concentrations of wetlands also occur to the south, southwest, and southeast. Extensive wetland areas located to the southwest, associated with streams, including Saguache Creek, are classified as palustrine wetlands with emergent plant communities that are temporarily flooded, with small scattered seasonally flooded areas, in which surface water is present for extended periods, particularly early in the growing season, but usually absent by the end of the growing season (USFWS 2009). Most of these wetland areas are classified as an Inter-Mountain Basin Greasewood Flat and Agriculture cover types; however, many areas of Rocky Mountain Alpine-Montane Wet Meadow and Rocky Mountain Lower Montane Riparian Woodland and Shrubland occur within these wetland areas. Numerous wetlands are located to the south and southeast and are classified as palustrine wetlands with emergent plant communities that are intermittently flooded, indicating that surface water is usually absent but may be present for variable periods (USFWS 2009). Most of these wetlands are scattered within Inter-Mountain Basin Greasewood Flat and Inter-Mountain Basins Semi-Desert Shrub Steppe cover types. San Luis Creek, southeast of the

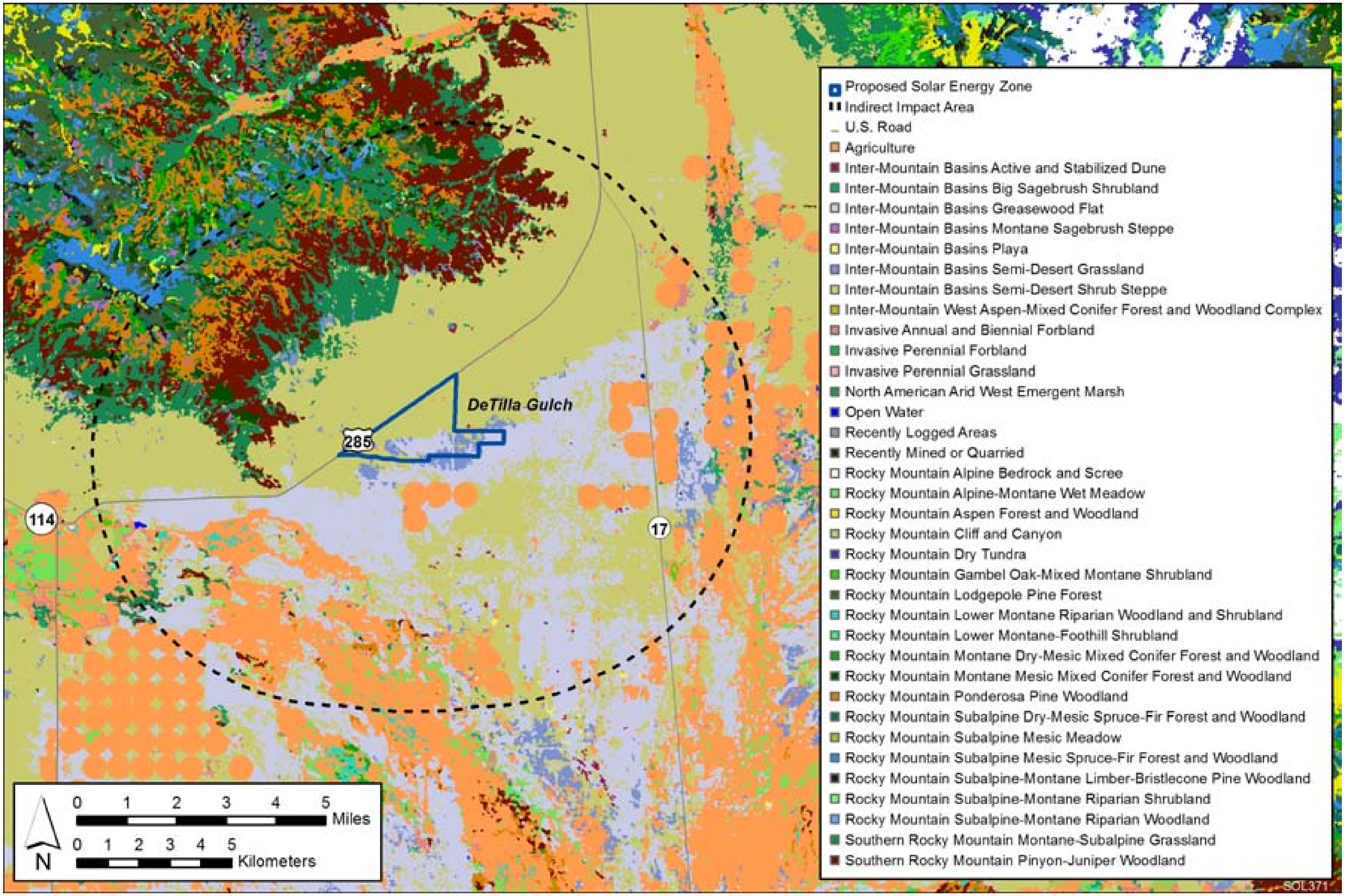

FIGURE 10.2.10.1-1 Land Cover Types within the Proposed De Tilla Gulch SEZ (Source: USGS 2004)

TABLE 10.2.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed De Tilla Gulch SEZ and Potential Impacts

Land Cover Type[a]	Area of Cover Type Affected (acres)[b]		
	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
S079 Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	959 acres[f] (0.2%, 1.0%)	27,983 acres (7.1%)	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.	325 acres (0.1%, 2.0%)	16,470 acres (5.8%)	Small
S090 Inter-Mountain Basins Semi-Desert Grassland: Consists of perennial bunchgrasses as dominants or co-dominants. Scattered shrubs or dwarf shrubs may also be present.	220 acres (0.9%, 2.4%)	1,224 acres (5.1%)	Small
N80 Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	12 acres (<0.1%, 0.4%)	10,862 acres (2.1%)	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.	0 acres	144 acres (0.2%)	Small
D09 Invasive Annual and Biennial Forbland: Areas dominated by annual and biennial non-native forb species.	0 acres	368 acres (1.5%)	Small
S085 Southern Rocky Mountain Montane-Subalpine Grassland: Typically occurs as a mosaic of two or three plant associations on well-drained soils. The dominant species is usually a bunchgrass.	0 acres	6,229 acres (0.9%)	Small

TABLE 10.2.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
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	131 acres (1.1%)	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	480 acres (0.8%)	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	6,281 acres (1.1%)	Small
S046 Rocky Mountain Gambel Oak-Mixed Montane Shrubland: Occurs on dry foothills and lower mountain slopes. Gambel oak (*Quercus gambelii*) may be the only dominant species or share dominance with other shrubs.	0 acres	39 acres (<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	2,720 acres (0.9%)	Small
N11 Open Water: Plant or soil cover is generally less than 25%.	0 acres	20 acres (0.2%)	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	44 acres (0.1%)	Small

TABLE 10.2.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
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	8 acres (0.2%)	Small
D06 Invasive Perennial Grassland: Dominated by non-native perennial grasses.	0 acres	83 acres (1.4%)	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	529 acres (0.3%)	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	125 acres (0.2%)	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	1,055 acres (0.5%)	Small
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	90 acres (0.4%)	Small
D07 Invasive Perennial Forbland: Dominated by non-native perennial forb species.	0 acres	2 acres (3.8%)	Small

TABLE 10.2.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
S023 Rocky Mountain Aspen Forest and Woodland: Dominated by quaking aspen (*Populus tremuloides)*, with or without a significant presence of conifers. The understory may consist of only herbaceous species or multiple shrub and herbaceous layers.	0 acres	23 acres (<0.1%)	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	116 acres (0.1%)	Small
D03 Recently Mined or Quarried: Includes open pit mines and quarries.	0 acres	7 acres (0.4%)	Small
D10 Recently Logged Areas: Includes clear-cut areas and areas thinned by 50% or more.	0 acres	2 acres (<0.1%)	Small
S015 Inter-Mountain Basins Playa: Playa habitats are intermittently flooded and generally barren or sparsely vegetated. Depressions may contain small patches of grass, and sparse shrubs may occur around playa margins.	0 acres	23 acres (0.2%)	Small
S025 Rocky Mountain Subalpine–Montane Limber-Bristlecone Pine Woodland: Occurs on dry, rocky, exposed ridges and slopes. Dominants in the open tree canopy include limber pine (*Pinus flexilis*) or bristlecone pine (*Pinus aristata*). Additional tree species are occasionally present. In some stands an open shrub layer may be present. Sparse grasses may also be present.	0 acres	116 acres (0.3%)	Small
S028 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland: Occurs on mountain slopes. The dominant tree species is Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), or both. Additional tree species commonly occur and shrubs may be present.	0 acres	117 acres (<0.1%)	Small

TABLE 10.2.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]		
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
S030 Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland: Occurs primarily on north- and east-facing mountain slopes and on alluvial terraces, well-drained benches, and inactive stream terraces. The dominant tree species are Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). Shrubs and herbaceous species are often present.	0 acres	295 acres (0.1%)	Small
S031 Rocky Mountain Lodgepole Pine Forest: Occurs in upper montane and subalpine zones. Lodgepole pine (*Pinus contorta*) is the dominant species and may form dense even-aged stands. The understory, if present, may be composed of shrubs or grasses.	0 acres	620 acres (0.3%)	Small
S042 Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland Complex: Occurs on montane slopes and plateaus. The tree canopy co-dominants are quaking aspen (*Populus tremuloides*) and conifers, Quaking aspen loses dominance in older stands. Shrubs and herbaceous species are often present.	0 acres	1 acre (<0.1%)	Small
S047 Rocky Mountain Lower Montane-Foothill Shrubland: Occurs on dry foothills, canyon slopes, and lower mountains. These areas are typically dominated by a variety of shrubs. Scattered trees or patches of grassland or steppe may occur.	0 acres	3 acres (<0.1%)	Small
S083 Rocky Mountain Subalpine Mesic Meadow: Occurs on gentle to moderate slopes on soils that are seasonally moist to saturated in spring. Forbs typically have more cover than graminoides.	0 acres	14 acres (<0.1%)	Small
S092 Rocky Mountain Subalpine-Montane Riparian Woodland: Occurs in seasonally flooded areas along river and stream floodplains or terraces, usually in narrow valleys and canyons, but may also occur in wide valley bottoms or along pond or lake margins. May include areas with a shallow water table or seeps for part of the growing season from snowmelt moisture. The dominant trees are typically conifers.	0 acres	67 acres (0.9%)	Small

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

Footnotes continue on next page.

TABLE 10.2.10.1.-1 (Cont.)

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

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

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary 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] Overall impact magnitude categories were based on professional judgment and are (1) *small*: a relatively small proportion of the cover type (≤1%) within the SEZ region would be lost; (2) *moderate*: an intermediate proportion of a cover type (>1 but ≤10%) would be lost; and (3) *large*: >10% of a cover type would be lost.

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

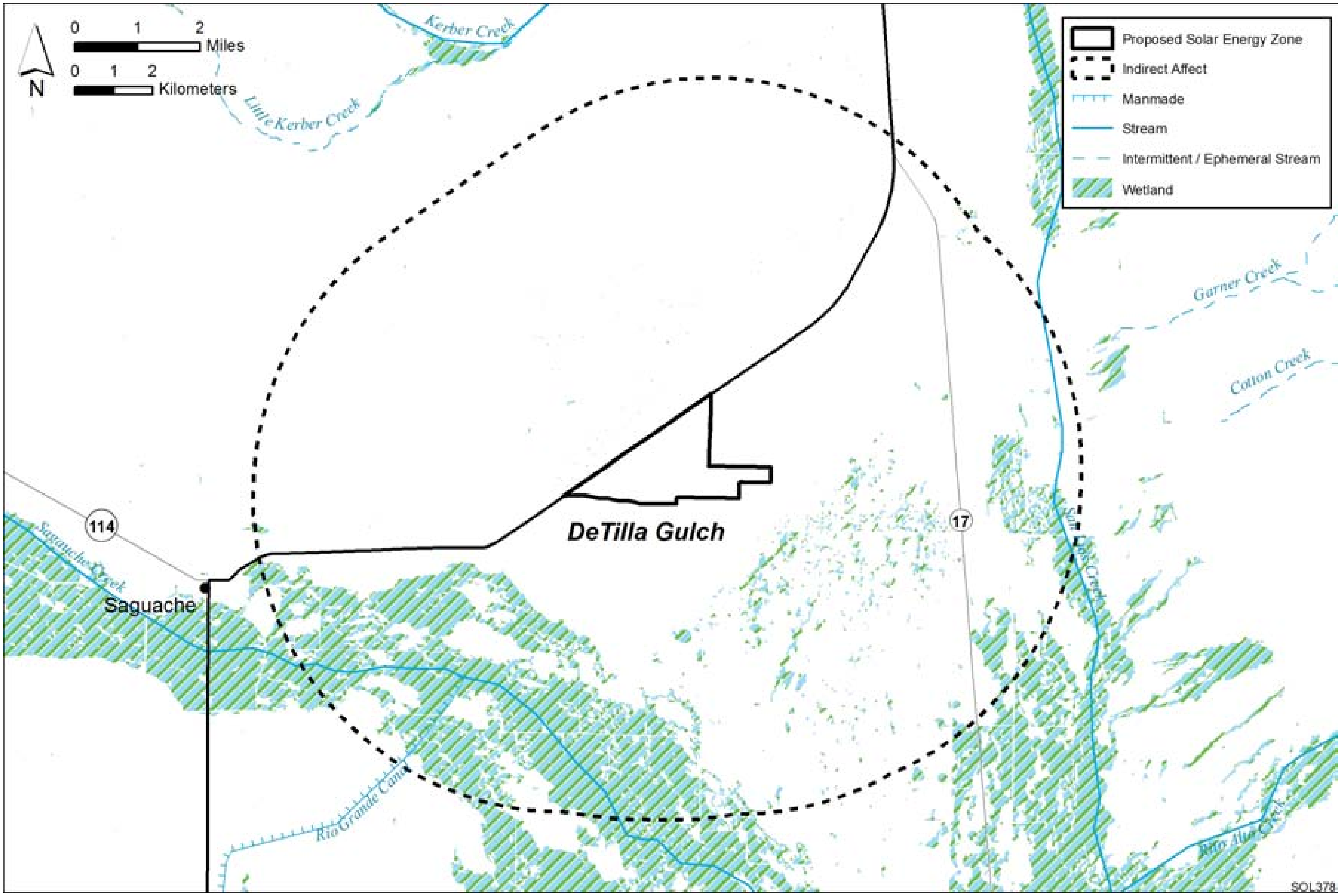

FIGURE 10.2.10.1-2 Wetlands within the Proposed De Tilla Gulch SEZ (Source: USFWS 2009)

SEZ, supports extensive palustrine wetlands with emergent plant communities that are temporarily flooded. The NWI maps are produced from high-altitude imagery and are subject to uncertainties inherent in image interpretation (USFWS 2009).

The State of Colorado maintains an official list of weed species that are designated noxious species (CDA 2010). Table 10.2.10.1-2 provides a summary of the noxious weed species regulated in Colorado that are known to occur in Saguache County. Noxious weeds observed on the SEZ include black henbane (*Hyoscyamos niger*) and spotted knapweed (*Centaurea stoebe* ssp. *micranthos*). Both of these species are included in Table 10.2.10.1-2.

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."

TABLE 10.2.10.1-2 Colorado Noxious Weeds Occurring in Saguache County

Common Name	Scientific Name	Status
Black henbane	*Hyoscyamus niger*	List B
Hoary cress/Whitetop	*Cardaria draba*	List B
Leafy spurge	*Euphorbia esula*	List B
Diffuse knapweed	*Centaurea diffusa*	List B
Russian knapweed	*Acroptilon repens*	List B
Spotted knapweed	*Centaurea maculosa*	List B
Canada thistle	*Cirsium arvense*	List B
Musk thistle	*Carduus nutans*	List B
Field bindweed	*Convolvulus arvensis*	List C
Quackgrass[a]	*Elytrigia repens*	
Wild Caraway[a]	*Carum carvi*	
Halogeton[a]	*Halogeton glomeratus*	
Perennial sowthistle[a]	*Sonchus arvensis*	

[a] Species not included on the CDA Saguache County list but that are believed to occur in the county (USDA 2010).

Source: CDA (2010).

- "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 De Tilla Gulch SEZ (Table 10.2.10.1-3).

In addition to black henbane and spotted knapweed, which have been observed on the SEZ, hoary cress and field bindweed are known to occur in the vicinity of the SEZ (BLM 2010a). The only species from Table 10.2.10.1-3 on List A, Hydrilla, is an aquatic species and not known to occur in the vicinity of the SEZ.

TABLE 10.2.10.1-3 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).

10.2.10.2 Impacts

The construction of solar energy facilities within the proposed De Tilla Gulch 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 (1,217 acres [4.9 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 for 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 within the SEZ 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 any additional mitigation applied. SEZ-specific design features are described in Section 10.2.10.3.

10.2.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact affected a relatively small proportion (<1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); a moderate impact could affect an intermediate proportion (>1 but <10%) of cover type; a large impact 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. Additional cover types within the SEZ that would be affected include Inter-Mountain Basins Greasewood Flat and Inter-Mountain Basins Semi-Desert Grassland. Although the Agriculture cover type occurs 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 De Tilla Gulch SEZ are summarized in Table 10.2.10.1-1. Most of these cover types are relatively common in the SEZ region, however, Inter-Mountain Basins Semi-Desert Grassland is relatively uncommon, representing approximately 0.5% of the land area within the SEZ region. The construction, operation, and decommissioning of solar projects within the SEZ would result in small impacts on each of the 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. Grading near the wetlands near the SEZ boundary could disrupt surface water or groundwater flow characteristics, resulting in changes in the frequency, duration, depth, or extent of inundation or soil saturation and could potentially alter wetland plant communities and affect wetland function. Increases in surface runoff from a solar energy project site could also affect wetland hydrologic characteristics. The introduction of contaminants into wetlands near the SEZ could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in wetland areas, which could degrade or eliminate wetland plant communities. However, the wetlands nearest to the SEZ, located to the northwest, are primarily associated with streams upgradient from the SEZ and would be unlikely to be affected by altered surface water or groundwater flows or water quality changes. Wetlands located farther from the SEZ and downgradient, to the south, southeast, or southwest, could potentially be affected by project construction activities, either by surface water or groundwater impacts. Communities associated with greasewood flats communities, riparian habitats, or other periodically flooded areas within or downstream from solar projects 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 10.2.9 for further discussion of washes.

Although the use of groundwater within the De Tilla Gulch 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 10.2.9). Plant communities that are supported by groundwater discharge, such as many of the wetlands south, southwest, or southeast of the SEZ, including the wetland complexes associated with Saguache and San Luis Creeks, could become degraded or lost as a result of groundwater flow alterations.

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 southeast of the SEZ, the predominant downwind direction, are those of the Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Greasewood Flat cover types. Inter-Mountain Basins Semi-Desert Grassland, as well as agricultural areas, Inter-Mountain Basins Active and Stabilized Dune, and Inter-Mountain Basins Playa, also occurs to the southeast.

10.2.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

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*, Vol. 64, page 6183, 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 the affected area of the proposed De Tilla Gulch SEZ. Weeds could be transported into areas that were previously relatively weed-free, and this could result in reduced restoration success and possible widespread habitat degradation.

Noxious weeds, including black henbane and spotted knapweed, occur on the proposed De Tilla Gulch SEZ. Additional species that are known to occur in San Luis Valley near the SEZ include hoary cress and field bindweed. Additional species known to occur in Saguache County or the San Luis Valley Resource Area are given in Table 10.2.10.1-2 and Table 10.2.10.1-3, respectively. Approximately 368 acres (1.49 km^2) of Invasive Annual and Biennial Forbland occur within 5 mi (8 km) of the SEZ. Invasive Perennial Grassland and Invasive Perennial Forbland also occur 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, transmission lines, 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 the spread of noxious weeds and invasive species. Disturbed areas, including 10,862 acres (44.0 km^2) of Agriculture, 7 acres (0.03 km^2) of Recently Mined or Quarried, and 2 acres (0.008 km^2) of Recently Logged Areas occur within the area of indirect effects and may contribute to the establishment of noxious weeds and invasive species.

10.2.10.3 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 considering specific project details, design features that can be identified at this time include the following:

- 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 Shrub Steppe, Greasewood Flat, or Grassland habitats and minimize the potential for the spread of invasive species, such as black henbane or spotted knapweed. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

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

- Appropriate engineering controls should be used to minimize impacts on riparian, dry wash, and wetland habitats, including downstream occurrences, such as those associated with Saguache Creek or San Luis Creek, resulting from surface water runoff, erosion, sedimentation, altered hydrology, or accidental spills, and fugitive dust deposition to these and nearby upland habitats. Appropriate engineering controls would be determined through agency consultation.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetlands, such as many of the wetlands south, southwest, or southeast of the SEZ, including the wetland complexes associated with Saguache and San Luis Creeks, that are associated with groundwater discharge.

If these SEZ-specific design features were 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, dry wash, and riparian habitat would be reduced to a minimal potential for impact. Residual impacts on wetlands could result from remaining groundwater withdrawal, etc.; however, it is anticipated these impacts would be avoided in the majority of instances.

10.2.11 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 De Tilla Gulch 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 within the SEZ). The maximum developed area within the SEZ would be 1,217 acres (4.9 km^2).

The area of indirect effects was defined as the area within 5 mi [8 km] of the SEZ boundary 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 road construction area). Potentially suitable habitat for a species within the SEZ greater than the maximum of 1,217 acres (4.9 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 effect are defined and the impact assessment approach is described in Appendix M. No area of direct or indirect effects was assumed for a new transmission line or access road because they are not expected to be needed for developments on the proposed De Tilla Gulch SEZ due to the proximity of an existing transmission line and state highway.

The primary habitat type within the affected area is semiarid shrub-steppe (Section 10.2.10), although aquatic and riparian habitats occur in and along San Luis Creek, Saguache Creek, and diversion canals to the Rio Grande (Figure 10.2.12.1-1). No permanent surface water bodies are located within the proposed De Tilla Gulch SEZ although several ephemeral drainages cross the SEZ. Saguache Creek, San Luis Creek, Rio Grande Canal, and wetland areas are located within the area of indirect effects (Figure 10.2.9.1-1).

10.2.11.1 Amphibians and Reptiles

10.2.11.1.1 Affected Environment

This section addresses amphibian and reptile species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed De Tilla Gulch SEZ. The list of amphibian and reptile species potentially present in the SEZ area was determined from the Colorado Natural 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.

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., Saguache and San Luis creeks and the Rio Grande Canal): the bullfrog (*Rana catesbeiana*), Great Plains toad (*Bufo cognatus*), northern leopard frog (*Rana pipiens*), tiger salamander (*Ambystoma tigrinum*), plains spadefoot (*Spea bombifrons*), and Woodhouse's toad (*Bufo woodhousii*). Based on habitat preferences of the amphibian species, the Great Plains toad and 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 within the SEZ.

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

Table 10.2.11.1-1 provides habitat information and the types and overall area of potentially suitable land cover for representative reptile species that could occur on the SEZ.

10.2.11.1.2 Impacts

The types of impacts that amphibians and reptiles could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 10.2.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed De Tilla Gulch 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 10.2.11.1.1 following the analysis approach described in Appendix M. Additional NEPA assessments and

TABLE 10.2.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Reptile Species That Could Occur on or in the Affected Area of the Proposed De Tilla Gulch 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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Amphibians				
Great Plains toad (*Bufo cognatus*)	Sandy semidesert shrublands in the San Luis Valley. Can be relatively common in agricultural areas. About 756,200 acres[g] of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	45,984 acres of potentially suitable habitat (6.1% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 2,492,200 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	52,847 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	Small overall impact.
Lizards				
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 1,728,500 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	55,210 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	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 925,300 acres of potentially suitable habitat occurs in the SEZ region.	220 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat)	10,315 acres of potentially suitable habitat (1.1% of available potentially suitable habitat)	Small overall impact. Avoidance of prairie dog colonies would reduce the potential for impact.

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TABLE 10.2.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Lizards				
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 3,356,800 acres of potentially suitable habitat occurs in the SEZ region.	220 acres of potentially suitable habitat lost (<0.01% of available potentially suitable habitat)	19,274 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	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 1,644,100 acres of potentially suitable habitat occurs in the SEZ region.	232 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat)	21,290 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	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 3,331,300 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat)	57,347 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Western terrestrial garter snake (*Thamnophis elegans*)	Most terrestrial and wetland habitats near bodies of water, but can be found many miles from water. About 1,917,400 acres of potentially suitable habitat occurs in the SEZ region.	959 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	31,223 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	Small overall impact.

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TABLE 10.2.11.1-1 (Cont.)

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[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 1,217 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 1,217 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] 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.

[f] 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.

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

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

coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 10.2.11.1.3).

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 individuals. On the basis of the impacts on representative amphibian and reptile species summarized in Table 10.2.11.1-1, direct impacts on amphibian and reptile species would be small, ranging from a high of 0.2% for the Great Plains toad to a low of <0.01% for the short-horned lizard. Larger areas of potentially suitable habitats for amphibian and reptile species occur within the area of potential indirect effects (e.g., up to 6.1% of available potentially suitable habitat for the Great Plains toad). 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.

10.2.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

The successful 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 could be avoided (e.g., ephemeral drainages). 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 considering specific project details, design features that can be identified at this time include the following:

- Ephemeral drainages within the SEZ should be avoided to the extent practicable.

- Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition on aquatic, riparian, and wetland habitats associated Saguache Creek, San Luis Creek, Rio Grande Canal, and wetland areas located within the area of indirect effects.

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.

10.2.11.2 Birds

10.2.11.2.1 Affected Environment

This section addresses bird species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the De Tilla Gulch 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 was determined 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 De Tilla Gulch SEZ, waterfowl, wading birds, and shorebirds are uncommon because of the lack of aquatic and wetland habitats. The mountain plover (*Charadrius montanus*) may occur on the SEZ. This special status species is discussed in Section 10.2.12. San Luis Creek, Saguache Creek, Rio Grande Canal, and the wetlands that occur within the 5-mi (8-km) area of indirect effect adjacent to the SEZ provide habitat more suitable 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 De Tilla Gulch 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 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 10.2.12.

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 De Tilla Gulch SEZ. No activity areas mapped for upland game birds such as the wild turkey (*Meleagris gallopavo*) occur within 5.0 mi (8.0 km) of the SEZ (CDOW 2008).

Table 10.2.11.2-1 provides habitat information for representative bird species that could occur within the proposed De Tilla Gulch SEZ. Special status bird species are discussed in Section 10.2.12.

10.2.11.2.2 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 any additional mitigation measures applied. Section 10.2.11.2.3, below, identifies design features of particular relevance to the De Tilla Gulch 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 10.2.11.2.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with federal or state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on birds (see Section 10.2.11.2.3).

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 10.2.11.2-1 summarizes the potential impacts on representative bird species resulting from solar energy development in the proposed De Tilla Gulch SEZ. Direct impacts on bird species would be small, as only 0.09% 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 4.0% of available potentially suitable habitat for horned

TABLE 10.2.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed De Tilla Gulch 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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
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 2,166,300 acres[g] of potentially suitable habitat occurs in the SEZ region.	765 acres of potentially suitable habitat lost (<0.04% of available habitat)	36,021 acres of potentially suitable habitat (1.7% of available habitat)	Small overall impact. Avoidance of prairie dog colonies would further reduce the potential for impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
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 332,700 acres of potentially suitable habitat occurs in the SEZ region.	220 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	1,657 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	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 2,498,600 acres of potentially suitable habitat occurs in the SEZ region.	1,179 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	52,856 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	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.

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TABLE 10.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
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 1,429,500 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.09% of available potentially suitable habitat)	57,121 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	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 692,800 acres of potentially suitable habitat occurs in the SEZ region.	12 acres of potentially suitable habitat lost (0.002% of available potentially suitable habitat)	11,693 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
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 2,047,900 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	47,055 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	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 10.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
Neotropical Migrants (Cont.)				
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 2,234,800 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	63,898 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	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.
Birds of Prey				
American kestrel (*Falco sparverius*)	Occurs in most open habitats, in various shrub and early successional forest habitats, forest openings, and various ecotones. Perches on trees, snags, rocks, utility poles and wires, and fence posts. Uses cavities in trees, snags, rock areas, banks, and buildings for nesting and cover. About 4,085,100 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	73,690 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
Birds of Prey (Cont.)				
Golden eagle (*Aquila chrysaetos*)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 4,554,100 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	75,274 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	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.
Red-tailed hawk (*Buteo jamaicensis*)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 2,512,200 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	45,640 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	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 1,563,100 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat)	46,507 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	Small overall impact.. Avoidance of nest trees would further reduce the potential for impact.

TABLE 10.2.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Birds of Prey (Cont.)				
Turkey vulture *(Cathartes aura)*	Occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally transmission line support towers. About 1,238,600 acres of potentially suitable habitat occurs in the SEZ region.	12 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat)	17,556 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	Small overall impact.
Upland Game Birds				
Mourning dove (*Zenaida macroura*)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, deserts, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 2,480,900 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	66,663 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	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 1,217 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 1,217 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.

Footnotes continued on next page.

TABLE 10.2.11.2-1 (Cont.)

[e] 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.

[f] 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.

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

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

lark). Other impacts on birds could result from collisions with buildings, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (e.g., 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; however, 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.

10.2.11.2.3 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 or eliminate the potential for effects on birds. While some SEZ-specific design features are best established when considering specific project details, design features that can be identified at this time include the following:

- For solar energy developments that occur 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.

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

- Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition on these habitats on aquatic, riparian, and wetland habitats associated with Saguache Creek, San Luis Creek, Rio Grande Canal, and wetland areas.

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.

10.2.11.3 Mammals

10.2.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed De Tilla Gulch 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 De Tilla Gulch 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 10.2.11.3-1 provides a description of the various activity areas that have been mapped for the big game species in Colorado. Table 10.2.11.3-2 provides habitat information for representative big game species that could occur within the proposed De Tilla Gulch SEZ.

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

American Black Bear. The proposed De Tilla Gulch 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 closest American black bear summer concentration area to the De Tilla Gulch SEZ is 10 mi (16 km) east of the SEZ. The closest fall concentration area is 6 mi (10 km) northwest 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 De Tilla Gulch SEZ.

Bighorn Sheep. No mapped activity areas for the bighorn sheep occur in the proposed De Tilla Gulch SEZ (Figure 10.2.11.3-1). However, the following mapped bighorn sheep activity areas occur within 5 mi (8 km) of the SEZ: overall range—1.3 mi (2.1 km); winter range—2 mi (3 km); severe winter range—5 mi (8 km); winter concentration area—2 mi (3 km); and production area—1.5 mi (2.4 km). These activity areas are located north and northwest of the proposed De Tilla Gulch SEZ (Figure 10.2.11.3-1). Because bighorn sheep typically inhabit

TABLE 10.2.11.3-1 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).

mountains and foothills in Colorado (CDOW 2009), they are not expected to frequent the De Tilla Gulch SEZ. On the basis of SWReGAP (USGS 2004, 2005, 2007) mapping, 959 acres (3.8 km^2) of habitat suitable for the bighorn sheep occurs on the SEZ and 45,888 acres (185.7 km^2) occurs within 5 mi (8 km) of the SEZ boundary.

Cougar. The proposed De Tilla Gulch SEZ occurs within the overall range of the cougar (CDOW 2008). Within Colorado, cougars mostly occur in rough, broken foothills and canyon

TABLE 10.2.11.3-2 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed De Tilla Gulch 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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Big Game				
American black bear (*Ursus americanus*)	Montane shrublands and forests, and subalpine forests at moderate elevations. Fairly common in Conejos County. About 2,716,700 acres[g] of potentially suitable habitat occurs in the SEZ region.	220 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat)	19,155 acres of potentially suitable habitat (0.7% of available potentially suitable habitat)	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 3,183,300 acres of potentially suitable habitat occurs in the SEZ region.	959 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	45,888 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	Small overall impact.
Cougar (*Puma concolor*)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 3,941,900 acres of potentially suitable habitat occurs in the SEZ region.	1,179 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	47,922 acres of potentially suitable habitat (1.2% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 3,156,200 acres of potentially suitable habitat occurs in the SEZ region.	0 acres of potentially suitable habitat lost (0.0% of available potentially suitable habitat)	18,187 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	None

TABLE 10.2.11.3-2 (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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Big Game (Cont.)				
Mule deer (*Odocoileus hemionus*)	Most habitats including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. About 4,460,500 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	75,432 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	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. About 2,129,600 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	72,327 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	Small overall impact.. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Small Game and Furbearers				
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Digs burrows in friable soils. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 3,760,200 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	64,349 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.2.11.3-2 (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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Small Game and Furbearers (Cont.)				
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 4,902,300 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat)	76,396 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	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*)	Abundant to common in grasslands, open forests, and desert shrub habitats. Can occur in areas with minimal vegetation as long as adequate cover (e.g., rock piles, fallen logs, fence rows) is present. Tickets and patches of shrubs, vines, and brush also used as cover. About 2,439,300 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	66,172 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact.. Avoidance of prairie dog colonies would further reduce the potential for impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Red fox (*Vulpes vulpes*)	Most common in open woodlands, pasturelands, riparian areas, and agricultural lands. About 3,644,200 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	58,158 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.2.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
Small Game and Furbearers (Cont.)				
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 4,301,800 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available habitat)	75,204 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
White-tailed 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 2,320,600 acres of potentially suitable habitat occurs in the SEZ region.	1,179 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	45,307 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	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*)	Tundra; alpine and subalpine grasslands;, plains grasslands; open, sparsely vegetated deserts; warm temperate swamps and riparian forests; and Sonoran desert scrub habitats. About 4,151,300 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	75320 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.2.11.3-2 (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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Nongame (small) Mammals (Cont.)				
Least chipmunk (*Tamias minimus*)	Low-elevation semidesert shrublands, montane shrublands and woodlands, forest edges, and alpine tundra. About 3,539,700 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	58,464 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Northern pocket gopher (*Thomomys talpoides*)	Various habitats such as agricultural and pasture lands, semidesert shrublands, and grasslands. Most common in meadows and grasslands. About 4,061,600 acres of potentially suitable habitat occurs in the SEZ region.	1,191 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	58,276 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	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 1,464,300 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat)	51,128 acres of potentially suitable habitat (3.5% of available potentially suitable habitat)	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 1,876,600 acres of potentially suitable habitat occurs in the SEZ region.	971 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	45,314 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact. Avoidance of prairie dog colonies would further reduce the potential for impacts.

TABLE 10.2.11.3-2 (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]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Nongame (small) Mammals				
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 4,198,400 acres of potentially suitable habitat occurs in the SEZ region.	1,217 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	75,203 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	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 1,217 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 1,217 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] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: $\leq$1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but $\leq$10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[f] 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.

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

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

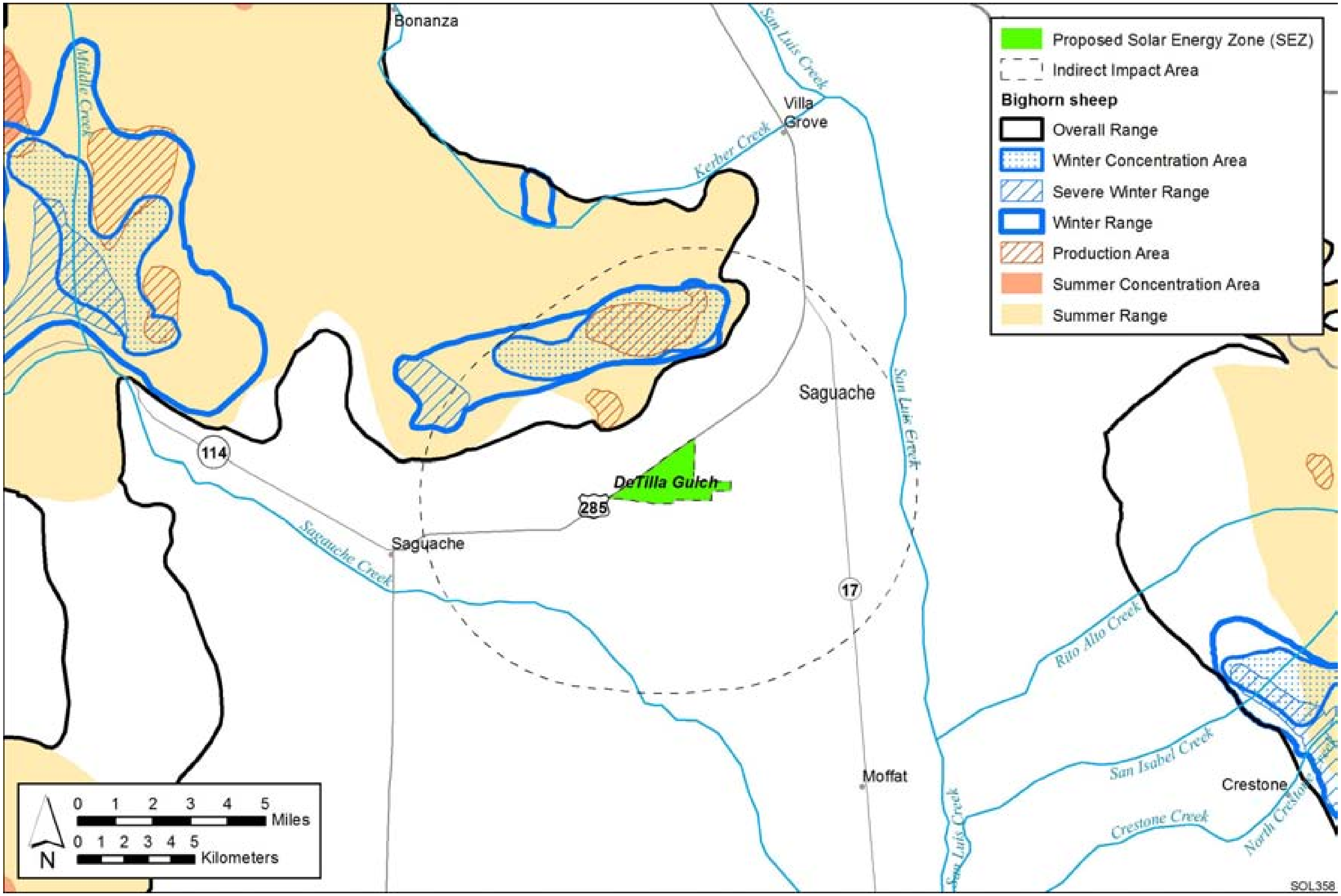

FIGURE 10.2.11.3-1 Bighorn Sheep Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

country, often in association with montane forests, shrublands, and pinyon-juniper woodlands (CDOW 2009). Thus, they are not expected to frequent the SEZ.

Elk. The proposed De Tilla Gulch SEZ occurs within the overall range, winter range, and severe winter range of the elk (Figure 10.2.11.3-2). In addition, the following mapped elk activity areas occur within 5 mi (8 km) of the SEZ: winter concentration area—2.5 mi (4.5 km); summer range—0.4 mi (0.6 km); summer concentration area—1.8 mi (2.9 km); and production area—1.7 mi (2.7 km). The winter concentration area is north of the De Tilla Gulch SEZ, while the other three activity areas are south of the SEZ (Figure 10.2.11.3-2).

Mule Deer. The proposed De Tilla Gulch SEZ occurs within the mule deer's overall range and winter range (Figure 10.2.11.3-3). Other mapped mule deer activity areas that occur within 5 mi (8 km) of the De Tilla Gulch SEZ are severe winter range—0.1 mi (0.2 km); winter concentration area—3.5 mi (5.6 km); summer range—2.0 mi (3.2 km); resident population area—2.2 mi (3.5 km); and concentration area—2.3 mi (3.7 km) (Figure 10.2.11.3-3).

Pronghorn. The proposed De Tilla Gulch SEZ occurs within the pronghorn's overall range, winter range, and winter concentration area (Figure 10.2.11.3-4). No other mapped pronghorn activity areas occur 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 De Tilla Gulch SEZ. Those species that are common or abundant within Saguache County and that could occur within the area of the SEZ include the American badger (*Taxidea taxus*, common), 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 Saguache County and that could occur within the area of the proposed De Tilla Gulch 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). Because of its special status (candidate for listing under the ESA), the species is discussed in Section 10.2.12.

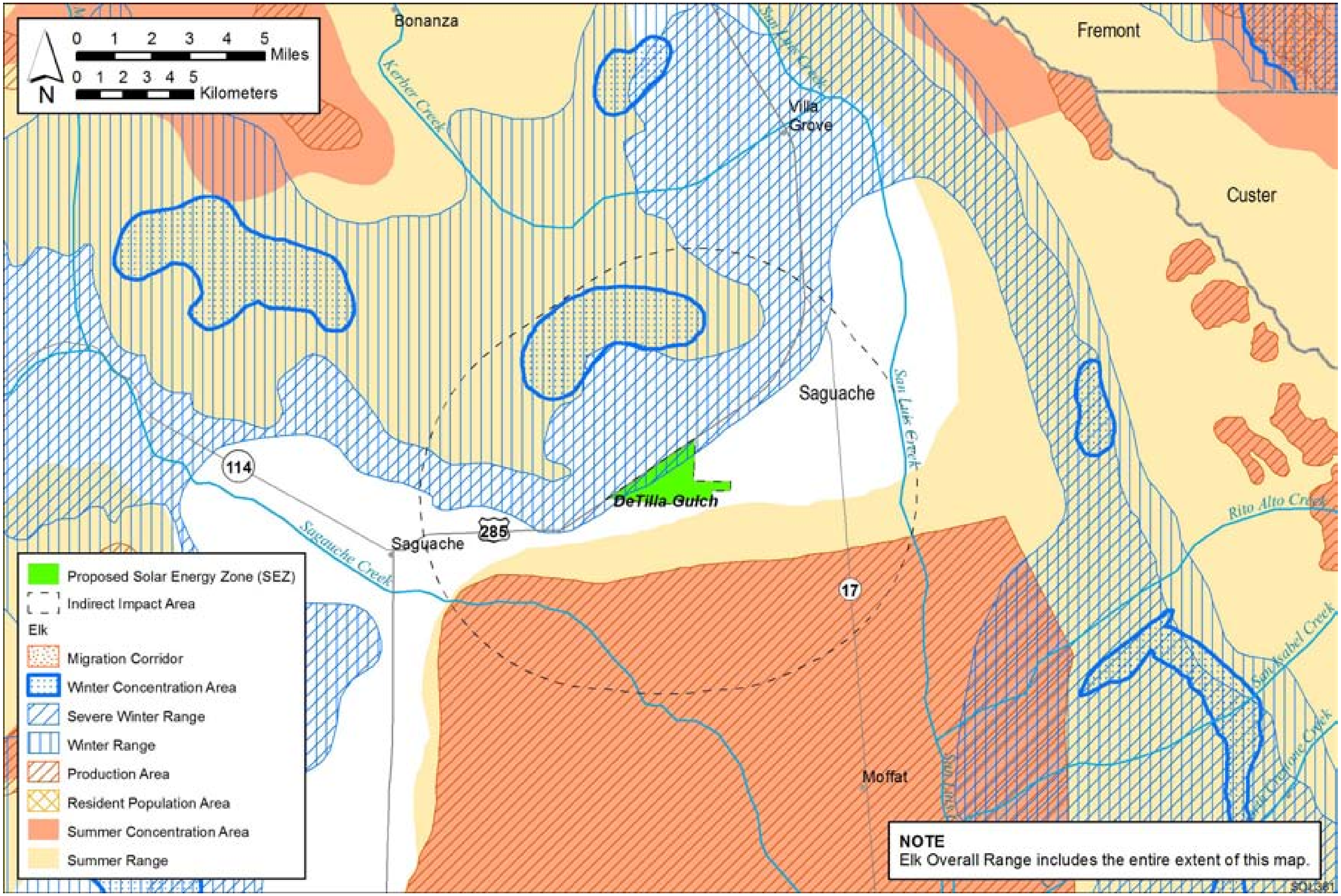

FIGURE 10.2.11.3-2 Elk Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

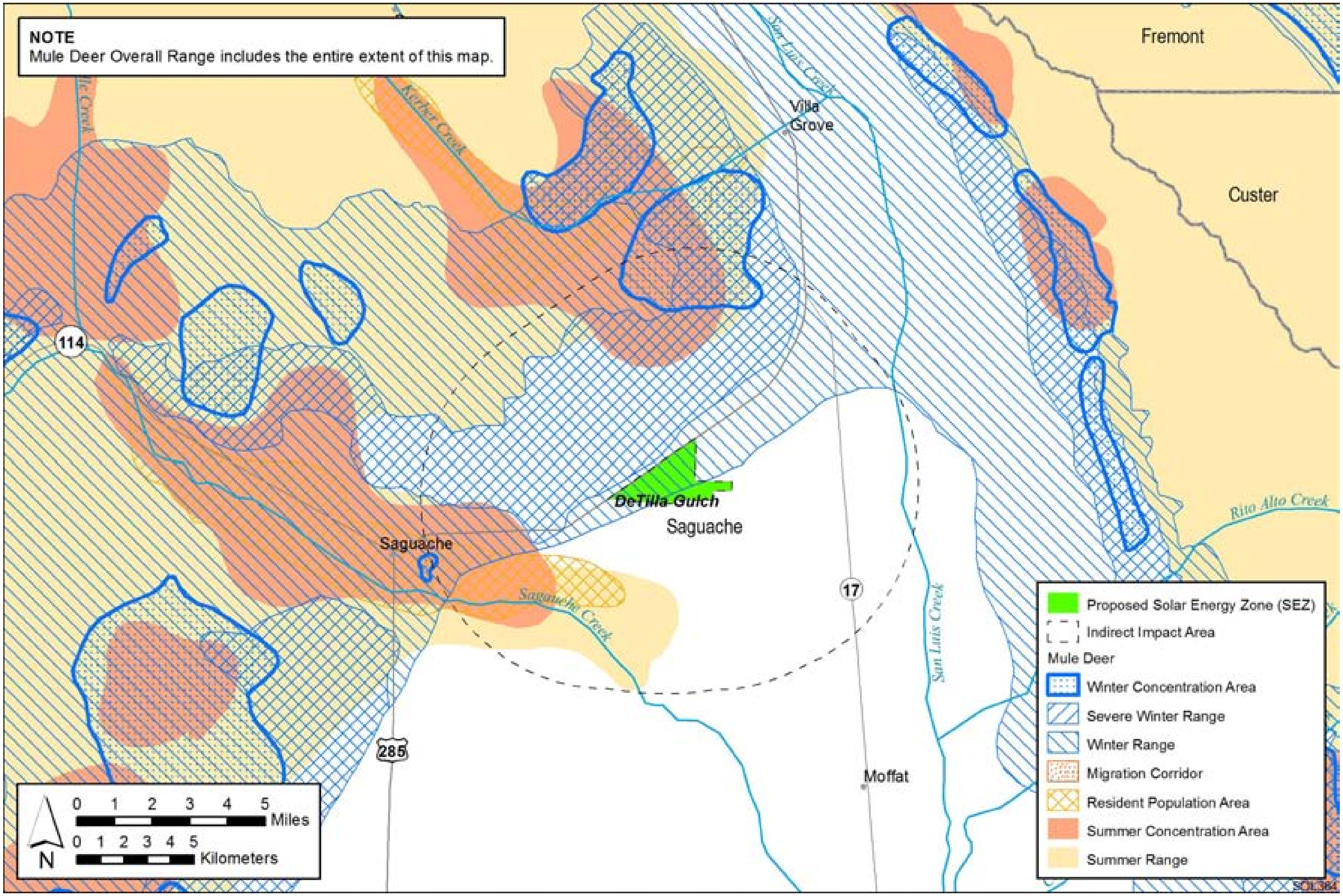

FIGURE 10.2.11.3-3 Mule Deer Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

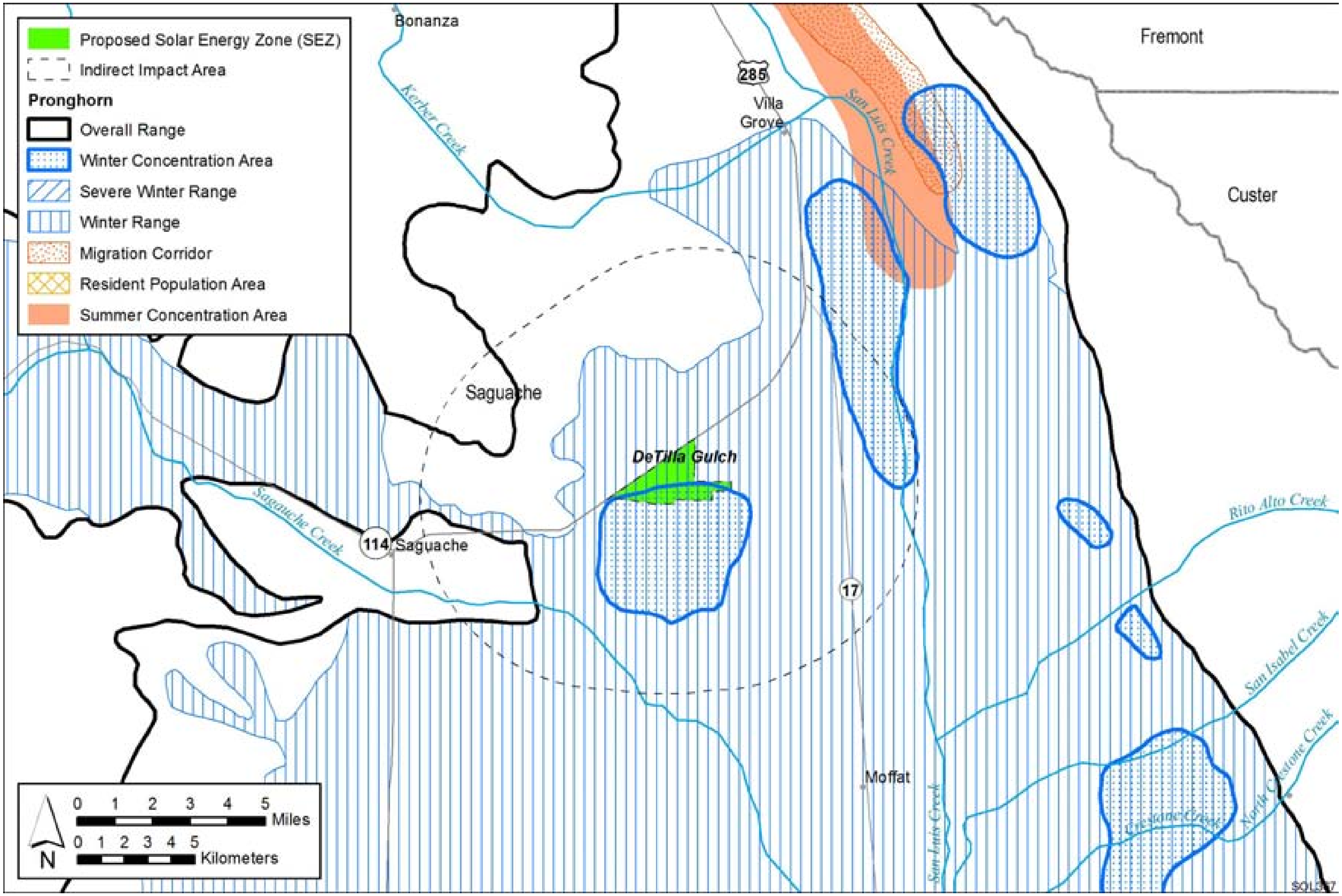

FIGURE 10.2.11.3-4 Pronghorn Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

Table 10.2.11.3-2 provides habitat information for these other mammal species that could occur within the proposed De Tilla Gulch SEZ.

10.2.11.3.2 Impacts

The types of impacts that mammals could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 10.2.11.3.3 below, identifies SEZ-specific design features of particular relevance to the proposed De Tilla Gulch 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 10.2.11.3.1, 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 10.2.11.3.3).

Table 10.2.11.3-2 summarizes the potential impacts on representative mammal species resulting from solar energy development (with the implementation of required programmatic design features) in the proposed De Tilla Gulch SEZ.

American Black Bear

Based on potentially suitable land cover, up to 220 acres (0.9 km^2) of potentially suitable American black bear habitat could be lost by SEZ development within the proposed De Tilla Gulch SEZ. This represents 0.008% of potentially suitable American black bear habitat within the SEZ region. Over 19,150 acres (77.5 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 959 acres (3.9 km^2) of potentially suitable bighorn sheep habitat could be lost by SEZ development within the proposed De Tilla Gulch SEZ. This represents about 0.03% of potentially suitable bighorn sheep habitat within the SEZ region. Over 45,800 acres (185 km^2) of potentially suitable bighorn sheep habitat (based on land cover analyses) occurs within the area of indirect effects. Indirect effects could occur also occur to bighorn sheep when occupying their mapped activity areas (based on range mapping) that occur within 5 mi (8 km) of the SEZ (Table 10.2.11.3-3). Overall, impacts on bighorn sheep from solar energy development in the SEZ would be small.

TABLE 10.2.11.3-3 Potential Magnitude of Impacts on Bighorn Sheep Activity Areas Resulting from Solar Energy Development within the Proposed De Tilla Gulch SEZ

Activity Area[a]	Area of Habitat Affected (acres)[b] Within SEZ (Direct Effects)[c]	Area of Habitat Affected (acres)[b] Outside SEZ (Indirect Effects)[d]	Area of Habitat within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	0 acres	76,370 acres[g] of habitat (1.5% of available habitat)	5,023,041 acres	None
Summer range	0 acres	14,316 acres of habitat (1.4% of available habitat)	1,034,612 acres	None
Winter range	0 acres	7,836 acres of habitat (2.0% of available habitat)	388,396 acres	None
Winter concentration area	0 acres	5,485 acres of habitat (4.9% of available habitat)	112,135 acres	None
Severe winter range	0 acres	405 acres of habitat (0.3% of available habitat)	144,563 acres	None
Production area	0 acres	2,605 acres of habitat (2.3% of available habitat)	113,551 acres	None

[a] Activity areas are described in Table 10.2.11.3-1.

[b] Activity area habitat affected relative to total available habitat within the SEZ region. Habitat availability was determined from suitable land cover for each species (CDOW 2009).

[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 1,127 acres (4.9 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.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ.

[f] 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.

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

Source: CDOW (2008).

Cougar

Based on potentially suitable land cover, up to 1,179 acres (4.85 km^2) of potentially suitable cougar habitat could be lost by SEZ development within the proposed De Tilla Gulch SEZ. This represents about 0.03% of potentially suitable cougar habitat within the SEZ region. More than 47,900 acres (193 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, no potentially suitable elk habitat would be lost by development within the proposed De Tilla Gulch SEZ. Nearly 18,180 acres (73.6 km^2) of potentially suitable elk habitat occurs within the area of indirect effects. Based on mapped activity areas, 1,217 acres (4.9 km^2) of overall elk range and 497 acres (2.0 km^2) of elk winter and severe winter range could be directly impacted by solar energy development within the proposed De Tilla Gulch SEZ (Table 10.2.11.3-4). Direct loss of overall elk range would account for about 0.02% of the elk range occurring within the Colorado portion of the SEZ region; while direct loss of winter range and severe winter range would represent a 0.02 and 0.05% loss, respectively. No direct impacts on other mapped elk activity areas would occur (Table 10.2.11.3-4). Overall, impacts on elk from solar energy development in the SEZ would be small.

Mule Deer

Based on potentially suitable land cover, up to 1,217 acres (4.9 km^2) of potentially suitable mule deer habitat could be lost by SEZ development within the proposed De Tilla Gulch SEZ. This represents about 0.03% of potentially suitable mule deer habitat within the SEZ region. More than 72,400 acres (293 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effects. Based on mapped activity areas, 1,217 acres (4.9 km^2) of overall mule deer range and 1,128 acres (4.6 km^2) of winter range could be directly impacted by solar energy development within the proposed De Tilla Gulch SEZ (Table 10.2.11.3-5). A mule deer resident population does occur within 0.6 mi (1.0 km) of the De Tilla Gulch SEZ. Although some mule deer within this population could be disturbed, particularly during construction, no loss of resident-population habitat would be expected. No direct impacts on other mapped mule deer activity areas would occur (Table 10.2.11.3-5). Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Pronghorn

Based on potentially suitable land cover, up to 1,217 acres (4.9 km^2) of potentially suitable pronghorn habitat could be lost by SEZ development within the proposed De Tilla Gulch SEZ. This represents about 0.06% of potentially suitable pronghorn habitat within the SEZ

TABLE 10.2.11.3-4 Potential Magnitude of Impacts on Elk Activity Areas Resulting from Solar Energy Development within the Proposed De Tilla Gulch SEZ

Activity Area[a]	Area of Habitat Affected (acres)[b]: Within SEZ (Direct Effects)[c]	Area of Habitat Affected (acres)[b]: Outside SEZ (Indirect Effects)[d]	Area of Habitat within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	1,217 acres[g] of habitat lost (0.02% of available habitat)	76,370 acres of habitat (1.6% of available habitat)	4,868,328 acres	Small
Summer range	0 acres	43,707 acres	3,370,822 acres	None
Summer concentration area	0 acres	20,295 acres	657,574 acres	None
Winter range	497 acres of habitat lost (0.02% of available habitat)	31,340 acres of habitat (1.2% of available habitat)	2,551,348 acres	Small
Winter concentration area	0 acres	5,254 acres	620,779 acres	None
Severe winter range	497 acres of habitat lost (0.05% of available habitat)	17,017 acres of habitat (1.6% of available habitat)	1,079,935 acres	Small
Production area	0 acres	0 acres	523,122 acres	None
Migration corridor	0 acres	0 acres	53,980 acres	None
Resident population area	0 acres	0 acres	66,078 acres	Small

a Activity areas are described in Table 10.2.11.3-1.

b Activity area habitat affected relative to total available habitat within the SEZ region. Habitat availability was determined from suitable land cover for each species (CDOW 2009).

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 1,127 acres (4.9 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 The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ.

f 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.

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

Source: CDOW (2008).

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TABLE 10.2.11.3-5 Potential Magnitude of Impacts on Mule Deer Activity Areas Resulting from Solar Energy Development within the Proposed De Tilla Gulch SEZ

Activity Area[a]	Area of Habitat Affected (acres)[b] Within SEZ (Direct Effects)[c]	Area of Habitat Affected (acres)[b] Outside SEZ (Indirect Effects)[d]	Area of Habitat within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	1,217 acres[g] of habitat lost (0.02% of available habitat)	76,370 acres of habitat (1.5% of available habitat)	5,023,041 acres	Small
Summer range	0 acres	20,153 acres of habitat (0.5% of available habitat)	3,791,243 acres	None
Summer concentration area	0 acres	11,789 acres of habitat (4.1% of available habitat)	285,222 acres	None
Winter range	1,128 acres of habitat lost (0.05% of available habitat)	38,891 acres of habitat (1.7% of available habitat)	2,301,462 acres	Small
Winter concentration area	0 acres	3,175 acres of habitat (0.7% of available habitat)	440,291 acres	None
Severe winter range	0 acres	22,752 acres of habitat (2.3% of available habitat)	1,003.481 acres	None
Migration corridor	0 acres	0 acres	45,592 acres	None
Resident population area	0 acres	4,479 acres of habitat (4.3% of available habitat)	103,481 acres	None

a Activity areas are described in Table 10.2.11.3-1.

b Activity area habitat affected relative to total available habitat within the SEZ region. Habitat availability was determined from suitable land cover for each species (CDOW 2009).

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 1,127 acres (4.9 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.

Footnotes continued on next page.

TABLE 10.2.11.3-5 (Cont.)

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[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ.

[f] 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.

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

Source: CDOW (2008).

region. About 72,300 acres (293 km^2) of potentially suitable pronghorn habitat occurs within the area of indirect effects. Based on mapped pronghorn activity areas (Table 10.2.11.3-6), solar development in the proposed De Tilla Gulch SEZ would directly impact 1,217 acres (4.9 km^2) of pronghorn overall range and winter range and 609 acres (2.5 km^2) of a winter concentration area. Solar energy development within the winter concentration area could force pronghorn to concentrate farther within the remainder of the concentration area or disperse to other areas within the pronghorn's overall winter range. No impacts would occur to other activity areas (Table 10.2.11.3-6). Overall, impacts on pronghorn from solar energy development in the SEZ would be small.

Other Mammals

Direct impacts on small game, furbearers, and nongame (small) mammal species would be small, as only 0.08% or less of habitats identified for each species would be lost (Table 10.2.11.3-2). Larger areas of suitable habitat for these species occur within the area of potential indirect effects (e.g., up to 3.5% of available habitat for the Ord's kangaroo rat). 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 proposed programmatic design features.

Summary

Overall, direct impacts on mammal species would be small for all species, as only 0.08% or less of potentially suitable habitats for the representative mammal species would be lost (Table 10.2.11.3-2). Larger areas of potentially suitable habitat for mammal species occur within the area of potential indirect effects (e.g., up to 3.5% for the Ord's kangaroo rat). Other impacts

TABLE 10.2.11.3-6 Potential Magnitude of Impacts on Pronghorn Activity Areas Resulting from Solar Energy Development within the Proposed De Tilla Gulch SEZ

	Area of Habitat Affected (acres)[b]			
Activity Area[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Area of Habitat within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	1,217 acres[g] of habitat lost (0.07% of available habitat)	70,053 acres of habitat (4.0% of available habitat)	1,746,710 acres	Small
Summer concentration area	0 acres	0 acres	108,142 acres	None
Winter range	1,217 acres of habitat lost (0.1% of available habitat)	53,623 acres of habitat (5.0% of available habitat)	1,064,517 acres	Small
Winter concentration area	609 acres of habitat lost (0.4% of available habitat)	10,090 acres of habitat (6.2% of available habitat)	161,810 acres	Small
Severe winter range	0 acres	0 acres	125,336 acres	None
Migration corridor	0 acres	0 acres	21,185 acres	None
Resident population area	0 acres	0 acres	27,693 acres	None

[a] Activity areas are described in Table 10.2.11.3-1.

[b] Maximum area of habitat affected relative to total available habitat within the SEZ region. Habitat availability was determined from suitable land cover for each species (CDOW 2009).

[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 1,127 acres (4.9 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.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ.

[f] 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.

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

Source: CDOW (2008).

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. Long-term benefits would accrue, however, if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for mammal species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

10.2.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, could greatly reduce the potential for effects on mammals. While some SEZ-specific design features are best established when considering specific project details, design features that can be identified at this time include the following:

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

- The extent of habitat disturbance should be minimized within elk severe winter range and pronghorn winter concentration area.

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

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

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.

10.2.11.4 Aquatic Biota

10.2.11.4.1 Affected Environment

No perennial surface water bodies, seeps, or springs are present on the proposed De Tilla Gulch SEZ. Several intermittent drainages do cross the site, but they do not support aquatic communities. As a consequence, no aquatic biota or habitats are present within the SEZ boundaries.

Two perennial streams (Saguache and San Luis Creeks) are located outside the SEZ (Figure 10.2.9.1-1) but still within the 5-mi (8-km) area where indirect effects are considered possible. Saguache Creek is about 4 mi (6 km) to the southwest, and San Luis Creek is about 5 mi (8 km) to the east. In addition, aquatic habitat may be provided by the Rio Grande canal, which is located within the area of potential indirect effects to the southwest of the SEZ. This canal diverts water from Saguache Creek for irrigation of agricultural fields. Aquatic biota, similar to that present in Saguache Creek, may occur in the canal during periods of the year when it contains water. Both Saguache and San Luis Creeks support coolwater fish communities, including species such as rainbow (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). There is a potential for suitable habitat for the Rio Grande chub (*Gila pandora*) and Rio Grande sucker (*Catostomus plebius*) (both considered sensitive species by the State of Colorado and by the BLM) to occur within these drainages (Section 10.2.12.1.5).

The NWI (USFWS 2009) did not identify any wetlands within the SEZ, although a number of small wetlands occur near the SEZ to the northwest (Section 10.2.9.1.1). On the basis of the classification of these wetlands, it is likely that surface water is present only for brief periods during the growing season. There are more extensive networks of wetland habitats associated with Saguache and San Luis Creeks (Section 10.2.9.1.1).

No significant open water aquatic habitats, such as reservoirs, lakes, or ponds, occur within the area of potential indirect effects.

10.2.11.4.2 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.

The types of impacts that aquatic habitats and biota could incur from development of utility-scale solar energy facilities are identified in Section 5.10.3. Aquatic habitats, including wetland areas, present on or near the De Tilla Gulch 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.

Because there are no permanent water bodies, perennial streams, or wetlands present on the SEZ, there would be no direct impacts on aquatic habitats from construction of utility-scale solar energy facilities within the SEZ. Also, because transmission lines and access roads are available within or immediately adjacent to the SEZ, it is assumed that there would be no need to cross nearby streams for those purposes.

Disturbance of land areas at the SEZ in order to construct solar energy facilities could increase the amount of sediment in nearby wetland areas due to deposition of waterborne and airborne soils from disturbed areas, and, over time, sediment could fill in some wetlands. Although some deposition and filling would occur naturally, removal of vegetation and disturbance of surface soils could increase the rate at which deposition occurs. Overall, there is approximately 12 mi (19 km) of perennial stream habitat in the area of potential indirect impacts, which represents about 1.0% of the available stream habitat within 50 mi (80 km) of the De Tilla Gulch SEZ.

It is likely that only a small portion of the airborne dust associated with solar energy development on the SEZ would settle in nearby streams or wetlands. Aquatic biota could be affected, although population-level effects would likely be small. There are only small intermittent drainages passing through the site, and these drain primarily to the south and southeast. Thus, although there might be a potential for some waterborne sediments entering those drainages to reach Saguache and San Luis Creek, it is unlikely that the quantities of sediment would be large considering the relatively small number of drainages reaching those streams, the distance to the streams (more than 3 mi [5 km]), and the low gradient. Consequently, effects on aquatic biota from airborne or waterborne sediments resulting from development within the SEZ would be small. Introduction of waterborne sediments to the drainages passing through the SEZ could be controlled through the use of commonly used mitigation measures, such as settling basins, silt fences, or by directing water draining from the developed areas away from these surface water features. Maintaining undisturbed (i.e., vegetated) areas around the perimeter of the SEZ would further reduce the potential for waterborne sediments to become deposited in areas outside the SEZ.

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 is altered. Water quantity could also be affected if significant amounts of surface water or groundwater were utilized to provide power plant cooling water for washing mirrors or for other needs. The greatest need for water would occur if technologies employing wet cooling, such as parabolic trough or power tower, were developed at the site; the associated impacts would ultimately depend on the water source used (including groundwater from various depth aquifers). There are no surface water habitats on the De Tilla Gulch SEZ that could be used to supply water needs. Withdrawing water from the San Luis or Saguache Creeks, or from other perennial surface water features in the vicinity could affect water levels, and, as a consequence, aquatic organisms in those streams. Additional details regarding the volume of water required and the types of organisms present in potentially affected water bodies would be required in order to further evaluate the potential for impacts from water withdrawals. Potential impacts on water resources from solar energy development in the De Tilla Gulch SEZ are analyzed in Section 10.2.9.

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/reclamation for a solar energy facility. However, because of the relatively large distance from the De Tilla Gulch SEZ to perennial streams (approximately 4 mi [6 km]) and the even longer distance to any ponds or reservoirs, the potential for solar energy development activities within the SEZ to introduce contaminants into such aquatic habitats would be low.

10.2.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation 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 considering specific project details, design features that can be identified at this time include the following:

- Sediment and erosion controls should be implemented along intermittent drainages that drain toward Saguache or San Luis Creeks.

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 De Tilla Gulch SEZ would be small.

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10.2.12 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 De Tilla Gulch SEZ. Special status species include the following types of species[4]:

- Species listed as threatened or endangered under the ESA;
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the State of Colorado[5];
- Species that are listed by the BLM as sensitive; and
- Species that have been ranked by the State of Colorado as S1 or S2, or 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 De Tilla Gulch SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010), information provided by the Colorado Natural Heritage Program (CNHP 2009), Colorado Division of Wildlife (CDOW 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, Chaffee, Costilla, Custer, Fremont, Gunnison, Huerfano, Mineral, Park, Rio Grande, and Saguache Counties, Colorado. However, the SEZ and affected area occur only in Saguache County. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

10.2.12.1 Affected Environment

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). For the De Tilla Gulch SEZ, the area of direct effect was limited to the SEZ itself, because no new transmission corridors or access roads are assessed (see Section 10.2.1.2). The area of indirect

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

5 State listed species for Colorado are those species protected under *Colorado Revised Statutes* 33-2-101.

effects was defined as the area within 5 mi (8 km) of the SEZ boundary 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, but do not include ground-disturbing activities. For the most part, the potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

The primary habitat type within the affected area is semiarid shrub-steppe (see Section 10.2.10). Potentially unique habitats in the affected area in which special status species may reside include rocky cliffs and outcrops, sand dunes, and woodlands. There are no ephemeral, intermittent, or perennial surface water features known to occur on the SEZ. Within the area of indirect effects, aquatic and riparian habitats occur in and along San Luis Creek, Saguache Creek, and diversion canals to the Rio Grande (Figure 10.2.12.1-1).

All special status species that are known to occur within the De Tilla Gulch 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 33 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 10.2.12.1-1. 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 Rio Grande chub intersect the affected area of the De Tilla Gulch SEZ: (Table 10.2.12.1-1). No other special status 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 De Tilla Gulch SEZ region (Section 10.2.9).

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

The USFWS did not identify any ESA-listed species in its scoping comments on the De Tilla Gulch 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 De Tilla Gulch SEZ on the basis of observed occurrences near the affected area and the presence of potentially suitable habitat in the area of indirect effect. In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

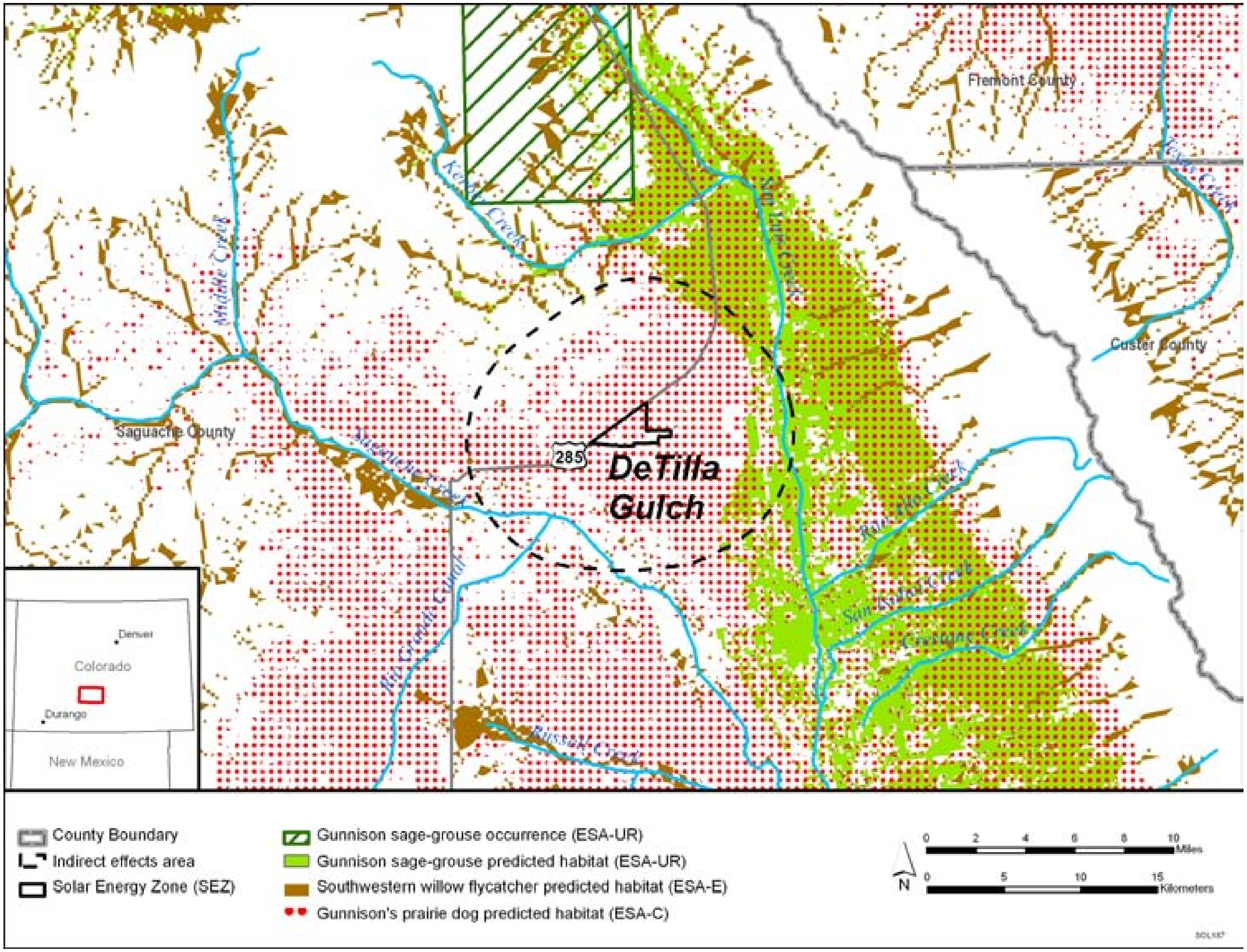

FIGURE 10.2.12.1-1 Locations of Species Listed as Endangered, Threatened, Candidates for Listing, or Species under Review for Listing under the ESA That May Occur in the Proposed De Tilla Gulch SEZ Affected Area (Sources: CNHP 2009; NatureServe 2010; USGS 2007)

TABLE 10.2.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed De Tilla Gulch 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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants						
Bodin milkvetch	*Astragalus bodinii*	CO-S2	Clearings in aspen, pinyon-juniper, and ponderosa pine woodlands at elevations between 7,500 and 7,875 ft.[h] Nearest known occurrences are 13 mi[i] south of the SEZ. About 910,500 acres[j] of potentially suitable habitat occurs in the analysis area within the San Juan Mountains.	0 acres	9,000 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Colorado larkspur	*Delphinium ramosum* var. *alpestre*	CO-S2	Meadows, aspen woodlands and sagebrush scrub communities at elevations between 6,900 and 10,500 ft. Nearest known occurrences are approximately 15 mi north of the SEZ. About 583,000 acres of potentially suitable habitat occurs in the analysis area.	0 acres	778 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

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TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Fendler's Townsend-daisy	*Townsendia fendleri*	CO-S2	Sandy or rocky soils within desert scrub and pinyon-juniper woodlands at elevations between 3,900 and 7,900 ft. Nearest known occurrences are approximately 22 mi from the SEZ. About 522,000 acres of potentially suitable habitat occurs in the analysis area.	960 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	28,100 acres of potentially suitable habitat (5.4% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the areas of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigations apply to all special status plants.
Helleborine	*Epipactis gigantea*	CO-S2	Wet gravelly and sandy stream shores and bars, seeps on sandstone cliffs, and to a lesser extent chaparral, marshes, hot springs, or riparian willow, box elder, and river birch woodlands at elevations between 4,800 and 8,000 ft. Nearest known occurrences are approximately 12 mi from the SEZ. About 19,250 acres of potentially suitable habitat occurs in the analysis area.	0 acres	140 acres of potentially suitable habitat (0.7% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 5,400 and 8,500 ft. Nearest known occurrences are approximately 20 mi from the SEZ. About 1,135,000 acres of potentially suitable habitat occurs in the analysis area.	0 acres	9,300 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Least moonwort	*Botrychium simplex*	CO-S1	Open habitats, including pastures, meadows, orchards, prairies, wetlands, fens, sand dunes, and lake and stream edges. Nearest known occurrences are 35 mi from the SEZ. About 912,500 acres of potentially suitable habitat occurs in the analysis area along San Luis Creek.	220 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	8,197 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland habitat in the SEZ could reduce impacts. See Fendler's Townsend-daisy for a list of potential mitigations applicable to all special status plant species.
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 18 mi from the SEZ. About 1,385,650 acres of potentially suitable habitat occurs in the analysis area.	0 acres	4,256 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Philadelphia fleabane	*Erigeron philadelphicus*	CO-S1	Woodland openings and margins, marshes edges, creek sides, roadsides, ditch banks, lawns, low prairies, and other open, disturbed sites at elevations below 9,500 ft. Nearest known occurrences are approximately 35 mi from the SEZ. About 96,150 acres of potentially suitable habitat occurs in the analysis area.	0 acres	377 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Prairie violet	*Viola pedatifida*	CO-S2	Rocky sites within prairies, open woodlands, and forest openings at elevations between 5,800 and 8,800 ft. Nearest known occurrences are approximately 30 mi from the SEZ. About 1,800,000 acres of potentially suitable habitat occurs in the analysis area.	0 acres	11,268 acres of potentially suitable habitat (0.6% 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, pine barrens, aspen clearings, granite depressions, stream sides, prairies, and open moist sites at elevations below 7,900 ft. Nearest known occurrences are approximately 25 mi from the SEZ. About 2,563,700 acres of potentially suitable habitat occurs in the analysis area.	220 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	18,860 acres of potentially suitable habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland habitat in the SEZ could reduce impacts. See Fendler's Townsend-daisy for a list of potential mitigations applicable to all special status plant species.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Southern Rocky Mountain cinquefoil	*Potentilla ambigens*	CO-S1	Occurs on gravelly soils within dry, open shrublands and grasslands at middle elevations. Nearest known occurrences are approximately 50 mi from the SEZ. About 681,800 acres of potentially suitable habitat occurs in the analysis area.	1,180 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	29,470 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	Small overall impact. See Fendler's Townsend-daisy for a list of potential mitigations applicable to all special status plant species.
Wahatoya Creek larkspur	*Delphinium robustum*	CO-S2	Broad canyon bottoms, aspen groves, subalpine meadows, riparian woodlands, and lower and upper montane coniferous forest at elevations between 7,200 and 11,200 ft. Nearest known occurrences are approximately 15 mi west of the SEZ. About 1,537,000 acres of potentially suitable habitat occurs in the analysis area.	0 acres	6,105 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Western moonwort	*Botrychium hesperium*	CO-S2	Early successional habitats with coarse gravelly soil which undergo periodic disturbance including grassy mountain slopes, snow fields, road ditches, and gneiss outcrops and cliffs, as well as old fields at elevations between 650 and 11,300 ft. Nearest known occurrences are 27 mi from the SEZ. About 172,175 acres of potentially suitable habitat occurs in the analysis area.	0 acres	467 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Wright's cliff-brake	*Pellaea wrightiana*	CO-S2	Acidic to mildly basic substrates on exposed or partially shaded cliffs and rocky slopes at elevations between 5,200 and 9,500 ft. Nearest known occurrences are approximately 45 mi from the SEZ. About 21,500 acres of potentially suitable habitat occurs in the analysis area.	0 acres	90 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Invertebrates						
Hoary skimmer	*Libellula nodisticta*	CO-S1	Wetlands with emergent vegetation including marshes, shallow pools, and slow springs. Nearest occurrences are approximately 7 mi from the SEZ. About 3,700 acres of potentially suitable habitat occurs in the analysis area.	0 acres	9 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Invertebrates (Cont.)						
Sphinx moth	*Sphinx dollii*	CO-S2	Madrean oak woodland, arid shrubland, and desert foothills with woody broad-leafed shrubs. Nearest occurrences are approximately 38 mi from the SEZ. About 952,400 acres of potentially suitable habitat occurs in the analysis area.	1,280 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	44,750 acres of potentially suitable habitat (4.7% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Fish						
Rio Grande[k] chub	***Gila pandora***	BLM-S; CO-SC; CO-S1	Clear, cool, fast-flowing water over rubble or gravel substrates. The nearest potentially suitable habitat is located in the Saguache Creek and San Luis Creek, approximately 3 mi south and 5 mi east, respectively. About 1,150 mi of potentially suitable stream habitat occurs in the analysis area.	0 mi	12 mi of potentially suitable habitat (1.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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] Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Fish (Cont.)						
Rio Grande sucker	*Catostomus plebeius*	CO-E; CO-S1	Restricted to streams of the Rio Grande Basin in Colorado. It is found in channels and backwaters near rapidly flowing waters. The nearest suitable habitat occurs within Saguache Creek and San Luis Creek, approximately 3.5 mi south and 4 mi east (downgradient) of the SEZ, respectively. Known to occur in Crestone Creek in the Baca National Wildlife Refuge, approximately 15 mi southeast of the SEZ. About 1,200 mi of potentially suitable habitat occurs in the analysis area.	0 mi	12 mi of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Birds						
American peregrine falcon	*Falco peregrinus anatum*	BLM-S; FWS-SC; CO-SC; CO-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 16 mi southwest of the SEZ. Suitable foraging habitat for this species may occur within the affected area. About 3,375,750 acres of potentially suitable habitat occurs in the analysis area.	298 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	39,803 acres of potentially suitable habitat (1.2% 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.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Bald eagle	*Haliaeetus leucocephalus*	CO-T; CO-S1	Year-round resident in the SEZ region. Seldom seen far from water, especially larger rivers, lakes, and reservoirs. Also occurs locally in semiarid shrubland habitats where there is an abundance of small mammal prey. Known from the San Luis Creek in the Baca National Wildlife Refuge as near as 12 mi southeast (downgradient) of the SEZ. About 1,443,500 acres of potentially suitable habitat occurs in the analysis area.	1,000 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	38,754 acres of potentially suitable habitat (2.7% 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.
Barrow's goldeneye	*Bucephala islandica*	BLM-S; CO-S2;	A winter resident in the De Tilla Gulch SEZ region. Occurs on larger lakes and rivers. Known to occur in the San Luis Valley. About 245,400 acres of potentially suitable habitat occurs in the affected area.	0 acres	200 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Ferruginous hawk	*Buteo regalis*	BLM-S; CO-SC	Summer resident in the SEZ region. Grasslands, sagebrush, and saltbush habitats, as well as the periphery of pinyon-juniper woodlands throughout the San Luis Valley. Known to occur in the Baca National Wildlife Refuge about 30 mi southeast of the SEZ. About 950,500 acres of potentially suitable habitat occurs in the analysis area.	298 acre of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	27,523 acres of potentially suitable habitat (2.9% 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.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Gunnison sage-grouse	*Centrocercus minimus*	ESA-UR; BLM-S; CO-SC; CO-S1	Year-round resident in the SEZ region. Primarily found in the Gunnison Basin in south-central Colorado, the species inhabits large expanses of sagebrush with mixed grasses and forbs. Populations have been observed as near as 10 mi north of the SEZ. About 657,100 acres of potentially suitable habitat occurs in the analysis area.	0 acres	7,000 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Mountain plover	*Charadrius montanus*	BLM-S; CO-SC; CO-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. Known to occur within 10 mi west (upgradient) of the SEZ. About 970,750 acres of potentially suitable habitat occurs in the analysis area.	0 acres	7,500 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Short-eared owl	*Asio flammeus*	CO-S2	Year-round resident in the SEZ region. Nests and forages in grasslands, agricultural areas, and marshes. Rarely observed in sagebrush shrubland or pinyon-juniper woodland. Nearest occurrences are approximately 25 mi from the SEZ. About 1,565,500 acres of potentially suitable habitat occurs in the analysis area.	1,234 acres of potentially suitable foraging and nesting habitat lost (0.1% of available potentially suitable habitat)	43,221 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland habitat in the SEZ would reduce impact. Alternatively, Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats (especially nests) in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Southwestern willow flycatcher	*Empidonax traillii extimus*	ESA-E; CO-E	Breeds in thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands in the Alamosa National Wildlife Refuge along the Rio Grande, approximately 38 mi southeast of the SEZ. Potential habitat may occur within the affected area along the Saguache Creek as near as 3 mi south (downgradient) of the SEZ. About 298,000 acres of potentially suitable habitat occurs in the analysis area.	0 acres	637 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; CO-T; FWS-SC	Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Known to occur in Saguache County, Colorado. About 1,135,500acres of potentially suitable habitat occurs in the SEZ region.	1,200 acres of potentially suitable foraging and nesting habitat lost (0.1% of available potentially suitable habitat)	40,300 acres of potentially suitable habitat (3.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied burrows and habitats in the area of direct effect 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 to feed on moths. About 1,246,800 acres of potentially suitable habitat occurs in the analysis area.	0 acres	10,700 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals (Cont.)						
Botta's pocket gopher	*Thomomys bottae rubidus*	CO-SC; CO-S1	Agricultural fields, grasslands, roadsides, parks, pinyon-juniper woodlands, open montane forest, montane shrublands, and semidesert shrublands at elevations between 4,000 and 8,500 ft. Nearest occurrences are approximately 50 mi from the SEZ. About 1,203,750 acres of potentially suitable habitat occurs in the analysis area.	1,400 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	45,362 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Common hog-nosed skunk	*Conepatus leuconotus*	CO-S1	Woodlands, grasslands, deserts, brushy areas, and rocky canyons in mountainous regions below 9,000 ft. Nearest occurrences are approximately 32 mi from the SEZ. About 3,749,000 acres of potentially suitable habitat occurs in the analysis area.	1,179 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	47,583 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals						
Dwarf shrew	*Sorex nanus*	CO-S2	Rocky sites within alpine, bare rock/talus/scree, coniferous forests, herbaceous grasslands, shrubland/chaparral, and woodland-conifer forests. Other habitats include sedge marsh, subalpine meadow, dry brushy slopes, arid shortgrass prairie, dry stubble fields, and pinyon-juniper woodlands. Nearest occurrences are approximately 30 mi from the SEZ. About 2,119,000 acres of potentially suitable habitat occurs in the analysis area.	0 acres	11,826 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Gunnison's prairie dog	*Cynomys gunnisoni*	ESA-C	Mountain valleys, plateaus, and open brush habitats in southwestern and south-central Colorado at elevations between 6,000 and 12,000 ft. Known to occur about 35 mi southwest of the SEZ. About 1,470,200 acres of potentially suitable habitat occurs in the analysis area.	1,289 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	51,500 acres of potentially suitable habitat (3.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of active colonies in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Mitigation should be developed in coordination with the USFWS and CDOW.

TABLE 10.2.12.1-1 (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]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals						
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 vicinity of the Rio Grande National Forest and Great Sand Dunes National Preserve approximately 25 mi southeast of the SEZ. About 2,363,500 acres of potentially suitable habitat occurs in the analysis area.	1,234 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	50,793 acres of potentially suitable habitat (2.1% 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 effect.

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; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern.

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 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. No new access road or transmission lines are assumed to be needed due to the proximity of these infrastructures 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 Area of indirect effects was assumed to be the area adjacent to the SEZ and within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff or dust from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

Footnotes continued on next page.

TABLE 10.2.12.1-1 (Cont.)

[f] 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.

[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 ft to m, multiply by 0.3048.

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

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

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

The southwestern willow flycatcher is known to breed in riparian habitats along the Rio Grande in the Alamosa National Wildlife Refuge, approximately 38 mi (61 km) southeast of the De Tilla Gulch SEZ. This area is considered to be outside of the De Tilla Gulch SEZ affected area. 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 in the area of indirect effects—particularly in riparian areas along Saguache Creek (Figure 10.2.12.1-1; Table 10.2.12.1-1). Potentially suitable habitat for the southwestern willow flycatcher does not occur on the SEZ. Designated critical habitat for this species does not occur in the SEZ region.

10.2.12.1.2 Species That Are Candidates for Listing under the ESA

In scoping comments on the proposed De Tilla Gulch 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 De Tilla Gulch SEZ (Table 10.2.12.1-1). The known or potential distribution of this species relative to the De Tilla Gulch SEZ is shown in Figure 10.2.12.1-1. 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 as near as 35 mi (56 km) southwest of the De Tilla Gulch SEZ. According to the SWReGAP habitat suitability model, 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 10.2.12.2-1; Table 10.2.12.1-1).

10.2.12.1.3 Species under Review for Listing under the ESA

In scoping comments on the proposed De Tilla Gulch 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 Gunnison sage-grouse is one species under review for ESA listing that may occur near the proposed De Tilla Gulch SEZ (Table 10.2.12.1-1). The known or potential distribution of this species relative to the De Tilla Gulch SEZ is shown in Figure 10.2.12.1-1. In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

The Gunnison sage-grouse inhabits sagebrush-dominated habitats in the Gunnison Basin of southern Colorado. This species occurs in the San Luis Valley, and individuals have been observed as near as 10 mi (16 km) north of the De Tilla Gulch SEZ. According to the SWReGAP habitat suitability model, potentially suitable sagebrush-steppe habitat for the Gunnison sage-grouse does not occur on the SEZ. However, potentially suitable habitat is predicted to occur within the area of indirect effects (Figure 10.2.12.1-1; Table 10.2.12.1-1).

10.2.12.1.4 BLM-Designated Sensitive Species

There are 9 BLM-designated sensitive species may occur in the affected area of the De Tilla Gulch SEZ (Table 10.2.12.1-1). These BLM-designated sensitive species include the following: (1) fish: Rio Grande chub; (2) birds: American peregrine falcon, Barrow's goldeneye, ferruginous hawk, Gunnison sage-grouse, mountain plover, and western burrowing owl; and (3) mammals: big free-tailed bat and pale Townsend's big-eared bat. Habitats for these species, the amount of this habitat in the affected area, and known locations of the species relative to the SEZ are presented in Table 10.2.12.1-1. Of the BLM-designated sensitive species that could occur in the affected area, occurrences of the ferruginous hawk and pale Townsend's big-eared bat intersect the affected area. The Gunnison sage-grouse is discussed in Section 10.2.12.1.3 because it is under review for listing under the ESA. The remaining 8 species as related to the SEZ are described in the remainder of this section. Life history information for these species is provided in Appendix J.

Rio Grande Chub

The Rio Grande chub is known to occur in tributary streams to the Rio Grande. 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 from Saguache and San Luis Creeks, approximately 3 mi (5 km) and 5 mi (8 km) west and east of the De Tilla Gulch SEZ, respectively. No suitable habitat for the species occurs on the SEZ; however, potentially suitable habitat occurs in the area of indirect effects within the Saguache and San Luis Creeks (Table 10.2.12.1-1).

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 16 mi (26 km) southwest of the De Tilla Gulch SEZ (Table 10.2.12.1-1). According to the SWReGAP habitat suitability model, potentially suitable summer nesting habitat for the American peregrine falcon may occur on the SEZ and throughout portions of the area of indirect effects. However, on the basis of an evaluation of SWReGAP land cover types, potentially suitable nesting habitat (cliffs or outcrops) does not occur within the area of direct effects. Approximately 90 acres (0.4 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 De Tilla

Gulch SEZ. This waterfowl species occurs in Colorado on larger lakes and rivers and is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ; however, potentially suitable habitat may occur in the area of indirect effects (Table 10.2.12.1-1).

Ferruginous Hawk

The ferruginous hawk is known to occur as a summer resident in the De Tilla Gulch SEZ affected area. 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 Baca National Wildlife Refuge within 30 mi (48 km) southeast of the De Tilla Gulch SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species may be present on the SEZ and within other portions of the affected area (Table 10.2.12.1-1). Most of this suitable habitat is shrubland foraging habitat. On the basis of an evaluation of SWReGAP land cover types, there is no suitable nesting habitat (woodlands) on the SEZ. However, approximately 12,000 acres (49 km^2) of woodland habitat and 90 acres (0.4 km^2) of rocky cliffs and outcrops that may be potentially suitable nesting habitat occurs in the area of indirect effects.

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 De Tilla Gulch 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 occurrences for this species are approximately 10 mi (16 km) north of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable habitat may occur in the area of indirect effects (Table 10.2.12.1-1). 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 may occur in the area of indirect effects.

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 De Tilla Gulch 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 Saguache County, Colorado, and potentially suitable summer breeding habitat may occur in the SEZ and in portions of the area of indirect effects (Table 10.2.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but 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 De Tilla Gulch 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 habitat for the big free-tailed bat does not occur on the SEZ; however, potentially suitable habitat may occur in portions of the area of indirect effects (Table 10.2.12.1-1). On the basis of an evaluation of SWReGAP land cover types, approximately 90 acres (0.4 km^2) of potentially suitable roosting habitat (rocky cliffs and outcrops) may occur in the area of indirect effects.

Pale Townsend's Big-Eared Bat

The pale 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 De Tilla Gulch SEZ region. The species roosts in caves, mines, tunnels, buildings, and other manmade structures. Nearest recorded quad-level occurrences of this species are from the Rio Grande National Forest approximately 25 mi (40 km) southeast of the De Tilla Gulch SEZ, and shrubland habitats suitable for foraging may be present on the SEZ and within other portions of the affected area. According to the SWReGAP habitat suitability model, potentially suitable habitat for the pale Townsend's big-eared bat occurs on the SEZ and in the area of indirect effects (Table 10.2.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) on the SEZ; however, approximately 90 acres (0.4 km^2) of potentially suitable roosting habitat may occur in the area of indirect effects.

10.2.12.1.5 State-Listed Species

There are 4 species listed by Colorado that may occur in the De Tilla Gulch SEZ affected area (Table 10.2.12.1-1). Two species (southwestern willow flycatcher and western burrowing owl) were discussed in Section 10.2.12.1.1 and Section 10.2.12.1.4 because of their status under the ESA and BLM. The remaining two state-listed species that may occur in the De Tilla Gulch SEZ affected area include the Rio Grande sucker and bald eagle. These 2 species as related to the SEZ are described in this section and are presented in Table 10.2.12.1-1. 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 Saguache and San Luis Creeks, between 3 mi (5 km) and 4 mi (6 km) west and east of the De Tilla Gulch SEZ, respectively. Suitable habitat for the Rio Grande sucker does not occur on the SEZ. However, potentially suitable habitat may occur in the area of indirect effects in Saguache and San Luis Creeks (Table 10.2.12.1-1).

Bald Eagle

The bald eagle is 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 the bald eagle are from San Luis Creek in the Baca National Wildlife Refuge, approximately 12 mi (19 km) southeast of the De Tilla Gulch SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for the species could occur on the SEZ and within the area of indirect effects. On the basis of an evaluation of SWReGAP land cover types, potentially suitable nesting habitat for the bald eagle does not occur on the SEZ (Table 10.2.12.1-1); however, approximately 200 acres (1 km^2) of riparian woodlands that may be potentially suitable nesting habitat occur in the area of indirect effects.

10.2.12.1.6 Rare Species

On the basis of the records provided by the CNHP, there are 31 species with a state status of S1 or S2 in Colorado or species of concern by the USFWS or Colorado that may occur in the affected area of the De Tilla Gulch SEZ (Table 10.2.12.1-1). Of these species, 20 have not been discussed as ESA-listed (Section 10.2.12.1.1), candidates for listing under the ESA (Section 10.2.12.1.2), species under review for listing under the ESA (Section 10.2.12.1.3), BLM-designated sensitive (Section 10.2.12.1.4), or state-listed species (Section 10.2.12.1.5).

10.2.12.2 Impacts

The potential for impacts on listed species from utility-scale solar energy development within the proposed De Tilla Gulch 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 project area as presented in Section 10.2.12.1 following the analysis approach described in Appendix M. It is assumed that, prior to development, surveys will 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 10.2.12.3).

Solar energy development within the De Tilla Gulch SEZ could affect a variety of habitats (see Section 10.2.10). These impacts on habitats could in turn affect special status species that are dependent on those habitats. Based on CNHP records, the Rio Grande chub is the only special status species known to 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 10.2.12.1, 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 10.2.12.1-1. 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 may occur from 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 10.2.1.2, no new access roads or transmission lines are assumed to be needed to serve developments on the SEZ because of the proximity of an existing state highway and electrical transmission infrastructure.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ where ground-disturbing activities are expected to occur. Indirect impacts on special status species 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 (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. 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.

10.2.12.2.1 Impacts on Species Listed under the ESA

In their scoping comments on the proposed De Tilla Gulch 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 is the only species listed under the ESA that 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, and, according to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ. However, approximately 650 acres (2.5 km^2) of potentially suitable habitat occurs in the area of indirect effects, and this area represents about 0.2% of the available potentially suitable habitat in the SEZ region (Table 10.2.12.1-1).

The overall impact on the southwestern willow flycatcher from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

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

In their scoping comments on the proposed De Tilla Gulch 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 is the only species that is a candidate for listing under the ESA that 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 1,289 acres (5 km^2) of potentially suitable shrubland habitat on the SEZ could be directly affected by construction and operations (Table 10.2.12.1-1), and Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009. This direct impact area represents about 0.1% of available suitable habitat in the SEZ region. About 51,500 acres (208 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 3.5% of the available suitable habitat in the SEZ region (Table 10.2.12.1-1).

The overall impact on the Gunnison's prairie dog from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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 of occupied habitats in the area of direct effects. If avoiding or minimizing disturbance of occupied habitats 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 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.

10.2.12.2.3 Impacts on Species under Review for ESA Listing

In their scoping comments on the proposed De Tilla Gulch 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 Gunnison sage-grouse, which is under ESA review, could occur in the affected area. The species has not been recorded on the SEZ or in the area of indirect effects, and, according to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ. However, approximately 7,000 acres (28 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.1% of the available suitable habitat in the SEZ region (Table 10.2.12.1-1).

The overall impact on the Gunnison sage-grouse from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

10.2.12.2.4 Impacts on BLM-Designated Sensitive Species

Of the 9 BLM-designated sensitive species that may occur in the affected area of the De Tilla Gulch SEZ, there is one, the Gunnison sage-grouse, that was discussed previously in Section 10.2.12.1.3 because of its status under the ESA. Impacts on the remaining 8 BLM-designated sensitive species that have potentially suitable habitat within the affected area are discussed below.

Rio Grande Chub

The Rio Grande chub is known from tributary streams to the Rio Grande in the San Luis Valley and the species is known from Saguache and San Luis Creeks about 5 mi (8 km) west and east of the De Tilla Gulch SEZ, respectively. Suitable aquatic habitat for the species does not occur on the SEZ. However, potentially suitable habitat occurs in the area of indirect effects within Saguache and San Luis Creeks (Table 10.2.12.1-1).

The overall impact on the Rio Grande chub from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

American Peregrine Falcon

The American peregrine falcon is a summer resident in the De Tilla Gulch SEZ region and is known to occur in the Rio Grande National Forest, approximately 16 mi (26 km) southwest of the SEZ. According to the SWReGAP habitat suitability model, approximately 298 acres (1 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 10.2.12.1-1). This direct impact area represents <0.1% of potentially suitable habitat in the SEZ region. About 39,803 acres (161 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.2% of the potentially suitable habitat in the SEZ region (Table 10.2.12.1-1). 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, but approximately 90 acres (0.4 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 De Tilla Gulch 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 De Tilla Gulch SEZ or in the area of indirect effects. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ; however, approximately 200 acres (1 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 0.1% of the available suitable habitat in the SEZ region (Table 10.2.12.1-1).

The overall impact on the Barrow's goldeneye from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

Ferruginous Hawk

The ferruginous hawk is a summer breeding resident in the De Tilla Gulch SEZ region and is known to occur about 30 mi (56 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, approximately 298 acres (1 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 10.2.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. About 27,523 acres (111 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 2.9% of the available suitable habitat in the SEZ region (Table 10.2.12.1-1). 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 (forests and rocky cliffs and outcrops) do not occur on the SEZ. However, approximately 12,000 acres (49 km^2) of woodland habitat and 90 acres (0.4 km^2) of cliffs and rock outcrops that may be potentially suitable nesting habitat occur in the area of indirect effects.

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

Mountain Plover

The mountain plover is a summer breeding resident in the De Tilla Gulch SEZ region and is known to occur as near as 10 mi (16 km) west of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species does not occur on the SEZ. However, about 7,500 acres (30 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 0.8% of the available suitable habitat in the region (Table 10.2.12.1-1). Most of the suitable habitat in the area of indirect effects could serve as foraging and nesting habitat. On the basis of an evaluation of SWReGAP land cover types, approximately 7,400 acres (30 km^2) of grassland habitat that may be potentially suitable nesting habitat occurs in the area of indirect effects.

The overall impact on the mountain plover from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

Western Burrowing Owl

The western burrowing owl is a summer breeding resident within the De Tilla Gulch SEZ region and is known to occur in Saguache County, Colorado. According to the SWReGAP habitat suitability model, approximately 1,200 acres (5 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 10.2.12.1-1). This direct impact area represents about 0.1% of potentially suitable habitat in the SEZ region. About 40,300 acres (163 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 3.5% of the potentially suitable habitat in the SEZ region (Table 10.2.12.1-1). 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 De Tilla Gulch 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 a feasible way 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 of occupied burrows and habitat in the area of direct effects. If avoiding or minimizing disturbance of 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 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 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 De Tilla Gulch SEZ region and is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ. However, about 10,700 acres (43 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 0.9% of the available suitable habitat in the region (Table 10.2.12.1-1). Most of the potentially suitable habitat in the area of indirect effects is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, approximately 90 acres (0.4 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 mountain plover from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

Pale Townsend's Big-Eared Bat

The pale Townsend's big-eared bat is a year-round resident within the De Tilla Gulch SEZ region and is known to occur approximately 25 mi (40 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, approximately 1,234 acres (5 km^2) of potentially suitable foraging habitat on the SEZ could be directly affected by construction and operations (Table 10.2.12.1-1). This direct impact area represents about 0.1% of available suitable foraging habitat in the SEZ region. About 50,793 acres (206 km^2) of potentially suitable foraging habitat occurs in the area of indirect effects; this area represents about 2.1% of the available potentially suitable foraging habitat in the SEZ region (Table 10.2.12.1-1). 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 90 acres (0.4 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 De Tilla Gulch 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.

10.2.12.2.5 Impacts on State-Listed Species

There are 4 state-listed species that could occur in the affected area of the De Tilla Gulch SEZ. Impacts on 2 of these species (southwestern willow flycatcher and western burrowing owl) were previously discussed in Section 10.2.12.2.1 and Section 10.2.12.2.4 because of their ESA and BLM status. Impacts on the remaining state-listed species (the Rio Grande sucker and bald eagle) are discussed below.

Rio Grande Sucker

The Rio Grande sucker is restricted to streams in the Rio Grande Basin and is known to occur in Saguache and San Luis Creeks about 3 mi (5 km) and 5 mi (8 km) west and east of the De Tilla Gulch SEZ, respectively. Suitable aquatic habitat for this species does not occur on the SEZ. However, potentially suitable habitat occurs in the area of indirect effects within Saguache and San Luis Creeks (Table 10.2.12.1-1).

The overall impact on the Rio Grande sucker from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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.

Bald Eagle

The bald eagle is a year-round resident within the De Tilla Gulch SEZ region and is known to occur approximately 12 mi (19 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, approximately 1,000 acres (4 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 10.2.12.1-1). This impact area represents <0.1% of available suitable habitat in the SEZ region. About 38,754 acres (157 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 2.7% of the available suitable habitat in the SEZ region (Table 10.2.12.1-2). 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, potentially suitable nesting habitat for the bald eagle (riparian woodlands) does not occur on the SEZ. However, approximately 200 acres (1 km^2) of riparian woodlands that may be potentially suitable nesting habitat occur in the area of indirect effects.

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the De Tilla Gulch 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 bald eagle because potentially suitable foraging habitat (shrubland) is widespread throughout the area of direct effects and readily available in other portions of the SEZ region.

10.2.12.2.6 Impacts on Rare Species

There are 31 species with a state status of S1 or S2 in Colorado or species of concern by the USFWS or Colorado that may occur in the affected area of the De Tilla Gulch SEZ. Impacts have been previously discussed for 11 of these species that are also listed under the ESA

(Section 10.2.12.2.1), candidates for listing under the ESA (Section 10.2.12.2.2), species under ESA review (Section 10.2.12.2.3), BLM-designated sensitive (Section 10.2.12.2.4), or state-listed species (10.2.12.2.5). Impacts on the remaining 20 rare species that do not have any other special status designation are presented in Table 10.2.12.1-1.

10.2.12.3 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 specific project details are being considered, some design features can be identified at this time, including the following:

- Pre-disturbance surveys should be conducted within the SEZ to determine the presence and abundance of special status species including those identified in Table 10.2.12.1-1; 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 effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.

- Avoiding or minimizing impacts on grassland habitat on the SEZ could reduce impacts on the least moonwort, Rocky Mountain blazing-star, and short-eared owl.

- Coordination with the USFWS and CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and Gunnison sage-grouse—species that are either a candidate 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 as indicated in Table 10.2.12.1-1. Any residual impacts are anticipated to be minor.

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10.2.13 Air Quality

10.2.13.1 Affected Environment

10.2.13.1.1 Climate

The proposed De Tilla Gulch SEZ is located in the east-central portion of Saguache County in south-central Colorado. The SEZ with an average elevation of about 7,750 ft (2,362 m) is located in the northern tip 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 Range to the west, which converge to the north. As a result of these barriers, the valley experiences an extremely 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 Saguache Municipal Airport and Saguache, which are located 7 mi (11 km) west and 5.5 mi (9 km) west-southwest of the e proposed De Tilla Gulch SEZ, respectively, are summarized below.

A wind rose from the Saguache Municipal Airport in Saguache for the period 2005 through 2006, taken at a 33-ft (10.2-m) level, is presented in Figure 10.2.13.1-1 (NCDC 2009b). During this period, the annual average wind speed at the airport was about 9.2 mph (4.1 m/s), and the wind was predominantly from the northwest and west-northwest (for about 24% and 21% of the time, respectively). This wind was primarily due to the valley breeze, a common wind pattern along the valley that is developed to the northwest of Saguache. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently—about 10% of the time. Average wind speeds were relatively uniform throughout the year: the highest in spring at 9.9 mph (4.4 m/s); lower in fall and winter at 8.9 mph (4.0 m/s) and 9.1 mph (4.1 m/s), respectively; and lowest in summer at 8.7 mph (3.9 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, so temperatures there are lower than they are at lower elevations of comparable latitude. For the 1894 to 2009 period, the annual average temperature at Saguache was 42.8°F (6.0°C) (WRCC 2009). January was the coldest month, with an average minimum of 4.1°F (–15.5°C), and July was the warmest month, with an average maximum of 81.1°F (27.3°C). In summer, daytime maximum temperatures over 90°F (32.2°C) were infrequent and minimum temperatures were in the 40s. On most days of colder months (November through March), the minimum temperatures recorded were below freezing (≤32°F [0°C]), and subzero temperatures also were common in January and December. For the same period, the highest temperatures reached 99°F (37°C) in July 2002, and the lowest reached –34°F (–36.7°C) in January 1971. Each year, about 2.5 days have maximum temperatures of ≥90°F (32.2°C), while about 216 days have minimum temperatures at or below freezing.

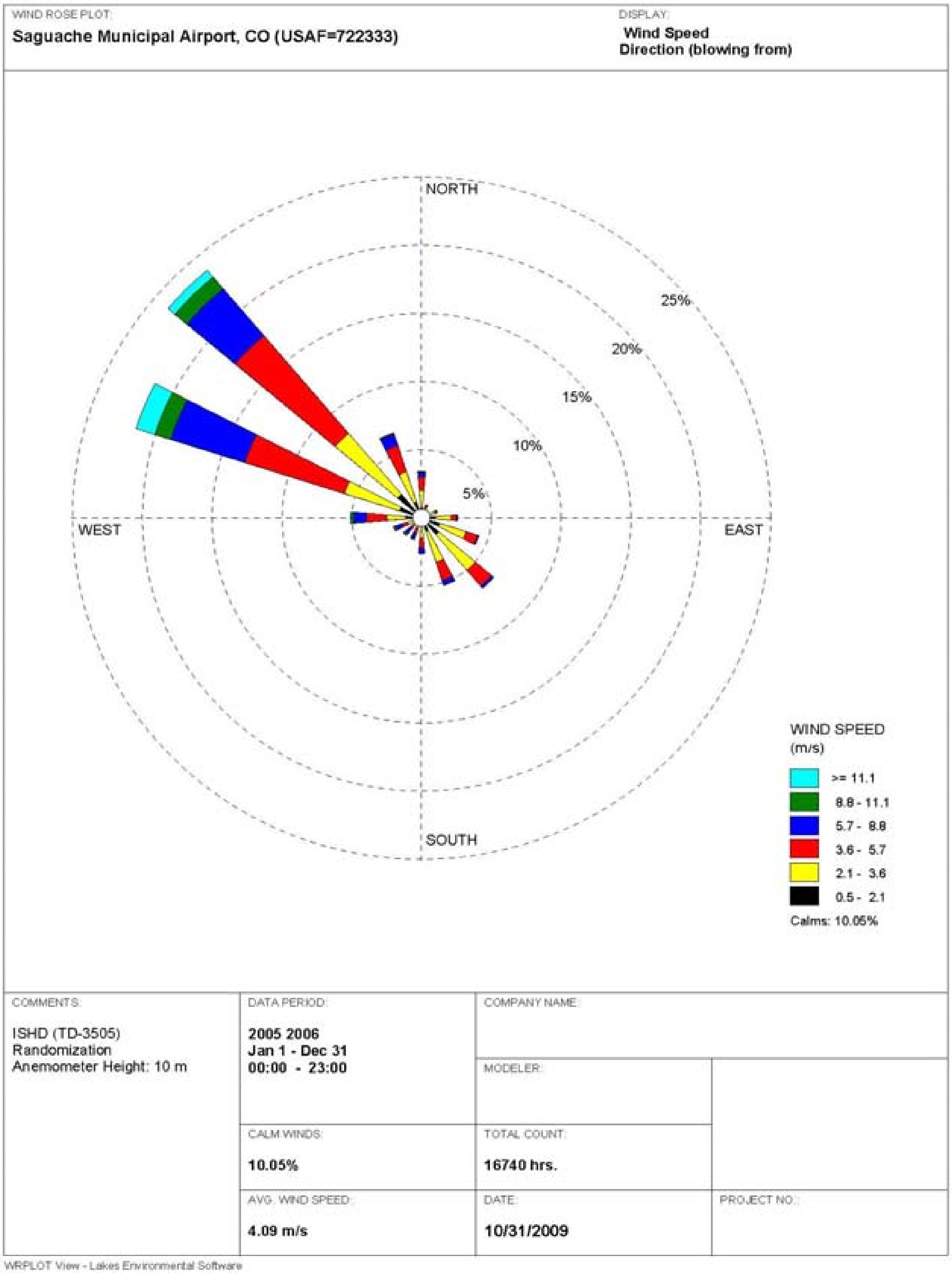

FIGURE 10.2.13.1-1 Wind Rose at 33-ft (10.2-m) Height at Saguache Municipal Airport, Saguache, Colorado, 2005–2006 (Source: NCDC 2009b)

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 is relatively light there. The valley is among the driest areas in Colorado. For the 1894 to 2009 period, annual precipitation at Saguache averaged about 8.28 in. (21.0 cm) (WRCC 2009). On average, 49 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 can start as early as September and last as late as May; most of the snow falls from December through March. The annual average snowfall at Saguache is about 23.5 in. (59.7 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 there (NCDC 2010).

Since 1999, two flash floods, both of which occurred near Saguache, were reported in Saguache County (NCDC 2010). These floods did cause some property and crop damage.

In Saguache County, 30 hail events in total have been reported since 1973; they caused one injury and some property and crop damage. Hail measuring 1.75 in. (4.4 cm) in diameter was reported several times. In Saguache County, 16 high wind and 5 thunderstorm wind events have been reported since 1993 and 1973, respectively, and those up to a maximum wind speed of 104 mph (46 m/s) have occurred any time of the year, causing three injuries and some property damage (NCDC 2010).

No dust storm events were reported in Saguache County (NCDC 2010). The ground surface of the SEZ is covered predominantly with gravelly to gravelly sand loams, which have relatively low to moderate dust storm potential. High winds can trigger large amounts of blowing dust in areas of Saguache 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 widespread heavy rains in Colorado (NCDC 2009c).

Tornadoes in Saguache County, which encompasses the proposed De Tilla Gulch SEZ, occur infrequently. For the period 1950 to June 2010, a total of five tornadoes (0.1 per year) were reported in Saguache County (NCDC 2010). However, most tornadoes occurring in Saguache County were relatively weak (i.e., three were F0 and two were F1 on the Fujita tornado scale); two caused minor property damage. Two of these tornadoes occurred near Saguache within 8 mi (13 km) of the SEZ.

10.2.13.1.2 Existing Air Emissions

Saguache County has only a few industrial emission sources, and their emissions are relatively low. Because of the sparse population, only a few major roads, such as U.S. 285 and U.S. 50, and several state routes exist in Saguache County. Thus, onroad mobile source emissions are not substantial. Annual emissions for criteria pollutants and VOCs in Saguache County, which encompasses the De Tilla Gulch SEZ, are presented in Table 10.2.13.1-1 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, structural fires, etc.). In 2002, onroad sources were major contributors to SO_2, NO_x, and CO emissions (about 45%, 45%, and 52%, respectively). Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally occurring emissions contributed secondarily to CO emissions (about 31%), and accounted for most of the VOC emissions (about 97%). Area sources accounted for most of the county emissions of PM_{10} and $PM_{2.5}$ (about 91% and 81%, respectively). Nonroad sources were secondary contributors to SO_2 and NO_x (about 30% and 32%, respectively). In Saguache County, point and fire sources were minor contributors to criteria pollutants and VOCs.

TABLE 10.2.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Saguache County, Colorado, Encompassing the Proposed De Tilla Gulch SEZ, 2002[a]

Pollutant[b]	Emissions (tons/yr)
SO_2	25
NO_x	1,013
CO	9,309
VOC	24,816
PM_{10}	1,569
$PM_{2.5}$	407

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 VOC = volatile organic compound.

Source: WRAP (2009).

In 2005, Colorado produced about 118 MMt of *gross*[6] carbon dioxide equivalent (CO_2e)[7] emissions (Strait et al. 2007). Gross GHG emissions in Colorado increased by about 35% from 1990 to 2005, which was twice as fast as the national rate (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 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%)

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

7 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.

and transportation (31%) sectors accounted for about three-fourths of the CO_2 total, and the residential, commercial, and industrial sectors accounted for the remainder.

10.2.13.1.3 Air Quality

Colorado SAAQS include six criteria pollutants: SO_2, NO_2, CO, O_3, PM_{10}, and Pb (5 *Code of Colorado Regulations* 1001-14, CDPHE 2008). The Colorado SAAQS are identical to the 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 10.2.13.1-2.

Saguache County, which encompasses the De Tilla Gulch SEZ, is located administratively within the San Luis Intrastate Air Quality Control Region (AQCR) (Title 40, Part 81, Section 176 of the *Code of Federal Regulations* [40 CFR 81.176]), along with other counties in and around the San Luis Valley, such as Alamosa, Conejos, Costilla, Mineral, and Rio Grande Counties, which is exactly 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). The Canon City PM_{10} Maintenance Area is approximately 45 mi (72 km) east-northeast of the SEZ.

Because of the low population density, low level of industrial activities (except for agricultural-related activities), and low traffic volume, the quantity of anthropogenic emissions in the San Luis Valley 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 10.2.13.1-2 are based on intermittent monitoring studies and routine monitoring data (Chick 2009; EPA 2009b). Except for Pb,[8] 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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[8] As a direct result of the phase-out 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 10.2.13.1-2 Applicable Ambient Air Quality Standards and Background Concentration Levels Representative of the Proposed De Tilla Gulch SEZ in Saguache County, Colorado

Pollutant[a]	Averaging Time	NAAQS/ SAAQS[b]	Highest Background Concentration Level	
			Concentration[c,d]	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 μg/m^3	27 μg/m^3 (18%)	Battle Mountain Gold Mine, San Luis, West Site, 1991
	Annual	50 μg/m^3 [k]	13 μg/m^3 (26%)	
$PM_{2.5}$	24-hour	35 μg/m^3	16 μg/m^3 (46%)	Great Sand Dunes, 1998–2002
	Annual	15.0 μg/m^3	4 μg/m^3 (27%)	
Pb[l]	Calendar quarter	1.5 μg/m^3	0.02 μg/m^3 (1.3%)	Pueblo, 2002
	Rolling 3-month	0.15 μg/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; and 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 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 10.2.13.1-2 (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 17, 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 PSD regulations (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 be located within 100 km (62 mi) of a Class I area. There are several Class I areas around the proposed De Tilla Gulch SEZ, three of which are situated within the 62-mi (100-km) range. The nearest Class I area is the Great Sand Dunes WA (40 CFR 81.406), about 19 mi (31 km) southeast of the De Tilla Gulch SEZ. This Class I area is located downwind of prevailing winds at the De Tilla Gulch SEZ (see Figure 10.2.13.1-1). The other two Class I areas within this range are the La Garita and Weminuche WAs, which are located about 37 mi (60 km) west and 50 mi (80 km) west-southwest of the De Tilla Gulch SEZ, respectively. The latter two Class I areas are not located downwind of the prevailing winds at the De Tilla Gulch SEZ.

10.2.13.2 Impacts

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

Air quality impacts shared by all solar technologies are discussed in detail in Section 5.11.1.1, and technology-specific impacts are discussed in Section 5.11.1.2. Impacts specific to the De Tilla Gulch 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 10.2.13.3 below identifies SEZ-specific design features of particular relevance to the De Tilla Gulch SEZ.

10.2.13.2.1 Construction

The De Tilla Gulch 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 do 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 assumptions 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 Prevention of Significant Deterioration (PSD) increment levels at nearby Class I areas.[9] For the De Tilla Gulch SEZ, the modeling was conducted based on the following assumptions and input:

- It was assumed that 80% of the 1,522-acre (6.2-km^2) area would be disturbed within the SEZ in the peak construction year, and emissions were modeled for a disturbance of 1,217 acres (4.9 km^2) uniformly distributed over the entire SEZ;

- Surface hourly meteorological for the Saguache Municipal Airport and upper air sounding data for Denver for 2005 to 2006 were used;

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

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9 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 were at the SEZ boundaries and at the nearest Class I area—Great Sand Dunes WA—about 19 mi (31 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 10.2.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled at the site boundaries would be about 518 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. Total 24-hour PM_{10} concentrations of 545 μg/m^3 would also exceed the standard level by more than a factor of 3, 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 200 μg/m^3 at the nearest residence about 0.3 mi (0.5 km) east of the SEZ, about 15 μg/m^3 at Saguache, about 10 μg/m^3 at Moffat, and about 5 μg/m^3 at Crestone. Annual modeled and total PM_{10} concentration increments at the SEZ boundary would be around 68.4 μg/m^3 and 81.4 μg/m^3, respectively, which are higher than the standard level of 50 μg/m^3. Annual PM_{10} increments would be much lower, about 30 μg/m^3 at the nearest residence, about 0.3 μg/m^3 at Moffat, and about 0.2 μg/m^3 at Saguache and Crestone. Total 24-hour $PM_{2.5}$ concentrations would be 48.3 μg/m^3 at the SEZ boundary, which is about 125% of its standard level; these modeled concentrations are less than two times background concentrations. The total annual average $PM_{2.5}$ concentration at the SEZ boundary would be

TABLE 10.2.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed De Tilla Gulch SEZ

			Concentration (μg/m^3)				Percent of NAAQS/SAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background	Total	NAAQS/ SAAQS	Increment	Total
PM_{10}	24-hour	H3H	518	27	545	150	346	364
	Annual	–	68.4	13	81.4	50	137	163
$PM_{2.5}$	24-hour	H8H	27.8	16	43.8	35	79	125
	Annual	–	6.8	4	10.8	15	46	72

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. H3H = highest of the third-highest concentrations at each receptor over the 2-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 2-year period. For the annual average, multiyear averages of annual means over the 2-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

Source: Chick (2009) for background concentration data.

10.8 μg/m^3, which is well below the standard level of 15.0 μg/m^3. At the nearest residence, predicted maximum 24-hour and annual $PM_{2.5}$ concentration increments would be about 12 and 3.0 μg/m^3, respectively.

Predicted 24-hour and annual PM_{10} concentration increments at the nearest Class I area—the Great Sand Dunes WA—would be about 11.0 and 0.33 μg/m^3, or 137% and 8%, respectively, of the PSD increment levels for Class I areas. Considering distances and prevailing winds, concentration increments at the other two Class I areas areas (La Garita WA and Weminuche WA) would be much lower than those at the Great Sand Dunes WA.

The Canon City PM_{10} Maintenance Area is about 45 mi (72 km) east-northeast of the SEZ. Canon City is not located downwind of prevailing winds at the SEZ (see Figure 10.2.13.1-1), and pollutants from the SEZ could be blocked by the Sangre de Cristo Mountain Range to the east, about 3,000 ft (914 m) or more higher than the SEZ. AERMOD modeling indicated that construction emissions from the SEZ would contribute minimally to PM_{10} concentrations in the maintenance area and thus are not anticipated to affect its attainment status.

In conclusion, predicted 24-hour and annual PM_{10}, and 24-hour $PM_{2.5}$ concentration levels could exceed their respective standards at the SEZ boundaries and immediately surrounding areas during the construction phase of a solar development. To reduce potential impacts on ambient air quality and in compliance with required programmatic design features, aggressive dust control measures would be used. In addition, potential impacts on the air quality of neighboring communities would be much lower. Predicted total concentrations for annual $PM_{2.5}$ would be well below its standard. Modeling indicates that construction activities could result in concentrations above Class I PSD PM_{10} increment levels at the nearest federal Class I area, the Great Sand Dunes WA. However, construction activities are not subject to the PSD program; the comparison is made as an indicator of possible dust levels in the WA during the limited construction period and as a screen to gauge the size of the potential impact. Therefore, it is anticipated that the potential impacts of construction activities on ambient air quality would be moderate and temporary.

Construction emissions from the engine exhaust of heavy equipment and vehicles could cause impacts on 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.

For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that an existing regional 115-kV transmission line might be used to connect some new solar facilities to load centers, and that additional project-specific analysis would be done for new transmission construction or line upgrades. However, some construction of transmission lines could occur within the SEZ. Potential impacts on ambient air quality would be a minor component of construction impacts in comparison to solar facility construction, and would be temporary in nature.

10.2.13.2.2 Operations

Emission sources associated with the operation of a solar facility would include auxiliary boilers; vehicle traffic (commuter, visitor, support, and delivery), 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 constitutes low-level PM emissions.

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

Estimates of potential air emissions displaced by solar project development at the De Tilla Gulch SEZ are presented in Table 10.2.13.2-2. Total power generation capacity ranging from 135 to 243 MW is estimated for the proposed De Tilla Gulch SEZ for various solar technologies (see Section 10.2.1.2). 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 De Tilla Gulch SEZ were fully developed, it is expected that the emissions avoided would be fairly modest. Development of 135 to 243 MW of solar power in the SEZ would result in avoided air emissions ranging from 0.5 to 0.9% 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 0.2% of total emissions from electric power systems in the six-state study area. When compared with emissions from all source categories, power production from the same solar facilities would displace up to 0.5% of SO_2, 0.2% of NO_x, and 0.4% of CO_2 emissions in Colorado (EPA 2009a; WRAP 2009). These emissions would be up to 0.12% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for more than 96% of the total electric power generated 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 De Tilla Gulch 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 De Tilla Gulch SEZ is located in an arid desert environment, these emissions would be small, and potential impacts on ambient air quality would be negligible, considering infrequent occurrences of and small amount of emissions from corona discharges.

TABLE 10.2.13.2-2 Annual Emissions from Combustion-Related Power Generation Displaced by Full Solar Development of the Proposed De Tilla Gulch 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
1,522	135–243	237–427	313–564	361–650	0.002–0.004	234–421
Percentage of total emissions from electric power systems in the State of Colorado[d]			(0.50-0.90%)	(0.50-0.90%)	(0.50-0.90%)	(0.50-0.90%)
Percentage of total emissions from all source categories in the State of Colorado[e]			0.27–0.48%	0.09–0.16%	-[f]	0.23–0.41%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.12–0.22%	0.10–0.18%	0.07–0.12%	0.09–0.16%
Percentage of total emissions from all source categories in the six-state study area[e]			0.07–0.12%	0.01–0.02%	-	0.03–0.05%

a 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 the parabolic trough technology) to 9 acres (0.036 km^2) per MW (for the power tower, dish engine, and PV technologies) would be required.

b Assumed a capacity factor of 20%.

c Composite combustion-related emission factors for SO_2, NO_x, Hg, and CO_2 of 2.64, 3.05, 1.71 × 10.2^{-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).

10.2.13.2.3 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).

10.2.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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10.2.14 Visual Resources

10.2.14.1 Affected Environment

10.2.14.1.1 Regional Setting

The proposed De Tilla Gulch SEZ is located approximately 76 mi (123 km) north of the Colorado–New Mexico border on the northern side of the San Luis Valley in Saguache County in southern Colorado. Section 10.1.7.1.1 discusses the regional setting (San Luis Valley) for De Tilla Gulch and the other Colorado SEZs.

10.2.14.1.2 De Tilla Gulch SEZ

The De Tilla Gulch SEZ (1,522 acres [6.2 km^2]) occupies an area approximately 1.6 mi (2.6 km) north to south (at greatest extent) and 3 mi (5 km) east to west and is located approximately 6 mi (10 km) (at closest approach) east-northeast of the town of Saguache Colorado, immediately southeast of U.S. 285 and 3 mi (5 km) west of CO 17.

The SEZ is in a gently sloping treeless plain, with the strong horizon line being the dominant visual feature, except to the northwest, where the San Juan Mountains dominate the view beyond U.S. 285. The SEZ appears flat, but actually slopes slightly upward to the northwest toward the San Juan Mountains. Elevation ranges from 7,675 ft (2,339 m) in the southeastern portion to 7,835 ft (2,388 m) in the northern portion of the De Tilla Gulch SEZ, along U.S. 285.

Vegetation is primarily low shrubs (generally less than 2 ft [0.6 m]) and grasses, with many areas of bare, generally tan soil or gravel. During a July 2009 site visit, the vegetation presented green and gray colors, with banding and other variation sufficient to add slight visual interest. Some or all of the vegetation might be snow-covered in winter, which might significantly affect the visual qualities of the area by changing the color contrasts associated with the vegetation. This in turn could change the contrasts associated with the introduction of solar facilities into the landscape.

A gravel road crosses the eastern part of the SEZ from north to south. Other two-track roads cross the SEZ in various directions. The SEZ is also crossed by several shallow dry washes, generally sloping downward from the northwest to the southeast. No permanent water features are present on the SEZ. This landscape type is common within the region.

On-site cultural modifications include unpaved roads, some cleared areas in the northeastern portion of the SEZ where sand, gravel, or both have been removed, a windmill, a transmission line that runs north to south along the road on the eastern side of the SEZ, and wire fences. Panoramic views of the SEZ are shown in Figures 10.2.14.1-1 and 10.2.14.1-2.

FIGURE 10.2.14.1-1 Approximately 180° Panoramic View of the West Side of the Proposed De Tilla Gulch SEZ, Facing Northwest, Including Copper Butte at Left Center and Sawatch Range in Background

FIGURE 10.2.14.1-2 Approximately 180° Panoramic View of the East Side of the Proposed De Tilla Gulch SEZ, Facing North, Including San Juan Mountains and Copper Butte at Left (West) and Off-Site Cultural Modifications and Sangre de Cristo Range at Right (East)

Off-site views include distant mountains (Cochetopa Hills to the west, the Sawatch Range to the north, and the Sangre de Cristo Range to the east). Views to the south are open and expansive, as the valley floor slopes slightly to the south, and the SEZ is at the northern end of the valley. Rattlesnake Hill and McIntyre Ridge are visible to the west of the SEZ, and as they are essentially a spur projecting southeast from the San Juan Mountains, they screen views of the town of Saguache, which is not visible from the SEZ.

A variety of cultural modifications are visible off-site from the proposed SEZ. The most prominent is U.S. 285, which borders the entire northwest edge of the SEZ. During a site visit in July 2009, much traffic was observed, including many trucks, and as the road is visible from the entire SEZ, the moving traffic is noticeable. South of the SEZ (less than 0.5 mi [0.8 km]) and east of the SEZ (approximately 2 mi [3.2 km]) are agricultural areas, utilizing primarily center pivot irrigation; these areas are visible from the SEZ, as are associated buildings. A small landfill is visible to the northeast of the SEZ, as are transmission lines and towers. Some of these cultural modifications are visible in Figure 10.2.14.1-2. In general, these off-site cultural modifications detract from the area's scenic quality. Undeveloped land is visible directly northwest of the SEZ (beyond U.S. 285), and the land rises rapidly to Copper Butte and the Sawatch Range (shown in Figure 10.2.14.1-1); the scenery in this direction is of much higher quality than in other lands adjacent to the SEZ.

The BLM conducted a VRI for the SEZ and surrounding lands in 2009 (BLM 2010c). The VRI evaluates BLM-administered lands based on scenic quality; sensitivity level, in terms of public concern for preservation of scenic values in the evaluated lands; and distance from travel routes or KOPs. Based on these three factors, BLM-administered lands are placed into one of four VRI Classes, which represent the relative value of the visual resources. Class I and II are the most valued; Class III represents a moderate value; and Class IV represents the least value. Class I is reserved for specially designated areas, such as national wildernesses and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape. Class II is the highest rating for lands without special designation. More information about VRI methodology is available in Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410.2-1 (BLM 1986a).

The VRI values for the SEZ and immediate surroundings are VRI Class III, indicating moderate relative visual values. 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, the relative commonness of the landscape type within the region, and some negative impacts from cultural modifications. Positive scenic quality attributes included some variety in vegetation types and color, and attractive off-site mountain views; however, these positive attributes were insufficient to raise the scenic quality to the "moderate" level. The inventory indicates high sensitivity for the SEZ and its immediate surroundings, because of its location next to U.S. 285, an important route for viewing the San Luis Valley and the Sangre de Cristo Mountains. The VRI notes that "first impressions of the San Luis Valley and the Sangre de Cristo Mountains are formed along this corridor. Changes to scenic quality may impact [the] visitor experience" (BLM 20101c).

Lands within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ contain 39,260 acres (158.88 km^2) of VRI Class II areas, primarily northwest and west of the SEZ in the San Juan Mountains; 195,470 acres (791.039 km^2) of Class III areas, primarily northeast and south of the SEZ; and 200,266 acres (810.448 km^2) of VRI Class IV areas, primarily southeast and east of the SEZ.

The VRI map for the SEZ and surrounding lands is shown in Figure 10.2.14.1-3. More information about VRI methodology is available in Section 5.7 and in *Visual Resource Inventory*, BLM Manual Handbook 8410.2-1 (BLM 1986a).

The San Luis RMP (BLM 1991) indicates that the entire SEZ is managed as VRM Class III. VRM Class III objectives include partially retaining the existing character of the SEZ and allowing a moderate level of changes to the characteristic landscape. Management activities may attract attention but should not dominate the views of casual observers. The VRM map for the proposed SEZ and surrounding lands is shown in Figure 10.2.14.1-4. More information about BLM's VRM program is available in Section 5.7 and in *Visual Resource Management*, BLM Manual Handbook 8400 (BLM 1984).

10.2.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed De Tilla Gulch 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 SEZ-specific design features.

Site-specific impact assessment is needed to systematically and thoroughly assess visual impact levels for a particular project. Without precise information about the location of a project and 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 be used to 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 for this Solar Energy PEIS, including assumptions and limitations, is presented in Appendix M.

Similarly, the nature and magnitude of potential glint- and glare-related visual impacts for a given solar facility is highly dependent on viewer position, sun angle, the nature of the reflective surface and its orientation relative to the sun and the viewer, atmospheric conditions and other variables. The determination of potential impacts from glint and glare from solar facilities within a given proposed SEZ would require precise knowledge of these variables, and is not possible given the scope of the PEIS. Therefore, the following analysis does not describe or suggest potential contrast levels arising from glint and glare for facilities that might be developed within the SEZ; however, it should be assumed that glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size, landscape setting, or technology

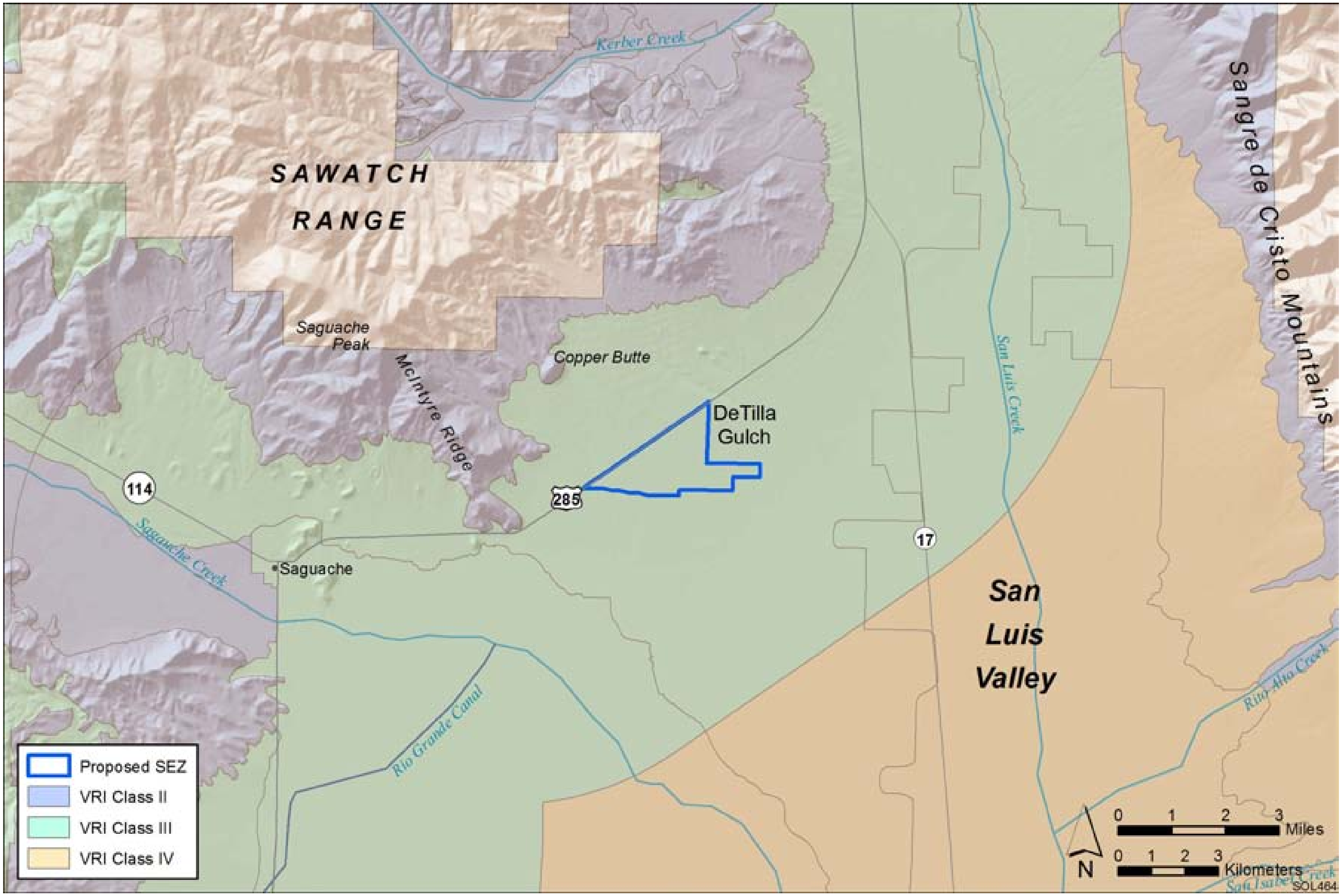

FIGURE 10.2.14.1-3 Visual Resource Inventory Values for the Proposed De Tilla Gulch SEZ and Surrounding Lands

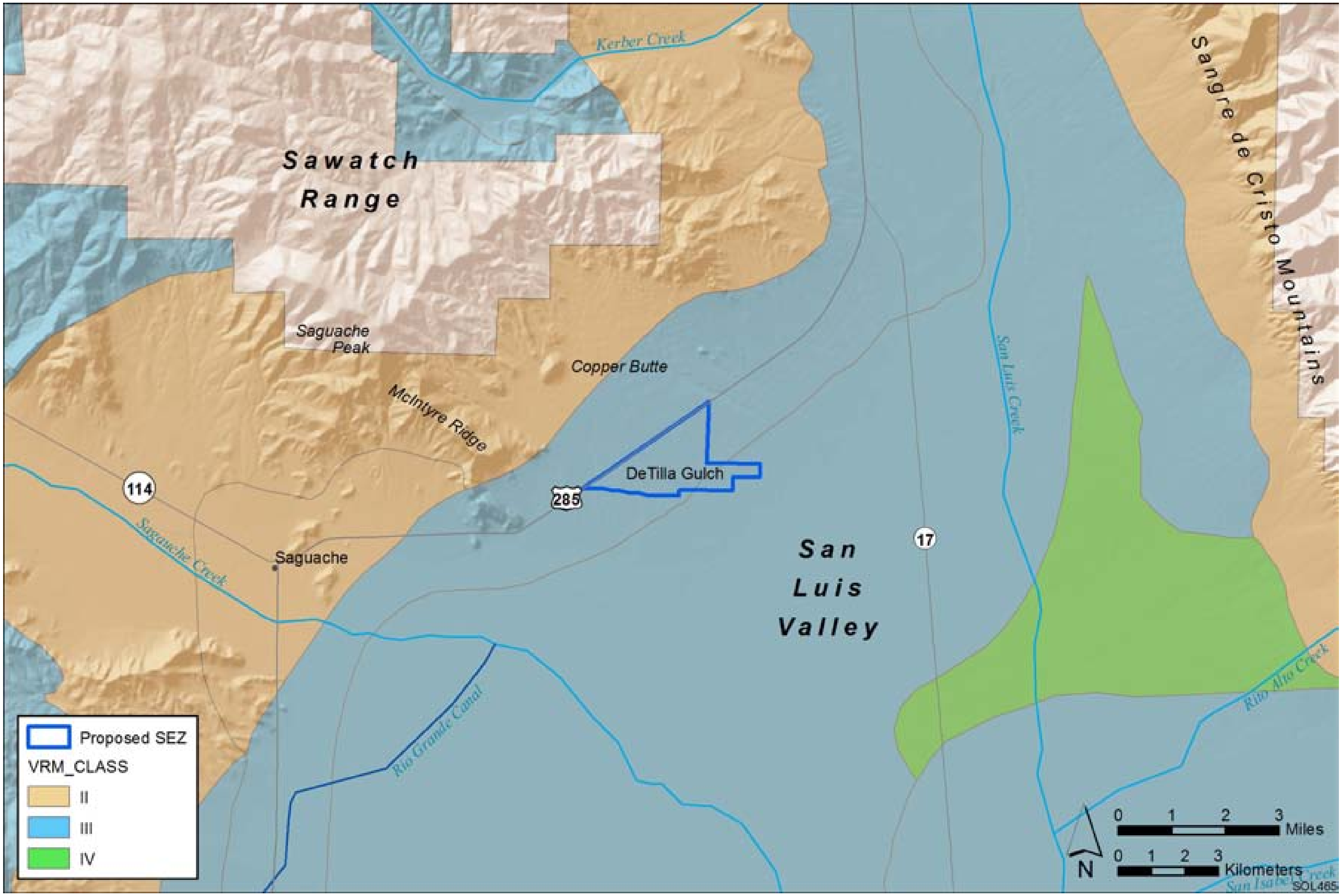

FIGURE 10.2.14.1-4 Visual Resource Management Classes for the Proposed De Tilla Gulch SEZ and Surrounding Lands

type. The occurrence of glint and glare at solar facilities could potentially cause large, but temporary, increases in brightness and visibility of the facilities. The visual contrast levels projected for sensitive visual resource areas discussed in the following analysis do not account for potential glint and glare effects; however, these effects would be incorporated into a future site-and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more information about potential glint and glare impacts associated with utility-scale solar energy facilities, see Section 5.12 of this PEIS.

10.2.14.2.1 Impacts on the Proposed De Tilla Gulch 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 from nearby locations. Additional, and potentially large impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines. While the primary visual impacts associated with solar energy development within the SEZ would occur during daylight hours, lighting required for utility-scale solar energy facilities would be a potential source of visual impacts at night, both within the SEZ and on surrounding lands. Common and technology-specific visual impacts from utility-scale solar energy development, as well as impacts associated with electric transmission lines, are discussed in Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and decommissioning, and some impacts could continue after project decommissioning. Visual impacts resulting from solar energy development in the SEZ would be in addition to impacts from solar energy development and other development that may occur on other public or private lands within the SEZ viewshed, and are subject to cumulative effects. For discussion of cumulative impacts, see Section 10.2.22.4.13 of the PEIS.

The changes described above would be expected to be consistent with BLM visual resource management objectives for VRM Class IV, as seen from nearby KOPs. VRM Class IV management objectives include major modification of the existing character of the landscape. As shown in Figure 10.2.14.1-4, the SEZ is currently designated as VRM Class III. VRM Class III objectives allow only a moderate level of change to the characteristic landscape; therefore, impacts associated with utility-scale solar energy development at the De Tilla Gulch SEZ could exceed those consistent with the current VRM Class III management objectives for the area. More information about impact determination using BLM's VRM program is available in Section 5.7 and in *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1 (BLM 1986b).

10.2.14.2.2 Impacts on Lands Surrounding the Proposed De Tilla Gulch 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 important information on 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 10.2.14.2-1 shows the combined results of the viewshed analyses for all four solar technologies. The colored segments indicate areas with clear lines of sight to one or more areas within the SEZ and from which solar facilities within these areas of the SEZ would be expected to be visible, assuming the absence of screening vegetation or structures and adequate lighting and other atmospheric conditions. The light brown areas are locations from which PV and parabolic trough arrays located in the SEZ could be visible. Solar dishes and power blocks for CSP technologies would be visible from the areas shaded in light brown and the additional areas shaded in light purple. Transmission towers and short solar power towers would be visible from the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power tower facilities located in the SEZ could be visible from areas shaded light brown, light purple, dark purple, and at least the upper portions of power tower receivers 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.

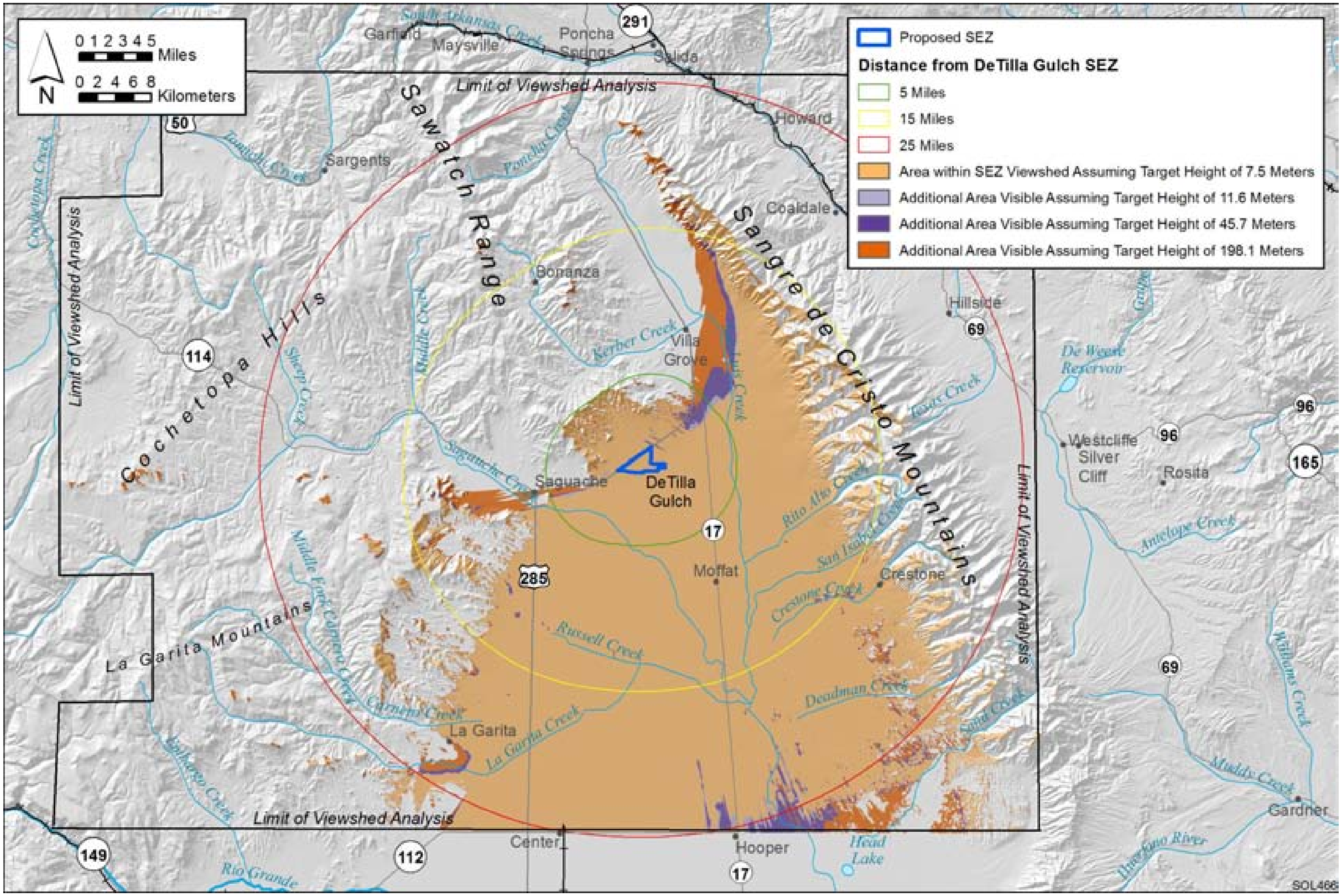

FIGURE 10.2.14.2-1 Viewshed Analyses for the Proposed De Tilla Gulch SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

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

Figure 10.2.14.2-2 shows the results of a GIS analysis that overlays selected federal-, state-, and BLM-designated sensitive visual resource areas onto the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds, in order to illustrate which of these sensitive visual resource areas would have views of solar facilities within the SEZ and therefore potentially would be subject to visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-specified foreground-middleground distance (5 mi [8 km]), background distance (15 mi [24.1 km]), and a 25-mi (40.2-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;
- 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 (40.2 km) of the proposed De Tilla Gulch SEZ are discussed below. The results of this analysis are also summarized in Table 10.2.14.2-1. Further discussion of impacts on these areas is available in Sections 10.2.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and 10.2.17 (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 observed landscape, including changes in the forms, lines, colors, and textures of objects seen in the landscape. A measure of *visual impact* includes potential human reactions to the visual contrasts arising from a development activity,

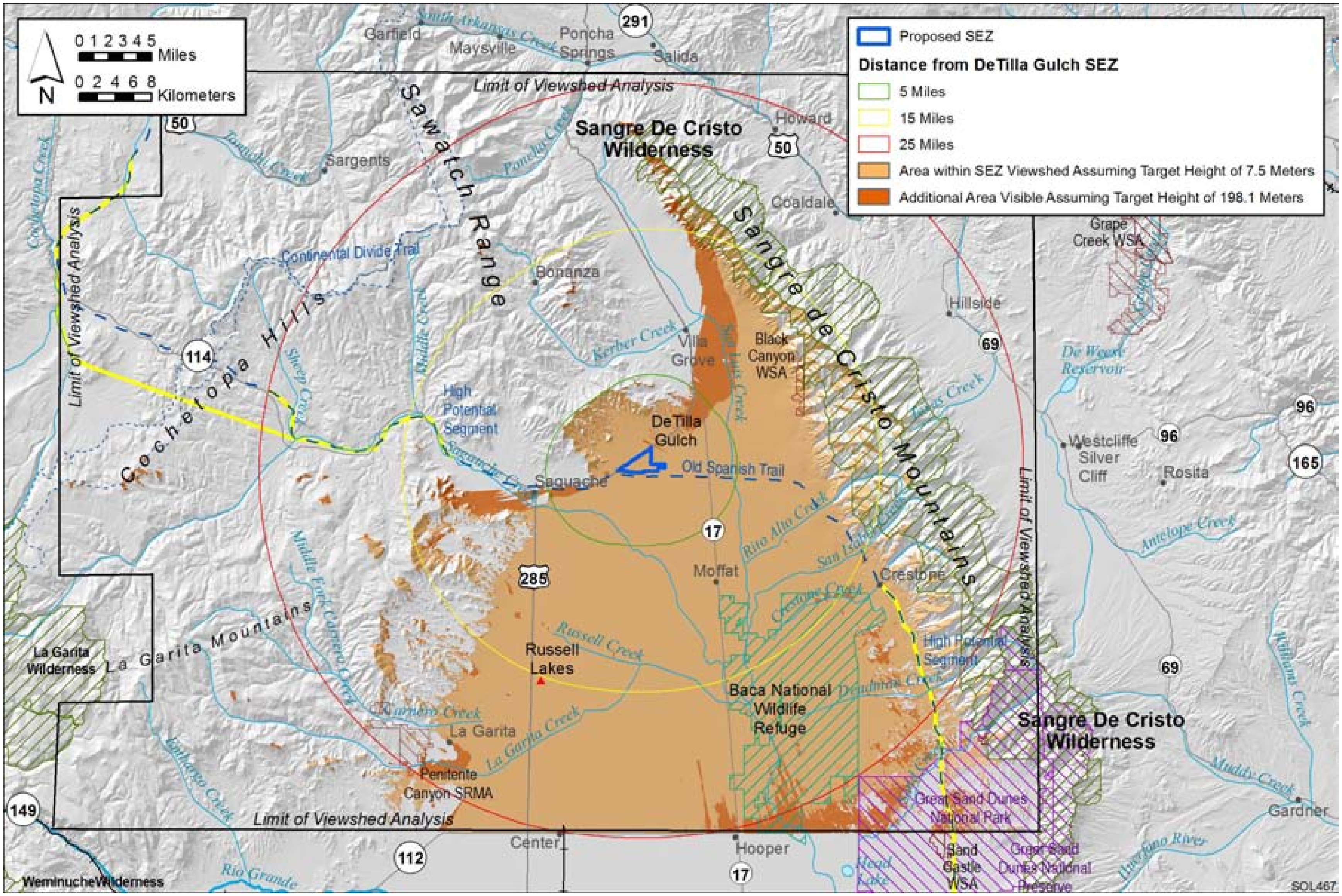

FIGURE 10.2.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds

GOOGLE EARTH™ VISUALIZATIONS

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

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

TABLE 10.2.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40.2-km) Viewshed of the Proposed De Tilla Gulch SEZ, Assuming a Viewshed Analysis Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance[a]		
			Visible between	
Feature Type	Feature Name (Total Acreage)	Visible within 5 mi	5 and 15 mi	15 and 25 mi
National Historic Trail	Old Spanish	13.2 mi (21.2 km)	10.7 mi (17.2 km)	10.7 mi (17.2 km)
WA	Sangre de Cristo (217,702 acres)[b]	0 acres	11,547 acres (5%)	7,043 acres (3%)[c]
WSA	Black Canyon (16,699 acres)	0 acres	1,043 acres (6%)	0 acres
NNL	Russell Lakes (3,860 acres)	0 acres	0 acres	3,860 acres (100%)
NWR	Baca (92,596 acres)	0 acres	13,949 acres (15%)	62,486 acres (68%)
SRMA	Penitente Canyon (4,173 acres)	0 acres	0 acres	308 acres (7%)

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

[b] Includes both BLM and NPS WA acreage.

[c] Percentage of total feature acreage or road length viewable.

based on viewer characteristics, including attitudes and values, expectations, and other characteristics that that are viewer- and situation-specific. Accurate assessment of visual impacts requires knowledge of the potential types and numbers of viewers for a given development and their characteristics and expectations; specific locations from which the project might be viewed; and other variables that were not available or not feasible to incorporate in the PEIS analysis. These variables would be incorporated into a future site-and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more discussion of visual contrasts and impacts, see Section 5.12 of the PEIS.

National Historic Trail

- *Old Spanish National Historic Trail*—The Old Spanish National Historic Trail is a congressionally designated multistate historic trail that passes within 0.6 mi (1 km) to 0.25 mi (0.4 km) of the SEZ as it parallels the entire southern boundary of the SEZ. Although traces of the trail are not visible to the casual viewer and the precise location of the congressionally designated trail in the vicinity is not known, the congressionally identified route requires management of the trail, trail resources, and trail setting to be in accordance with the National Trail System Act.

  Approximately 34.6 mi (55.7 km) of the congressionally designated Old Spanish National Historic Trail route is within the calculated 650-ft (198.1-m) viewshed of the SEZ. The trail route is visible as a blue dashed line parallel to, and extending both east and west beyond the southern boundary of the SEZ in Figure 10.2.14.2-2. The tall solar power tower (650 ft [198.1 m]) viewshed analysis indicates that power tower projects within the SEZ could be visible from the trail starting approximately 25 mi (40.2 km) southeast of the SEZ to approximately 5.5 mi (8.9 km) west of the SEZ, while the PV and parabolic trough array (24.6 ft [7.5 m]) viewshed shows that projects within the SEZ using these lower-height components could be visible from the trail starting approximately 25 mi (40.2 km) southeast of the SEZ to approximately 2.3 mi (3.6 km) west of the SEZ. Approximately 7.9 mi (12.7 km) of the southeasternmost portion of the Old Spanish National Historic Trail within the 25-mi (40.2-km) viewshed has been designated as a high-potential segment. High-potential segments of the Old Spanish National Historic Trail are highlighted in yellow in Figure 10.2.14.2-2.

  Trail users approaching the De Tilla Gulch SEZ from the east would likely have intermittent views of the SEZ and solar facilities within the SEZ as they traveled generally north-northwest along the trail from distances exceeding 25 mi (40.2 km) from the SEZ to approximately 12 mi (19.3 km) from the SEZ, where the trail turns westward and gradually slopes downward toward the valley bottom. Because of the undulating terrain along the trail route as it crosses the foothills of the Sangre de Cristo range, the SEZ would be in view briefly and repeatedly as trail users crossed rises; then the SEZ would disappear from view as trail users traversed low areas between the rises. At these relatively long distances, solar energy development within the SEZ would be expected to result in weak visual contrasts with the surrounding landscape, as viewed from the trail.

Figure 10.2.14.2-3 is a three-dimensional perspective visualization created with Google Earth™ depicting the SEZ as it would be seen from a point on the high-potential segment of Old Spanish National Historic Trail east of the SEZ at a distance of approximately 17.6 mi (28.3 km) from the SEZ. The viewpoint is elevated about 400 ft (120 m) above the SEZ. The visualization includes a simplified wireframe model of a hypothetical solar power tower facility. The model was placed in the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities for this and other visualizations shown in this section of the PEIS. The receiver tower depicted in the visualizations is a properly scaled model of a 459-ft (139-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats, representing approximately 100 MW of electric generating capacity. The SEZ area is depicted in orange, the heliostat fields in blue.

The visualization suggests that because the distance to the SEZ is relatively long, the vertical angle of view is very 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, could be visible, depending on lighting, but might not be noticed by casual observers.

If operating power towers were located in the SEZ, the receivers would likely appear as points of light against a backdrop of the valley floor or the base of the mountains northwest of the SEZ. If sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances at night, and would likely be visible from this viewpoint, although there would be other lights visible in the valley. 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 the PEIS, solar energy development within the SEZ would be expected to create weak contrasts as viewed from this location on the trail.

After the Old Spanish National Historic Trail turns west to approach the proposed De Tilla Gulch SEZ from the east, the trail passes through an agricultural area, parallels and crosses roads, and crosses a transmission line

FIGURE 10.2.14.2-3 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from a High-Potential Segment of the Old Spanish National Historic Trail

ROW. Other cultural modifications, including a landfill located east of the SEZ would likely be visible.

The valley floor is flat, with little possibility of screening from vegetation, so views of the SEZ are open, and trail users approaching from the east would have extended views of the proposed De Tilla Gulch SEZ as they approached and passed the SEZ. Where views are open, trail users distant from the SEZ would generally see solar facilities located in 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 and north from the center of the field of view looking down the trail. The facilities would appear to be larger and more detailed and would have greater contrast with their surroundings. The associated visual contrast levels would be expected to increase as trail users approached the SEZ, rising from weak through moderate to strong as trail users passed the SEZ at a distance of 0.25 mi (0.4 km) from the southern boundary of the SEZ.

Old Spanish National Historic Trail users approaching the proposed De Tilla Gulch SEZ from the west would not see the SEZ or solar facilities within the SEZ until they passed just north of the community of Saguache (approximately 5.6 mi [9.0 km] west of the SEZ), where the 650-ft (198.1-m) viewshed suggests that the top portions of sufficiently tall power towers might just project over the southern end of McIntyre Ridge and Rattlesnake Hill. During the day, an operating power tower receiver might look like a very bright point of light against the sky backdrop, while at night, flashing hazard lights on the power tower could be visible.

As trail users passed the south side of Rattlesnake Hill (approximately 2.2 mi [3.5 km] west of the SEZ), the southern portion of the SEZ would abruptly come into view, and lower-height solar technologies and associated facilities would become visible. As trail users passed the extreme southern tip of McIntyre Ridge (approximately 1.3 mi [2.1 km] west of the SEZ), the entire SEZ would come into view. At the relatively short distance involved, utility-scale solar facilities would likely cause strong visual contrasts, although the small size of the SEZ would restrict the size of solar facilities and thereby limit associated visual contrasts. The sudden appearance of large-scale industrial facilities at relatively short range could be visually disconcerting to some trail users. It should be noted that the Old Spanish National Historic Trail in this area closely parallels and actually crosses U.S. 285. Thus, traffic and other cultural disturbances would also be visually prominent to trail users in the area, which could tend to decrease the perceived visual impacts of solar facilities within the SEZ.

For Old Spanish National Historic Trail users viewing solar facilities within the SEZ from the portion of the trail immediately south of the SEZ, the facilities would be viewed against the natural-appearing backdrop of a range of hills approximately 2 mi (3.2 km) northwest of the SEZ. U.S. 285 and moving traffic on U.S. 285 could be visible behind or between the structures that compose the facilities. Because of the very close approach of the trail to the SEZ (approximately 0.25 mi [0.4 km]), solar energy facilities located within the SEZ might be viewed in the immediate foreground for trail users and would likely dominate views from the trail, creating strong visual contrasts with the surrounding landscape.

Figure 10.2.14.2-4 is a Google Earth visualization depicting the SEZ as it would be seen from a point on the Old Spanish National Historic Trail at a distance of approximately 0.25 mi (0.4 km) directly south of the SEZ. The visualization includes a simplified wireframe model of a hypothetical solar power tower facility. The SEZ area is depicted in orange, the heliostat fields in blue.

The power tower in this view is approximately 0.9 mi (1.5 km) from the viewpoint. The viewpoint is approximately 17 ft (5.2 m) lower in elevation than the southern edge of the SEZ. The visualization suggests that the SEZ would stretch across the horizon, and trail users would have to turn their heads to encompass the entire SEZ in their view. Solar projects within the SEZ would generally be viewed against the backdrop of the hills north of the SEZ, but depending on tower location and height, power tower receivers could potentially be visible above the peaks of the hills. Lower-height facility components, such as heliostats or solar trough arrays, would be seen almost edge on, repeating the line of the valley floor. But if lower-height components were located sufficiently close to the southern 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 structural components, would likely be visible, which would increase visible contrasts.

Operating power towers in the closest part of the SEZ would likely appear as brilliant white nonpoint light sources atop towers with clearly discernable structural details. In addition, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). When operating, the power towers would likely strongly attract visual attention, and would likely dominate views from this section of the trail.

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 at night, and could strongly attract visual attention. Other lighting from solar facilities in the SEZ could be visible as well.

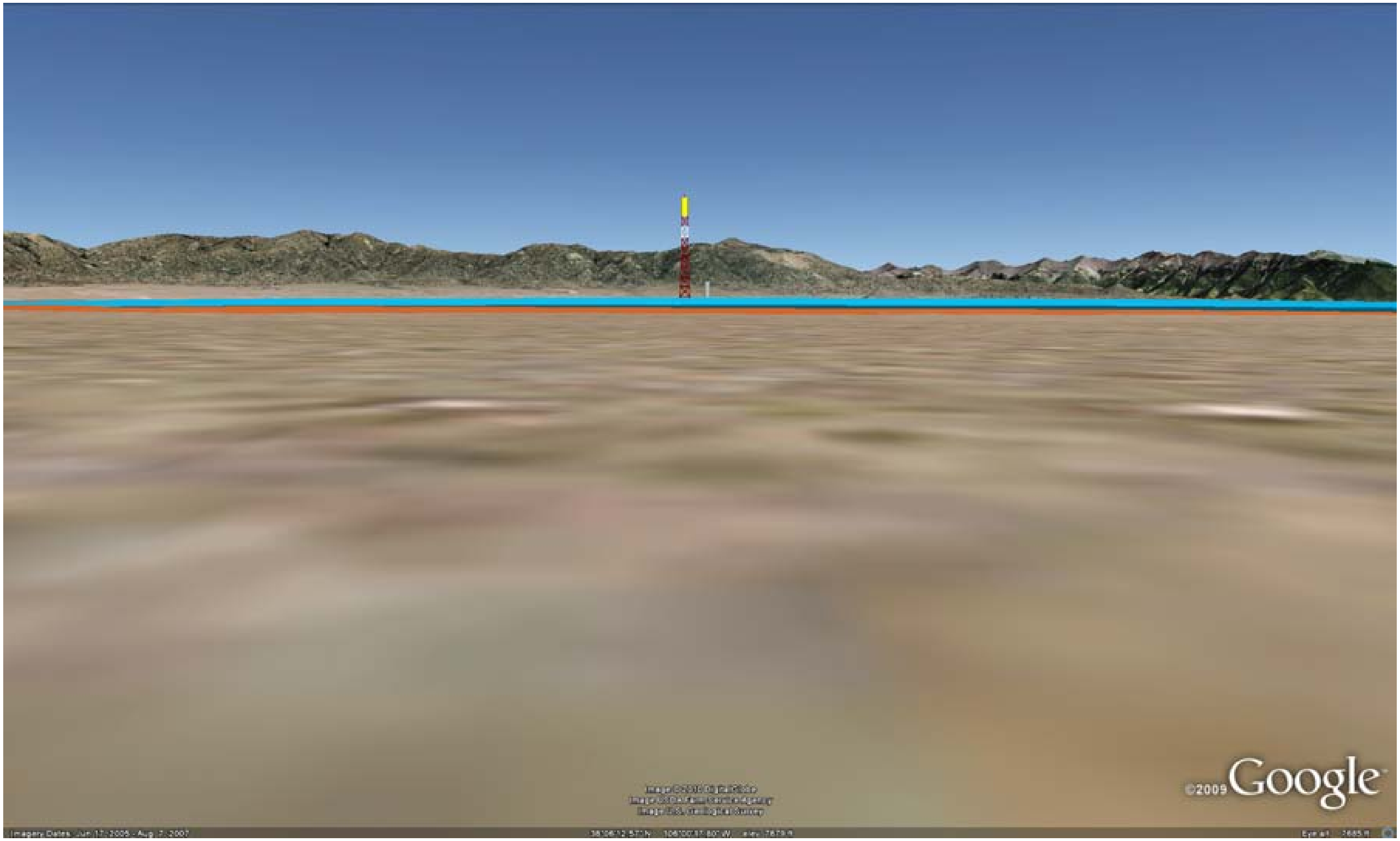

FIGURE 10.2.14.2-4 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Old Spanish National Historic Trail

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 the PEIS, solar energy development within the SEZ would be expected to create strong contrasts as viewed from this location on the trail.

In summary, westbound trail users would have extended views of solar facilities within the SEZ as they crossed the lower slopes of the Sangre de Cristo Mountains, then turned west to cross the San Luis Valley, approaching the SEZ directly. As they crossed the valley, visual contrast levels from solar facilities would gradually increase until they reached strong levels in the vicinity of the SEZ. Topographic screening would prevent eastbound trail users from seeing the SEZ until they were about 5 mi (8 km) from the SEZ, at which point contrast levels would rise quickly to strong levels.

Wilderness Areas

- *Sangre de Cristo*—The Sangre de Cristo WA is a 217,702 -acre (881.009 km^2) (including both BLM- and NPS-managed portions) congressionally designated WA located approximately 12.9 mi (20.8 km) northeast of the SEZ at the point of closest approach. As shown in Figure 10.2.14.2-2, a small portion of the WA (about 9%, or approximately 18,590 acres [75.231 km^2]) is within the 650-ft (198.1-m) viewshed of the SEZ, and about 8%, or approximately 16,244 acres (65.737 km^2), is within the (24.6 ft [7.5 m]) viewshed of the SEZ. These areas are generally limited to the southwest faces of the westernmost mountains of the range. Those portions extend from approximately 14.4 mi (23.2 km) from the northern SEZ boundary to 16.7 mi (26.9 km) from the eastern SEZ boundary.

  Some portions of the WA in the visible area are forested, and views of the SEZ are screened by trees in some locations; however, some higher elevation meadows and mountain peaks are not forested, and visitors to these areas would have elevated open views of the SEZ. Where there were open views of the SEZ, because of the relatively long distance to the SEZ and the small size of the SEZ, the SEZ would occupy a very small portion of the field of view, and solar energy facilities within the SEZ would be expected to create weak visual contrasts when viewed from the WA.

  Figure 10.2.14.2-5 is a Google Earth visualization depicting the SEZ (highlighted in orange) as it would be seen from Nipple Mountain, located within the WA at a distance of approximately 14.1 mi (22.7 km) from the SEZ. The viewpoint is elevated about 4,300 ft (1,300 m) above the SEZ. The visualization includes a simplified wireframe model of a hypothetical solar power tower facility, placed within the SEZ. The heliostat fields are depicted in blue.

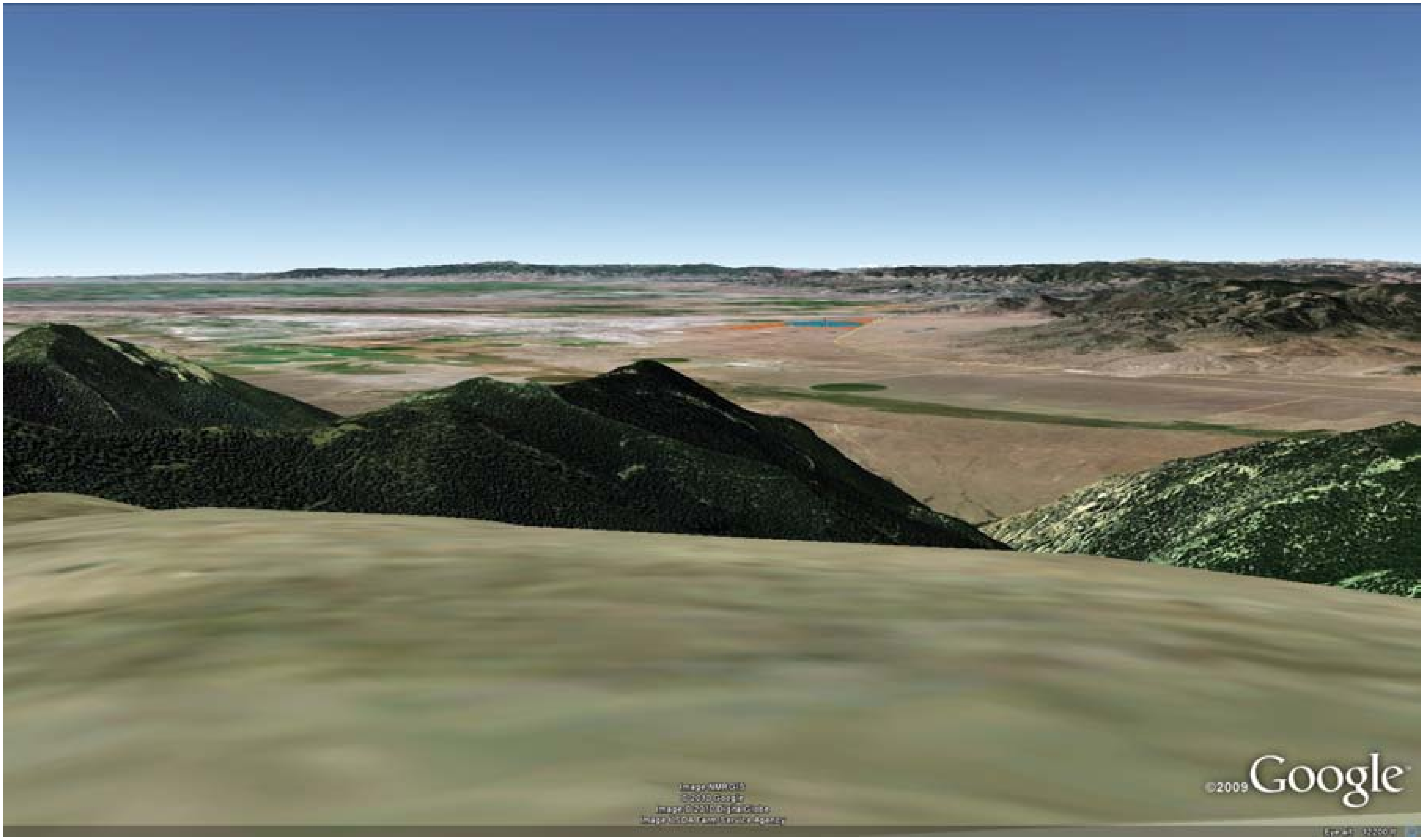

FIGURE 10.2.14.2-5 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Peak of Nipple Mountain within the Sangre de Cristo WA

The visualization suggests that even though the distance to the SEZ is relatively long, because of the elevated viewpoint, the vertical angle of view is high enough that the whole SEZ and the tops of solar collector/reflector arrays in the SEZ would be visible. Their full areal extent would be apparent, as would their strong regular geometry, which would tend to increase visual contrasts; however, because of the small size of the SEZ and its distance from the viewpoint, it would occupy a very small portion of the horizontal field of view. Taller solar facility components, such as transmission towers, could be visible, depending on lighting, but might not be noticed by casual observers.

If operating power towers were located in the SEZ, the receivers would likely appear as points of light against a backdrop of the valley floor. If sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances at night, and would likely be visible from this viewpoint, although there would be other lights visible in the valley. 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 the PEIS, solar energy development within the SEZ would be expected to create weak contrasts as viewed from this location in the WA.

Wilderness Study Areas

- *Black Canyon*—The Black Canyon WSA is located approximately 9.8 mi (15.8 km) away at the closest point of approach northwest of the SEZ. As shown in Figure 10.2.14.2-2, a portion (approximately 1,044 acres [4.225 km^2], or 6% of the total acreage) of the WSA is located within the 650-ft (198.1-m) viewshed of the SEZ. The Black Canyon WSA is between the SEZ and the Sangre de Cristo WA, running about 4 mi (6.4 km) long on the western edge of the WA.

  Some portions of the WSA in the visible area are forested, and views of the SEZ may be screened by trees in some locations; however, some ridges are not forested (particularly on the south-facing slopes), and visitors in these areas would have elevated open views of the SEZ. Where there were open views of the SEZ, because of the relatively long distance to the SEZ and its small size, the SEZ would occupy a very small portion of the field of view, and solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the WSA.

  Figure 10.2.14.2-6 is a three-dimensional perspective visualization created with Google Earth depicting the SEZ (highlighted in orange) as it would be

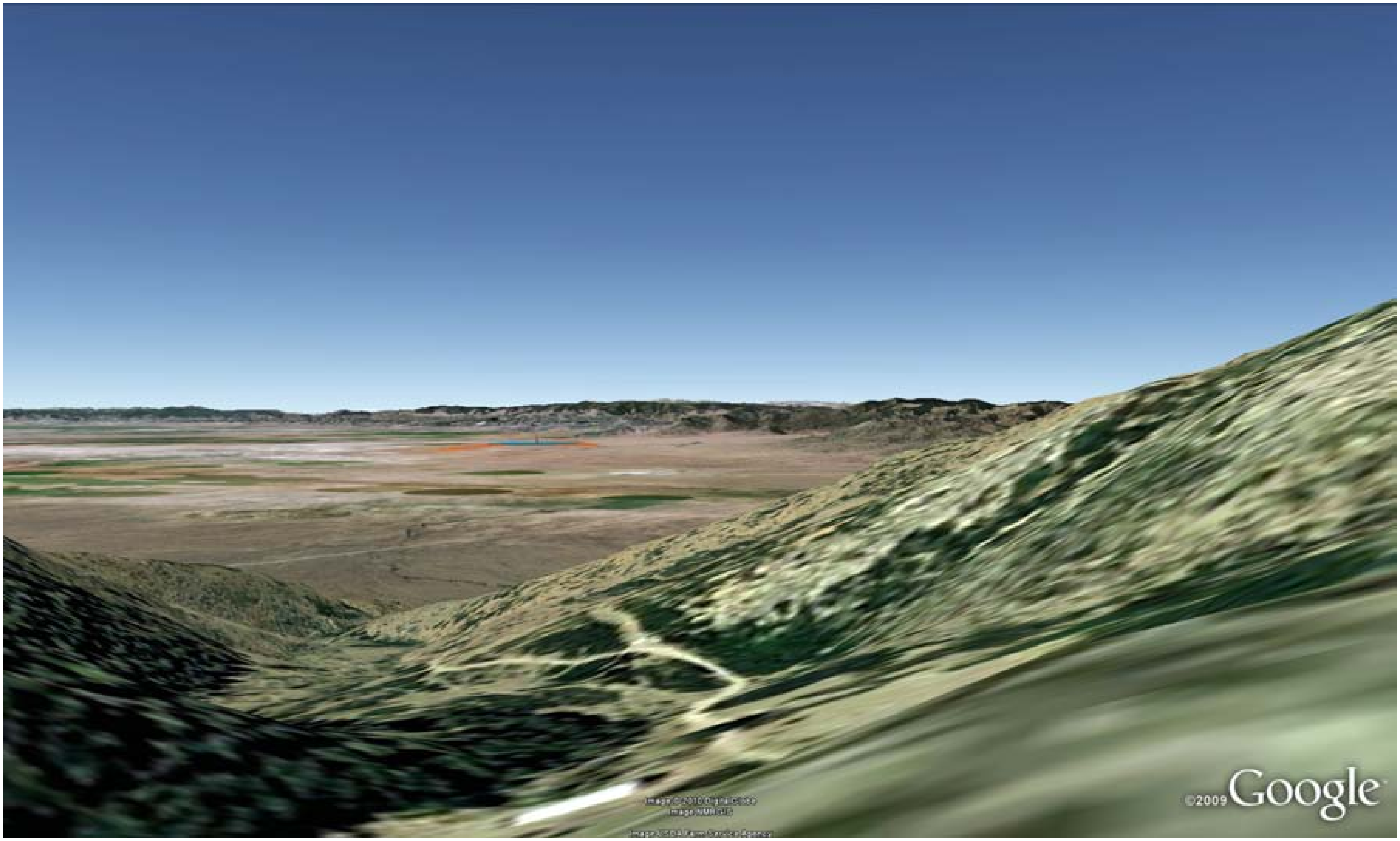

FIGURE 10.2.14.2-6 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Black Canyon WSA

seen from a ridge located within the northern portion of the WSA at a distance of approximately 11.4 mi (18.4 km) from the SEZ. The viewpoint is about 1,900 ft higher than the SEZ. The visualization includes a simplified wireframe model of a hypothetical solar power tower facility placed within the SEZ. The heliostat fields are depicted in blue.

The visualization suggests that because the distance to the SEZ is relatively long, despite the elevated viewpoint, the vertical angle of view is low. The SEZ would occupy a very small amount of the horizontal field of view. The solar collector/reflector arrays for facilities within the SEZ would be seen nearly edge-on, 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, could be visible, as well.

If operating power towers were located in the SEZ, the receivers would likely appear as points of light against a backdrop of the valley floor. If sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances at night, and would likely be visible from this viewpoint, although there would be other lights visible in the valley. 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 the PEIS, solar energy development within the SEZ would be expected to create weak contrasts as viewed from this location in the WSA.

National Natural Landmarks

- *Russell Lakes*—Russell Lakes National Natural Landmark (NNL), under both federal and private ownership, is located 15.5 mi (24.9 km) southwest of the proposed De Tilla Gulch SEZ. Russell Lakes NNL is the most extensive bulrush marsh in Colorado and is entirely within the viewshed of the SEZ. The NNL is located on the valley floor, at an elevation approximately 100 ft (30 m) lower than the SEZ, thus viewpoints from the NNL are not elevated relative to the SEZ. While power tower receivers might be visible as distant bright light sources against a mountain backdrop as viewed from the NNL, the remainder of the facilities might be at least partially screened by topography. If visible, solar collectors and other low-height facility components would be expected to repeat the line of the horizon as seen from the NNL, which would tend to reduce visual contrast. Because of the low viewing angle and the long distance to the SEZ, the SEZ would occupy a very small portion of the field of view, and solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the NNL.

Figure 10.2.14.2-7 is a Google Earth visualization depicting the SEZ (highlighted in orange) as it would be seen from a ridge located within the northern portion of the NNL at a distance of approximately 11.4 mi (18.4 km) from the SEZ.

The visualization suggests that because the distance to the SEZ is relatively long and because the viewpoint is lower in elevation than the SEZ, the vertical angle of view is extremely low. The SEZ would occupy a very small amount of the horizontal field of view. The solar collector/reflector arrays for facilities within the SEZ would be seen edge-on, appearing as thin lines at the base of the hills north of the SEZ. The edge-on view would greatly reduce their apparent size, largely conceal their strong regular geometry, and cause them to appear to repeat the strong horizontal line of the valley floor, substantially reducing visual contrast. Taller solar facility components, such as transmission towers, could be visible, depending on lighting, but might not be noticed by casual observers.

If operating power towers were located in the SEZ, the receivers would likely appear as points of light at the base of the hills north of the SEZ. If sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances at night, and would likely be visible from this viewpoint, although there would be other lights visible in the valley. 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 the PEIS, solar energy development within the SEZ would be expected to create weak contrasts as viewed from this location in the NNL.

National Wildlife Refuges

- *Baca*—In 2000, Congress authorized the establishment of Baca National Wildlife Refuge (NWR). It is managed by the U.S. Fish and Wildlife Service and is currently closed to the public. The NWR is located approximately 9.8 mi (15.8 km) away at the closest point of approach southeast of the proposed De Tilla Gulch SEZ. A significant portion (approximately 76,435 acres [309.32 km^2] or 83% of the total NWR acreage) of the refuge is within the 650-ft. (198.1-m) viewshed of the SEZ; however, most of visible area is more than 15 mi (24.1 km) distant from the SEZ.

FIGURE 10.2.14.2-7 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Russell Lakes NNL

Baca NWR is located on the San Luis Valley floor, at an elevation 100 to 300 ft. (30.5 to 91.4 m) lower than the SEZ; thus viewpoints from the NWR are not elevated relative to the SEZ. The NWR area is generally devoid of vegetation that is sufficiently high to provide screening of views to the SEZ.

From the southernmost portions of the NWR, sufficiently tall power tower receivers might be visible as distant bright light sources against a mountain backdrop as viewed from the NWR and, if visible, solar collectors and other low-height facility components would be expected to repeat the line of the horizon as seen from the NWR, which would tend to reduce visual contrast. Because of the low viewing angle and the long distance to it, the SEZ would occupy a very small portion of the field of view, and solar energy development within the SEZ would be expected to create minimal visual contrasts as viewed from the southernmost portions of the NWR. Taller solar facility components, such as transmission towers, could be visible, depending on lighting, but might not be noticed by casual observers.

Operating power towers in the SEZ would likely appear as star-like points of light at the base of the hills north of the SEZ. If sufficiently tall, they could have red or white flashing hazard navigation lights that could potentially be visible from the southern part of the NWR at night, but they would be very low on the horizon, and would likely escape the attention of casual observers.

Figure 10.2.14.2-8 is a Google Earth visualization depicting the SEZ (highlighted in orange) as it would be seen from the far northern portion of the NWR at a distance of approximately 9.9 mi (16.0 km) from the SEZ.

The northern portion of the NWR is much closer to the SEZ and slightly elevated with respect to the southernmost portions of the NWR. While low-height solar facilities would still repeat the strong horizontal lines of the landscape as viewed from the northern portions of the NWR, the SEZ would occupy a somewhat greater part of the field of view, and the presence of solar facilities within the SEZ could create greater visual contrasts than those that might be seen from the southern portion of the NWR, but because of the low angle of view and the 10.2-mi (16-km) distance to the SEZ, contrast levels would not be expected to rise to moderate levels.

As for viewpoints in the southern portion of the NWR, collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, substantially reducing visual contrasts. Operating power towers would be seen as points of light, potentially bright as viewed from closer portions of the NWR, and the tower structures supporting the receivers would likely be visible as well. If power towers were tall enough to have navigation hazard lighting, the flashing red or white lights would likely be visible from the northern portion of the NWR at night, but they would be low on the horizon at the distance involved.

FIGURE 10.2.14.2-8 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Baca NWR

In general, as viewed from the northern portions of the NWR, weak visual contrasts with the surrounding landscape could potentially result from solar energy development within the SEZ, while from the more southerly portions of the NWR, minimal visual contrast levels would be expected.

Special Recreation Management Areas

- *Penitente Canyon*—The Penitente Canyon SRMA is a 4,173-acre (16.9-km^2) BLM-designated SRMA located 22 mi (36 km) southwest of the SEZ at the point of closest approach. The area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ includes 308 acres (1.25 km^2), or 7% of the total SRMA acreage, which includes uplands outside Penitente Canyon itself, and other canyons within the SRMA.

  Penitente Canyon SRMA is a nationally known rock-climbing area and also includes camping facilities and mountain bike trails. The SEZ cannot be seen from canyon bottoms within the SRMA, so visual impacts on visitors to the canyon floors would not be expected; however, persons on the canyon rims and nearby uplands within the SRMA could potentially see solar energy facilities within the SEZ. Because the SRMA is more than 22 mi (35.4 km) away and because of the relatively small size of the SEZ, the SEZ would occupy a very small part of the field of view. Solar energy development within the SEZ would be expected to create weak visual contrasts as viewed from the canyon rims and nearby uplands.

Additional scenic resources exist at the national, state, and local levels, and impacts could occur on both federal and nonfederal lands, including sensitive traditional cultural properties important to Tribes. In addition to the resource types and specific resources analyzed in the PEIS, future site-specific NEPA analyses would include state and local parks, recreation areas, other nonfederal 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, the SEZ, surrounding lands, and sensitive visual resources could be affected by facilities that would be built and operated in conjunction with the solar facilities. For 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 a transmission line within the SEZ, but if it can be utilized an upgrade may be required. In addition, construction (or upgrading) and operation of a transmission line outside the SEZ may be required. An existing transmission line is located in close proximity to the SEZ's eastern boundary. If this transmission line can be utilized for the project, visual impacts associated with the transmission line would likely be smaller than if construction of a new, longer line was required. Depending on project- and site-specific conditions, visual impacts associated with access roads, and to an even greater extent transmission lines, could be large. Detailed information about visual impacts associated with transmission lines is presented in Section 5.12.1 of this PEIS. A detailed site-specific NEPA analysis would be required to precisely determine visibility and associated impacts for any future solar projects, based on more precise knowledge of facility location and characteristics.

Impacts on Other Lands and Resources

Community of Saguache. The 650-ft (198.1-m) viewshed analysis indicates potential visibility of the upper portions of sufficiently tall power towers within the SEZ from the community of Saguache (approximately 6 mi [10 km] west of the SEZ), with lower-height facilities completely screened by the landforms of Rattlesnake Hill and McIntyre Ridge. A site visit in July 2009 suggests at least partial additional screening of views toward the SEZ from most of Saguache, due primarily to buildings and trees in and around the community. Where views were not screened, the receivers of tall power towers in the far southwestern portion of the SEZ could potentially be just visible from particular locations in Saguache as very bright point light sources appearing just above Rattlesnake Hill and/or McIntyre Ridge during daylight hours, while at night flashing hazard lights could be visible. A detailed site-specific NEPA analysis would be required to determine visibility precisely.

Regardless of visibility from Saguache, residents, workers, and visitors to the area might 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, especially U.S. 285 (see discussion below), which is immediately adjacent to the SEZ, and CO 17, approximately 3 mi (4.8 km) east of the SEZ.

Community of Moffat. The viewshed analyses indicate visibility of the SEZ from the community of Moffat (approximately 9 mi [14 km] southeast of the SEZ); however, a site visit in July 2009 suggests at least partial screening of ground-level views of the SEZ from Moffat, due to slight variations in topography, vegetation, or both. A detailed site-specific NEPA analysis would be required to determine visibility precisely; however, 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 any likely screening and could cause visual impacts on Moffat and surrounding lands.

Moffat is about 200 ft (61 m) lower in elevation than the SEZ, so assuming clear views of the SEZ existed in Moffat, the vertical angle of view to the SEZ would be extremely low. Collector/reflector arrays for solar facilities within the SEZ would be seen edge-on, substantially reducing visual contrasts. Taller solar facility components, such as transmission towers, could be visible as well. Operating power towers would be seen as points of light, potentially bright as viewed from Moffat, and the tower structures supporting the receivers would likely be visible as well. If power towers were tall enough to have navigation hazard lighting, the flashing red or white lights would likely be visible from Moffat at night, although at a distance of 9 mi (14 km) they would be low on the horizon. Under the 80% development scenario analyzed in the PEIS, expected contrast levels for views from Moffat (absent screening by vegetation or structures) would be weak.

Regardless of visibility from the community of Moffat, residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ as they drive in and around Moffat.

U.S. 285. As shown in Figure 10.2.14.2-2, U.S. 285 forms the northwest boundary of the SEZ, with approximately 2.9 mi (4.6 km) of the highway immediately adjacent to the SEZ. U.S. 285 is an important access route to the San Luis Valley and to the community of Saguache. During a site visit in July 2009, substantial truck and other traffic was observed on the highway.

Drivers on U.S. 285 approaching the De Tilla Gulch SEZ from the east could potentially have views of solar facilities within the SEZ as they approach within approximately 7.0 mi (11.3 km) of the SEZ, where the upper portions of tall power tower receivers could potentially be seen. Lower-height facilities would come into view approximately 4.2 mi (6.8 km) east of the SEZ. At normal highway speeds, the SEZ facilities could therefore be seen for approximately four to seven minutes before vehicles reached the boundary of the SEZ.

U.S. 285 users approaching the De Tilla Gulch SEZ from the west might briefly see the upper portions of tall solar power towers from within the community of Saguache as they passed through town, though it is likely that many views within Saguache would be screened by building and/or trees.

As highway users passed the extreme southern tip of McIntyre Ridge (approximately 1.3 mi [2.1 km] west of the SEZ), the entire SEZ would come into view. At the relatively short distance involved, utility-scale solar facilities would likely cause strong visual contrasts, although the small size of the SEZ would restrict the size of solar facilities and thereby limit associated visual contrasts. The sudden appearance of large-scale industrial facilities at relatively short range could be distracting to drivers and visually disconcerting to passengers. Traffic and other cultural disturbances would also be visible to travelers on U.S. 285, which could tend to decrease the perceived visual impacts of solar facilities within the SEZ. For vehicles traveling at highway speeds, the SEZ and associated facilities would be visible for less than 90 seconds before reaching the boundary of the SEZ.

As users travel along the northwest side of the SEZ, facilities located within the SEZ would strongly attract the eye, and would likely dominate views from U.S. 285. Structural details of some facility components for nearby facilities would likely be visible. Buildings, transmission towers and other tall facility components, as well as plumes (if present) would be seen projecting above the collector/reflector arrays, and they could contrast noticeably with the strongly horizontal and regular geometry of the collector/reflector arrays. From this viewpoint, solar collector arrays would be seen nearly edge-on, and would repeat the horizontal line of the plain in which the SEZ is situated, which would tend to reduce visual line contrast. However, for nearby facilities, the collector arrays would likely be large enough in apparent size that their individual forms could be seen, and they would no longer appear as horizontal lines. Depending on location and distance from the road, solar facilities in the SEZ could block views of the San Luis Valley from U.S. 285, though briefly. The close-up views of solar facilities within the SEZ would last less than 3 minutes for occupants of vehicles traveling at normal highway speeds.

If power towers were located within the SEZ, the receivers would likely appear as brilliant white nonpoint light sources atop towers with structural details clearly discernable. In addition, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). When operating, the power towers would likely strongly attract visual attention, and could be a distraction for drivers.

If sufficiently tall, visible power towers in the SEZ would have red flashing lights, or white or red flashing strobe lights that could be very conspicuous at night from nearby locations on U.S. 285. Other light associated with solar facilities in the SEZ would likely 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, major visual contrast from solar development within the SEZ could potentially be observed from some locations.

10.2.14.2.3 Summary of Visual Resource Impacts for the Proposed De Tilla Gulch SEZ

Under the 80% development scenario analyzed in this PEIS, there could be multiple solar facilities within the De Tilla Gulch 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 greatly 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.

Approximately 34.6 mi (55.7 km) of the Old Spanish National Historic Trail route is within the SEZ viewshed, and it passes within 0.25 mi (0.4 km) of the SEZ. Utility-scale solar energy development within the proposed De Tilla Gulch SEZ is likely to result in strong visual contrasts for some viewpoints on the trail.

U.S. 285 forms the northwest boundary of the SEZ, with approximately 2.9 mi (4.6 km) of the highway immediately adjacent to the SEZ. Utility-scale solar energy development within the proposed De Tilla Gulch SEZ is likely to result in strong visual contrasts for travelers on U.S. 285.

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.

10.2.14.3 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 SEZ-specific design features would depend on site- and project-specific information that would be available only after a specific solar energy project had been proposed, one design feature can be identified for the De Tilla Gulch SEZ at this time, as follows:

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

The height of solar power tower receiver structures, combined with the intense light generated by the receiver atop the tower, would be expected to create strong visual contrasts that could not be effectively screened from view for most areas surrounding the SEZ, given the broad, flat, and generally treeless expanse of the San Luis 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 Old Spanish National Historic Trail, the community of Saguache, and other residents and visitors to the San Luis Valley, a regionally important tourist destination.

Because of the very small size of the De Tilla Gulch SEZ (relative to the other Colorado SEZs) and the very close proximity of the Old Spanish National Historic Trail, the distance-based design features utilized for the other Colorado SEZs are impractical for application in the De Tilla Gulch SEZ. It is unlikely that any type of utility-scale solar energy development could meet the impact mitigation requirements of conformance with VRM Class II or VRM Class III management objectives, as viewed from the nearby sections of the Old Spanish National Historic Trail. While application of the SEZ-specific design features above and the programmatic design features described in Appendix A, Section A.2.2 would reduce potential visual impacts somewhat, utility-scale solar energy development using any of the solar technologies analyzed in the PEIS at the scale analyzed in the PEIS would be expected to result in large adverse visual impacts on the Old Spanish National Historic Trail that could not be mitigated.

10.2.15 Acoustic Environment

10.2.15.1 Affected Environment

The proposed De Tilla Gulch SEZ is located in the east-central portion of the Saguache 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 runs along the northeast-southwest boundary of the De Tilla Gulch SEZ; one county road (CR AA) runs about 0.4 mi (0.6 km) south of the SEZ; and another county road (CR 55) runs through the eastern part of the SEZ. There are access roads to the SEZ on all sides. No railroads are nearby. The nearest airport is Saguache Municipal Airport, about 7 mi (11 km) west of the SEZ. Other nearby airports include Leach Airport, McCullough Airport, and Del Nolte Municipal and County Airport, which are located about 22 mi (35 km) south, 32 mi (51 km) south, and 33 mi (53 km) south-southwest of the SEZ, respectively. Developed small-scale irrigated agricultural activities occur about 0.4 mi (0.6 km) to the south; large-scale agricultural activities occur beyond about 4 mi (6 km) to the east and the southwest. Potato and barley farms are adjacent. There is grazing lease on site but no grazing occurred in last 10 years. The SEZ is used as a winter range for antelope. There are no industrial activities around the SEZ except nearby Saguache County Landfill on CR 55. No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist around the De Tilla Gulch SEZ. The nearest residence from the boundary of the SEZ is located about 0.3 mi (0.5 km) to the east. The closest population center with schools or town infrastructure is Saguache, which is located about 6 mi (10 km) west of the SEZ. Accordingly, noise sources around the SEZ would include road traffic, aircraft flyover, agricultural activities, animal noise, and nearby landfill activities. The proposed De Tilla Gulch SEZ is mostly undeveloped, the overall character of which is considered rural. To date, no environmental noise survey has been conducted in the vicinity of the De Tilla Gulch SEZ. On the basis of the population density, the day-night average sound level (L_{dn} or DNL) is estimated to be 25 dBA for Saguache County, lower than 33 to 47 dBA L_{dn} typical of a rural area[10] (Eldred 1982; Miller 2002).

10.2.15.2 Impacts

Potential noise impacts associated with solar projects in the De Tilla Gulch SEZ would occur during all phases of the projects. During the construction phase, potential noise impacts associated with operation of heavy equipment and vehicular traffic on the nearest residence (within 0.3 mi [0.5 km] of the SEZ) would be anticipated, albeit of short duration. During the operation 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

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10 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.

detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the proposed De Tilla Gulch 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 10.2.15.3 below). This section primarily addresses potential noise impacts on humans, although potential impacts on wildlife at nearby sensitive areas are discussed. Additional discussion on potential noise impacts on wildlife is presented in Section 5.10.2.

10.2.15.2.1 Construction

The proposed De Tilla Gulch 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, equipment installation, piping, and electrical installation). 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 not using impact equipment such as pile drivers or rock drills. Typically, the power block area is located in the center of a solar facility, at a distance of more than 0.5 mi (0.8 km) to the facility boundary. Noise levels from construction of the solar array would be lower than 95 dBA. When geometric spreading and ground effects are considered, as explained in Section 4.13.1, noise levels would attenuate to about 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 that would be 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 somewhat shorter distances than the aforementioned distances. If a 10.2-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 residence closest to the eastern SEZ boundary, estimated noise levels at this residences would be about 56 dBA, which is higher than the typical daytime mean rural background level of 40 dBA. However, estimated 52 dBA L_{dn}[11]as DNL falls below the EPA guideline of 55 dBA L_{dn} for residential areas.

In addition, noise levels are estimated at the specially designated areas within a 5-mi (8-km) range of the De Tilla Gulch SEZ, which is the farthest distance that all but extremely high noise would be discernable. The Old Spanish National Historic Trail, which runs as close as 0.25 mi (0.4 km) from the southern SEZ boundary, is the only specially designated area within the range. For construction activities occurring near the southern SEZ boundary, estimated noise

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

levels would be about 58 dBA at the Old Spanish National Historic Trail, which is higher than the typical daytime mean rural background level of 40 dBA. Accordingly, construction occurring near the southern SEZ boundary could result in noise impacts on the Old Spanish National Historic Trail, but these would be temporary in nature.

Depending on the soil conditions, pile driving might be required for installation of solar dish engines. However, the pile drivers to be used , such as vibratory or sonic drivers, would be relatively small and quiet, in contrast to the impulsive impact pile drivers that are 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 0.3 mi [0.5 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 eastern proposed SEZ boundary, close to 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 about 65 VdB (Hanson et al. 2006). During the construction phase, no major construction equipment that can cause ground vibration would be used, and no residences or sensitive structures are located in close proximity. Therefore, no adverse vibration impacts are anticipated from construction activities, including from pile driving for dish engines.

For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that an existing regional 115-kV transmission line located within the SEZ might be used to connect some new solar facilities to load centers, and that the additional project-specific analysis would be done for new transmission construction or line upgrades. However, some construction of transmission lines could occur within the SEZ. Potential noise impacts on nearby residences from this activity would be a minor component of solar facility construction impacts and would be temporary in nature.

10.2.15.2.2 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 eastern SEZ, the predicted noise level from the power block would be about 47 dBA at the nearest residence, located 0.3 mi (0.5 km) from the facility boundary,[12] which is higher than 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 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 residence, about 45 dBA L_{dn}would be estimated, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. However, day-night average noise levels higher than those estimated above by using the simple noise modeling would be anticipated if TES were used during nighttime hours, as explained below and in Section 4.13.1.

On a calm, clear night typical of the proposed De Tilla Gulch 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 (2 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 the day-night average noise level (L_{dn}), 6-hour nighttime generation with TES was assumed after 12-hour daytime generation. For nighttime hours under temperature inversion, 10 dB was added to the noise levels estimated from the uniform atmosphere (see Section 4.13.1). Using these assumptions, the estimated nighttime noise level at the nearest residence (about 0.8 mi [1.3 km] from the power block area for a solar facility located near the eastern SEZ boundary) would be about 57 dBA, which is quite higher than the typical

[12] The nearest residence is located near the eastern panhandle area of the SEZ, which has not enough area for the 0.5-mi (0.8-km) buffer to the site boundary. In reality, this residence would be located more than 1 mi (1.6 km) from the power block area.

[13] Maximally possible operating hours around the summer solstice but limited to 7 to 8 hours around the winter solstice.

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

nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 58 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, so it is likely that sound levels would be lower than 58 dBA at nearby residences, even if TES were used at a solar facility. Consequently, operating parabolic trough or power tower facilities that use TES and are located near the eastern SEZ boundary could result in potential noise impacts on the nearest residence, depending on background noise levels and meteorological conditions.

For a parabolic trough or power tower solar facility located near the southern SEZ boundary, estimated daytime and nighttime noise levels at the Old Spanish National Historic Trail would be about 48 and 58 dBA, respectively, which are higher than typical daytime and nighttime mean rural background levels of 40 and 30 dBA. Accordingly, operation of a solar facility near the southern SEZ boundary could result in noise impacts on the Old Spanish National Historic Trail.

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

The solar dish engine is unique among CSP technologies because it generates electricity directly, and this technology does not need a power block. A single, large solar dish engine has relatively low noise levels; a solar facility might employ thousands of dish engines, however, which would cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar Two, LLC 2008). At the proposed De Tilla Gulch SEZ, assuming a dish engine facility of up to 135-MW capacity (covering 80% of the total area, or 1,217 acres [4.9 km^2]), up to 5,400 25-kW dish engines could be employed. Also, for a large dish engine facility, fewer than 100 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 several thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility; for example, about 45 dBA at 1.0 mi (1.6 km) and 40 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; these levels are higher than and equivalent to typical daytime mean rural background level of 40 dBA, respectively. However, these levels would occur 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 residence, it was assumed that dish engines were placed all over the De Tilla Gulch SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest receptor (0.3 mi [0.5 km] from the SEZ boundary) would be about 51 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 48 dBA L_{dn} at this residence is lower than the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other attenuation mechanisms, noise levels at the nearest residence would be lower than the values estimated above. Noise from dish engines could cause adverse impacts on the nearest residence, depending on background noise levels and meteorological conditions.

For dish engines placed all over the SEZ, estimated noise level would be about 51 dBA at the Old Spanish National Historic Trail, which is higher than the typical daytime mean rural background level of 40 dBA. Thus, dish engine noise from the SEZ could result in noise impacts on the Old Spanish National Historic Trail.

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 De Tilla Gulch 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 placed 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 the nearby residences, assuming a 0.8-mi (1.3-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and another 0.3 mi [0.5 km] to the nearest residence). Accordingly, potential impacts of these noise sources on the nearest residence would be minimal.

Regarding impacts from transmission line corona discharge noise (Section 5.13.1.5) during rainfall events, the noise level at 50 ft (15 m) and 300 ft (91 m) from the center of a 230-kV transmission line tower would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of daytime and nighttime mean background levels in rural environments. Corona noise includes high-frequency components, which may be judged to be more annoying than other environmental noises. However, corona noise would not likely cause impacts, unless a residence is located close to it (e.g., within 500 ft [152 m] of a 230-kV transmission line). The proposed De Tilla Gulch SEZ is located in an arid desert environment, and incidents of corona discharge are infrequent. Therefore, potential impacts on nearby residences from transmission lines along the transmission lines ROW would be negligible.

10.2.15.2.3 Decommissioning/Reclamation

Decommissioning/reclamation requires many of the same procedures and equipment used in traditional construction. Decommissioning/reclamation would include dismantling of solar facilities, 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 less than those for construction activities.

Decommissioning activities would be of short duration, and their potential impacts would be minor and temporary in nature. The same mitigation measures adopted during the construction phase could also be implemented during the decommissioning phase.

Similarly, potential vibration impacts on surrounding communities and vibration-sensitive structures during decommissioning of any solar facility would be less than those during construction and thus minimal.

10.2.15.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from development and operation of solar energy facilities. While some SEZ-specific design features are best established when specific project details are being considered, measures that can be identified at this time include the following:

- Noise levels from cooling systems equipped with TES should be managed so that levels of off-site noise are 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 proposed De Tilla Gulch SEZ should be located more than 1 mi (1.6 km) from nearby residences located to the east and the south of the SEZ (i.e., the facilities should be located in the western 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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10.2.16 Paleontological Resources

The paleontological conditions of the San Luis Valley, which encompasses the proposed De Tilla Gulch SEZ, are described in Section 10.1.16.

10.2.16.1 Affected Environment

The proposed De Tilla Gulch SEZ is 100% covered in Quaternary gravels and alluvium (classified as Qg on geological maps). The PFYC for Qg is Class 3b, which indicates that the potential for significant fossil materials to occur is unknown and needs to be investigated further. (Section 4.14 discusses the PFYC system.) Occasional fossils of vertebrates that have been found in the San Luis Resource Area include mammoths, camels, horses, bison, and others (Armstrong 2009). Areas immediately adjacent to the De Tilla Gulch SEZ are also covered in Quaternary gravels and alluvium and are classified as PFYC Class 3b. During a July 2009 preliminary site visit, the ground surface was covered in vegetation and no surface exposures of bedrock were noticed.

10.2.16.2 Impacts

The potential for impacts on significant paleontological resources at the proposed De Tilla Gulch SEZ is unknown. A more detailed look at the local geological deposits of the SEZ and their potential depth is needed, and possibly a paleontological survey (depending on the Colorado PFYC rankings and the likely geologic rock exposures and as determined by the BLM Field Office in coordination with the BLM Paleontology Lead or Regional Paleontologist), prior to development to determine the appropriate course of action per BLM IM2008-009 and IM2009-011 (BLM 2007a, 2008a). A sample survey is potentially sufficient for a large area identified as PFYC Class 3b (Armstrong 2009). Section 5.14 discusses the types of impacts that could occur on any significant paleontological resources found to be present within the De Tilla Gulch SEZ. Because it is possible that no significant paleontological resources may be present within the SEZ, there may not be any impacts on this resource as a result of construction and operation of a solar facility.

Indirect impacts on paleontological resources outside of the SEZ, such as through looting or vandalism, are unknown but unlikely as any such resources would be below the surface and not readily accessed. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

No new roads or transmission lines have been assessed for the proposed De Tilla Gulch SEZ, assuming existing corridors would be used; impacts on paleontological resources related to the creation of new corridors would be evaluated at the project-specific level if new road or transmission construction or line upgrades are to occur. No surface paleontological finds are anticipated near the SEZ due to prior disturbances, vegetation cover, and the absence of bedrock exposures.

The programmatic design feature requiring a stop work order in the event of an inadvertent discovery of paleontological resources would reduce impacts by preserving some information and allowing possible excavation of the resource, if warranted. Depending on the significance of the find, it could also result in some modification to the project footprint. Since the SEZ is located in an area classified as PFYC Class 3 or greater, a stipulation would be included in permitting documents to alert solar energy developers of the possibility of a delay if paleontological resources are uncovered during surface-disturbing activities.

10.2.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features, including a stop-work stipulation in the event that paleontological resources are encountered during construction, as described in Appendix A, Section A.2.2.

The need for and the nature of any SEZ-specific design features would depend on findings of paleontological surveys.

10.2.17 Cultural Resources

The general culture history of the San Luis Valley, which encompasses the proposed De Tilla Gulch SEZ, is described in Section 10.1.17.

10.2.17.1 Affected Environment

Two cultural resource surveys have been conducted in close proximity to the proposed De Tilla Gulch SEZ, amounting to survey of approximately 51 acres (0.2 km^2), or 3.76%, within the 1,522-acre (6.2-km^2) SEZ. One linear survey was conducted along U.S. 285, which is the northwestern boundary of the SEZ. No archaeological sites were recorded in that stretch of survey adjacent to the SEZ. A second linear survey was conducted for a proposed 230-kV transmission line along the eastern side of the SEZ, bisecting the easternmost arm of the proposed zone. One isolated Late Prehistoric projectile point was recorded during the survey just outside of the southeast corner of the SEZ. No sites have been recorded to date within the SEZ (Colorado SHPO 2009). Within a 5-mi (8-km) buffer of the SEZ, 15 sites have been recorded as well as 22 isolated artifacts.[15] Most sites are open lithic or open camp sites and have not been evaluated for eligibility. A couple of historic mining sites are located to the west in the San Juan Mountains. A northern segment of the Rio Grande Canal (an irrigation ditch running between the Rio Grande and Saguache Creek) is located approximately 3 mi (5 km) southeast of the SEZ and has been determined officially eligible for listing on the NRHP.

No properties currently listed in the NRHP for Saguache County are located within the SEZ or within 5 mi (8 km) of the SEZ. 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 located in the vicinity of the SEZ (see also Section 10.2.18).

The proposed SEZ has the potential to contain significant cultural resources. The potential for finding significant Paleoindian sites exists throughout the entire valley. The Great Sand Dunes National Park and Preserve abuts the base of the Sangre de Cristo Mountains southeast of the De Tilla Gulch SEZ. Human burials have been encountered in the National Park as a result of shifting dunes; they have also been noted in areas in the northern portion of the valley. The East Fork of the North Branch of the Old Spanish Trail, congressionally designated as a National Historic Trail, is also located nearby (south of the SEZ). A 0.25-mi (0.4-km) buffer has been added to the mapped portion of the trail to minimize impacts on it; however, the mapping is considered an approximation of its location because this segment of trail has not been ground-truthed. Recent investigation of LIDAR images of the area has revealed a linear feature through the proposed SEZ, but field survey is needed to determine the nature and significance of the feature (Brown 2010). Although the precise location of the trail is unknown, the congressionally identified route requires the trail, trail resources, and setting to be managed in accordance with the National Trail System Act. To the west, west of the town of Saguache, a

[15] Most of the isolated finds are of single projectile points or other solitary stone tools (e.g., biface, mano), although four of the finds are of historic material (cans, bottles, or glass fragments).

segment of the trail has been designated as a high-potential segment because it is believed to retain its historical character. An additional high-potential segment southeast of the SEZ runs from Crestone south to near the Fourmile East SEZ. The BLM and USFS are in the process of determining a management approach for addressing the high-potential segments.

10.2.17.2 Impacts

Direct impacts on significant cultural resources during site preparation and construction activities could occur in the proposed De Tilla Gulch SEZ; however, as stated in Section 10.2.17.1, further investigation is needed. A cultural resource survey of the entire area of potential effect would first be required to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would follow to determine whether any are eligible for listing in the NRHP. Section 5.15 discusses the types of impacts that could occur on any significant cultural resources found to be present within the proposed SEZ. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

Necessary surveys would include a survey of the Old Spanish Trail in the vicinity of the SEZ to determine its location relative to the SEZ and the integrity of the trail segment. The physical trail (if observable) could be directly affected by construction if it is located farther north than currently mapped. If portions of the trail that cut east–west across the valley retain sufficient integrity, visual impacts of solar energy development in the immediate vicinity of the SEZ and the trail could be of concern. The identified high-potential segment of the Old Spanish National Historic Trail west of Saguache (approximately 11 mi [18 km] from the SEZ) would not be visually affected by solar energy development because of intervening topography (see the viewshed analysis for the De Tilla Gulch SEZ in Section 10.2.14.2). However, the northern half of the high-potential segment located approximately 16 mi (26 km) to the southeast of the SEZ would be within the viewshed if a solar facility were installed, regardless of technology type[16] (see Figures 10.2.14.2-3 and 10.2.14.2-4). In addition, a nearly 20-mi (32-km) segment of the West Fork of the North Branch of the Old Spanish Trail is within that same viewshed (within approximately 6 mi [10 km] of the SEZ at it closest point) and could be affected. Until additional research has been completed on the West Fork, the trail is being managed as a significant cultural resource in order to maintain the historic and visual integrity of the corridor (BLM 2010a; see also Section 10.1.17.1). Development adjacent to the proposed SEZ includes a local landfill and agricultural land, as well as an existing ROW for transmission, an unpaved road network, and U.S. 285. Visual impacts on historic properties typically 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).

Programmatic design features to reduce water runoff and sedimentation would prevent the likelihood of indirect impacts on cultural resources resulting from erosion outside of the SEZ

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[16] Although the visual impact of a PV installation (approximate height of 25 ft [7.5 m]) would be less obvious than a power tower (approximate height of 650 ft [198 m]) at that distance.

boundary (including along ROWs). Indirect impacts on cultural resources through vandalism or theft are unlikely since the SEZ is small in size and is readily accessible. No new roads or transmission lines have been assessed for the proposed De Tilla Gulch SEZ, assuming existing corridors would be used; impacts on cultural resources related to the creation of new corridors would be evaluated at the project-specific level if new road or transmission construction or line upgrades are to occur.

10.2.17.3 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 SHPO and the appropriate Native American governments would be conducted during the development of the De Tilla Gulch SEZ. It is likely that most 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 among the BLM, DOE, Colorado SHPO, and ACHP, to consistently address impacts on significant cultural resources from solar energy development. 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 NPS Intermountain Trails Office, Santa Fe) should also be included in the development of that PA.

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10.2.18 Native American Concerns

10.2.18.1 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 De Tilla Gulch SEZ, Section 10.2.17 discusses archaeological sites, structures, landscapes, trails, and traditional cultural properties, and Section 10.2.17 describes the general cultural history of the San Luis Valley; Section 10.2.9.1.3 discusses water rights and water use; Section 10.2.10 discusses plant species; Section 10.2.11 discusses wildlife species, including wildlife migration patterns; Sections 10.2.19 and 10.2.20 discuss socioeconomics and environmental justice, respectively; and issues of human health and safety are discussed in Section 5.21.

The San Luis Valley encompassing the proposed SEZ 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 De Tilla Gulch SEZ is for the Cheyenne and Arapaho, Northern Cheyenne, and Northern Arapaho. Their land claim is located approximately 16 mi (26 km) north of the De Tilla Gulch SEZ.

Consultation for the Colorado SEZs has been initiated by the BLM with the Tribes[17] shown in Table 10.2.18.1-1.

Details on government-to-government consultation efforts are presented in Chapter 14 and Appendix K. Plants and other resources within the San Luis Valley of potential importance are discussed in Sections 10.1.18.1.1 and 10.1.18.1.2.

10.2.18.2 Impacts

To date, no comments have been received from the Tribes referencing the proposed De Tilla Gulch 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 would occur to areas previously indicated as culturally significant (San Luis Lakes, the Great Sand Dunes, Blanca Peak). It is possible that there will be Native American concerns about potential visual effects and the effects of noise from solar energy development on these areas (see Section 10.2.17) or on the valley as a whole as consultation continues and additional analyses are undertaken. If 80% of the proposed SEZ is developed, it is likely that some plants traditionally important to Native Americans will be destroyed and that habitat of traditionally

[17] 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 10.2.18.1-1 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

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 impacted.

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.

10.2.18.3 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 10.2.18.1-1.

10.2.19 Socioeconomics

10.2.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the ROI surrounding the proposed De Tilla Gulch SEZ. The ROI is a four-county area composed of Alamosa, Chaffee, Saguache, and Rio Grande Counties in Colorado. It encompasses the area in which workers are expected to spend most of their salaries and in which a portion of site purchases and non-payroll expenditures from the construction, operation, and decommissioning phases of the proposed SEZ facility are expected to take place.

10.2.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 24,761 (Table 10.2.19.1-1). Over the period 1999 to 2008, annual average employment growth rates were higher in Rio Grande County (2.4%) than elsewhere in the ROI. The remaining ROI counties experienced small employment increases. At 0.8%, growth rates in the ROI as a whole were smaller than the average state rate for Colorado (1.4%).

In 2006, the service sector provided the highest percentage of employment in the ROI at 38.9%, followed by agriculture (24.4%) and wholesale and retail trade (19.7%) (Table 10.2.19.1-2). Smaller employment shares were held by construction, finance, insurance, and real estate (6.3%). Within the ROI, the distribution of employment across sectors varies

TABLE 10.2.19.1-1 ROI Employment in the Proposed De Tilla Gulch SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Alamosa County	7,885	7,935	0.1
Chaffee County	7,658	7,986	0.4
Saguache County	2,612	2,800	0.7
Rio Grande County	4,784	6,040	2.4
ROI	22,939	24,761	0.8
Colorado	2,269,668	2,596,309	1.4

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

TABLE 10.2.19.1-2 ROI Employment for the Proposed De Tilla Gulch SEZ by Sector, 2006[a]

	Alamosa County		Chaffee County		Saguache County		Rio Grande County	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,470	22.4	172	3.3	964	52.1	1,763	41.9
Mining	10	0.2	60	1.1	10	0.5	0	0.0
Construction	324	4.9	574	10.9	60	3.2	179	4.3
Manufacturing	93	1.4	136	2.6	140	7.6	79	1.9
Transportation and public utilities	201	3.1	99	1.9	42	2.3	70	1.7
Wholesale and retail trade	1,300	19.8	1,043	19.7	418	22.6	769	18.3
Finance, insurance, and real estate	434	6.6	465	8.8	28	1.5	197	4.7
Services	2,752	41.9	2,792	52.8	257	13.9	1,172	27.9
Other	9	0.1	10	0.2	0	0	10	0.2
Total	6,575		5,285		1,851		4,207	

	ROI	
	Employment	% of Total
Agriculture[a]	4,369	24.4
Mining	80	0.4
Construction	1,137	6.3
Manufacturing	448	2.5
Transportation and public utilities	412	2.3
Wholesale and retail trade	3,530	19.7
Finance, insurance, and real estate	1,124	6.3
Services	6,973	38.9
Other	29	0.2
Total	17,918	

a Agricultural employment includes 2007 data for hired farmworkers.

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

somewhat compared with the ROI as a whole. Saguache County (52.1%) and Rio Grande County (41.9%) have a higher percentage of employment in agriculture than Alamosa County (22.4%), and these three counties have lower shares of employment in services compared with the ROI as a whole. Service sector employment in Alamosa County (41.9%) and Chaffee County (52.8%) is higher than in the ROI as a whole.

10.2.19.1.2 ROI Unemployment

Unemployment rates have varied across the four counties in the ROI. Over the period 1999 to 2008, the average rate in Saguache County was 6.8%, with a relatively high rate of 5.6% in Rio Grande County (Table 10.2.19.1-3). The average rate in the ROI over this period was 5.2%, higher than the average rate for Colorado (4.5%). Rates were higher in 2008 than the average rate for the period 1999 to 2008. Unemployment rates for the first five months of 2009 contrast with rates for 2008 as a whole. In Saguache County, the unemployment rate increased to 9.1%, while rates reached 8.1% and 7.6% in Rio Grande and Alamosa Counties, respectively. The average rates for the ROI (7.8%) and for Colorado (7.5%) were also higher during this period than the corresponding average rates for 2008.

10.2.19.1.3 ROI Urban Population

The population of the ROI in 2008 was 43% urban; the largest town, Alamosa, had an estimated 2008 population of 8,746; other towns in the ROI include Salida (5,426), Monte Vista (4,015), and Buena Vista (2,137) (Table 10.2.19.1-4). In addition, there are six smaller towns in the ROI, with 2008 populations of less than 1,000.

TABLE 10.2.19.1-3 ROI Unemployment Rates for the Proposed De Tilla Gulch SEZ (%)

Location	1999–2008	2008	2009[a]
Alamosa County	5.0	5.3	7.6
Chaffee County	4.6	4.6	7.3
Saguache County	6.8	7.4	9.1
Rio Grande County	5.6	5.8	8.1
ROI	5.2	5.4	7.8
Colorado	4.5	4.2	7.5

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

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

TABLE 10.2.19.1-4 ROI Urban Population and Income for the Proposed De Tilla Gulch 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	7,960	8,746	1.2	32,771	NA	NA
Salida	5,504	5,426	–0.2	37,068	NA	NA
Monte Vista	4,529	4,015	–1.5	36,556	NA	NA
Buena Vista	2,195	2,137	–0.3	44,806	NA	NA
Saguache	578	580	0.0	27,738	NA	NA
Poncha Springs	466	480	0.4	40,465	NA	NA
Hooper	123	125	0.2	41,154	NA	NA
Moffat	114	125	1.2	37,217	NA	NA
Crestone	73	107	4.9	40,235	NA	NA
Bonanza	14	14	0.0	82,079	NA	NA

[a] NA = data not available.

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

Population growth rates in the ROI have varied over the period 2000 to 2008 (Table 10.2.19.1-4). Crestone grew at an annual rate of 4.9% during this period, with higher than average growth also experienced in Moffat (1.2%) and Alamosa (1.2%). The remaining cities experienced lower growth rates between 2000 and 2008, with majority of these towns experiencing negative growth rates during this period.

10.2.19.1.4 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 2000, only Bonanza ($82,079) had median incomes that were higher than the average for Colorado ($56,574) (Table 10.2.19.1-4).

10.2.19.1.5 ROI Population

Table 10.2.19.1-5 presents recent and projected populations in the ROI and states as a whole. Population in the ROI stood at 51,974 in 2008, having grown at an average annual rate of 0.6% since 2000. Saguache County experienced higher growth rates (1.9%), while population declined in Rio Grande County (–0.1%) over the period. Growth rates for the ROI were lower than the rates for Colorado (1.9%) over the same period.

TABLE 10.2.19.1-5 ROI Population for the Proposed De Tilla Gulch SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Alamosa County	14,966	15,783	0.7	20,210	20,943
Chaffee County	16,242	17,009	0.6	23,690	24,856
Saguache County	5,917	6,903	1.9	8,613	8,830
Rio Grande County	12,413	12,279	–0.1	14,465	14,776
ROI	49,538	51,974	0.6	66,978	69,405
Colorado	4,301,261	5,010,395	1.9	6,398,532	6,613,747

Sources: U.S. Bureau of the Census (2009e-f); State Demography Office (2009).

The ROI population is expected to increase to 66,978 by 2021, and to 69,405 by 2023.

10.2.19.1.6 ROI Income

Personal income in the ROI stood at $1.4 billion in 2007 and has grown at an annual average rate of 1.5% over the period 1998 to 2007 (Table 10.2.19.1-6). ROI personal income per capita also rose over the same period at a rate of 0.6%, resulting in a slight increase from $25,609 to $27,299. Per capita incomes were higher in Chaffee ($30,101) and Rio Grande ($27,814) Counties in 2007 than elsewhere in the ROI. Personal income growth rates in the ROI (0.6%) were lower than the state rate (1.0%), but rates were higher than the state rate in Chaffee County (1.6%). Per capita incomes were significantly lower in the ROI than for Colorado as a whole ($41,955).

Median household income over the period 2006 to 2008 varied between $32,825 in Alamosa County and $44,249 in Chaffee County (U.S. Bureau of the Census 2009d).

10.2.19.1.7 ROI Housing

In 2007, more than 26,600 housing units were located in the four ROI counties, with more than 85% of these located in Alamosa, Chaffee, and Rio Grande Counties (Table 10.2.19.1-7). Owner-occupied units compose approximately 70% of the occupied units in the four counties, with rental housing making up 30% of the total. Vacancy rates in 2007 were significantly higher in Chaffee (21.5%), Saguache (25.5%), and Rio Grande (21.7%) Counties than in Alamosa County (10.2%), although a significant portion of vacant housing in Chaffee, Saguache, and Rio Grande Counties consisted of units used for seasonal or recreational purposes. With an overall vacancy rate of 19.4%, there were 5,157 vacant housing units in the ROI in 2007, of which 1,565 are estimated to be rental units that would be available to

TABLE 10.2.19.1-6 ROI Personal Income for the Proposed De Tilla Gulch SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Alamosa County			
Total income[a]	0.4	0.4	1.1
Per capita income	26,089	27,238	0.4
Chaffee County			
Total income[a]	0.4	0.5	2.6
Per capita income	25,634	30,101	1.6
Saguache County			
Total income[a]	0.1	0.1	1.7
Per capita income	20,324	19,484	–0.4
Rio Grande County			
Total income[a]	0.3	0.4	0.5
Per capita income	27,435	27,814	0.1
ROI			
Total income[a]	1.2	1.4	1.5
Per capita income	25,609	27,299	0.6
Colorado			
Total income[a]	118.5	199.5	2.8
Per capita income	37,878	41,955	1.0

[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).

construction workers. There were 2,532 seasonal, recreational, or occasional-use units vacant in the ROI at the time of the 2000 Census.

Housing stock in the ROI as a whole grew at an annual rate of 1.7% over the period 2000 to 2007, with 3,038 new units added to the existing housing stock in the ROI.

The median value of owner-occupied housing in the ROI in 2006 to 2008 varied from $76,467 in Saguache County to $158,107 in Chaffee County (U.S. Bureau of the Census 2009g).

10.2.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 10.2.19.1-8. Although there are no Tribal governments located in the ROI, there are

TABLE 10.2.19.1-7 ROI Housing Characteristics for the Proposed De Tilla Gulch SEZ

Parameter	2000	2007[a]
Alamosa County		
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
Chaffee County		
Owner-occupied	4,831	5,612
Rental	1,753	2,036
Vacant units	1,808	2,100
Seasonal and recreational use	1,335	NA
Total units	8,392	9,748
Saguache County		
Owner-occupied	1,593	1,938
Rental	707	860
Vacant units	787	958
Seasonal and recreational use	361	NA
Total units	3,087	3,756
Rio Grande County		
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	6,641
ROI Total		
Owner-occupied	13,245	14,939
Rental	5,807	6,511
Vacant units	4,518	5,157
Seasonal and recreational use	2,532	NA
Total units	23,570	26,608

[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 10.2.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed De Tilla Gulch SEZ

Governments	
City	
Alamosa	Moffat
Bonanza	Monte Vista
Buena Vista	Poncha Springs
Crestone	Saguache
Hooper	Salida
County	
Alamosa County	Saguache County
Chaffee County	Rio Grande County
Tribal	
None	

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

members of other Tribal groups located in the ROI whose Tribal governments are located in adjacent counties or states.

10.2.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

Schools

In 2007, the four-county ROI had a total of 39 public and private elementary, middle, and high schools (NCES 2009). Table 10.2.19.1-9 provides summary statistics for enrollment, educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Saguache County schools (9.9) is lower than that for schools in the remaining three counties. Chaffee County has the fewest teachers per 1,000 population (8.9).

TABLE 10.2.19.1-9 ROI School District Data for the Proposed De Tilla Gulch SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Alamosa County	2,483	166	14.9	10.5
Chaffee County	2,112	150	14.1	8.9
Saguache County	973	98	9.9	14.2
Rio Grande County	2,272	170	13.4	13.5
ROI	7,840	584	13.4	11.2

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

Source: NCES (2009).

Health Care

Alamosa and Chaffee Counties have a much larger number of physicians (85 in all) and doctors per 1,000 population (2.6 in each county) than elsewhere in the ROI, and a significantly higher number than in Saguache County (Table 10.2.19.1-10). The smaller number of healthcare professionals in Saguache and Rio Grande Counties may mean that residents of these counties have poorer access to healthcare; 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 10.2.19.1-11). Saguache County, within which the SEZ is located, has 8 officers; 46 officers serve the remainder of the ROI counties. Currently, there are only 11 professional firefighters in the ROI, and all are located in Chaffee County. The majority of firefighting services are provided by volunteers. Levels of service in police protection in Alamosa (1.3) and Saguache (1.2) Counties are slightly higher than for the remaining counties in the ROI.

10.2.19.1.10 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.

TABLE 10.2.19.1-10 Physicians in the Proposed De Tilla Gulch SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Alamosa County	41	2.6
Chaffee County	44	2.6
Saguache County	4	0.6
Rio Grande County	13	1.0
ROI	102	2.0

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

Source: AMA (2009).

TABLE 10.2.19.1-11 Public Safety Employment in the Proposed De Tilla Gulch 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
Chaffee County	17	1.0	11	0.6
Saguache County	8	1.2	0	0.0
Rio Grande County	8	0.6	0	0.0
ROI	54	1.0	11	0.2

[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).

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, while levels of community satisfaction would decrease (BLM 1980, 1983, 1996). Tables 10.2.19.1-12 and 10.2.19.1-13 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.

TABLE 10.2.19.1-12 County and ROI Crime Rates for the Proposed De Tilla Gulch SEZ ROI[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
	Offences	Rate	Offences	Rate	Offences	Rate
Alamosa County	65	4.1	477	30.2	542	34.3
Chaffey County	15	0.9	125	7.3	140	8.2
Rio Grande County	26	2.1	139	11.3	165	13.4
Saguache County	11	1.6	25	3.6	36	5.2
ROI	117	2.3	766	14.7	883	17.0

[a] Rates are the number of crimes per 1,000 population.

[b] Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

[c] Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

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

TABLE 10.2.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed De Tilla Gulch SEZ ROI[a]

Geographic Area	Alcoholism[a]	Illicit Drug[a] Use	Mental Health[b]	Divorce[c]
Colorado Region 3 (includes Chaffee County)	8.8	3.5	9.0	–[d]
Colorado Region 4 (includes Alamosa County, Rio Grande County and Saguache County)	9.7	3.1	10.2	–
Colorado	–	–	–	4.4

[a] Data for alcoholism and drug use represent % 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 % 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).

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 SAMHSA regions in which the ROI is located. There is some variation across the ROI, with slightly higher rates in the Colorado Region 4 portion of the ROI than in Colorado Region 3 (Table 10.2.19.1-13). Divorce rates for Colorado as a whole are also presented.

10.2.19.1.11 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 11.2.5.

Because the number of visitors using state and federal lands for recreational activities is not available from the various administering agencies, the value of recreational resources in these areas, based solely on the number of recorded visitors, is likely to be an underestimation. In addition to visitation rates, the economic valuation of certain natural resources can also be assessed in terms of the potential recreational destination for current and future users, that is, their nonmarket value (see Section 5.17.1.1.1).

Another method is to estimate the economic impact of the various recreational activities supported by natural resources on public land in the vicinity of the proposed solar 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, 2,981 people were employed in the ROI in the various sectors identified as recreation, constituting 11.7% of total ROI employment (Table 10.2.19.1-14). Recreation spending also produced almost $51.8 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

10.2.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including common impacts of solar development on recreation, social change and livestock grazing. These impacts would occur regardless of the solar technology developed in the SEZ. Impacts of facilities employing various solar energy technologies are analyzed in detail in subsequent sections.

10.2.19.2.1 Common Impacts

Construction and operation of solar energy facilities at the proposed De Tilla Gulch SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of

TABLE 10.2.19.1-14 ROI Recreation Sector Activity in the Proposed De Tilla Gulch SEZ, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	377	7.0
Automotive rental	8	1.8
Eating and drinking places	1,939	29.4
Hotels and lodging places	395	7.3
Museums and historic sites	0	0.0
Recreational vehicle parks and campsites	114	2.3
Scenic tours	51	2.5
Sporting goods retailers	97	1.6
Total ROI	2,981	51.8

Source: MIG, Inc. (2010).

expenditures on wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as project wages and salaries, procurement expenditures, and tax revenues subsequently circulate through the economy of each state, thereby creating additional employment, income, and tax revenues. Facility construction and operation would also require in-migration of workers and their families into the ROI surrounding the site, which would affect population, rental housing, health service employment, and public safety employment. Socioeconomic impacts common to all utility-scale solar energy developments are described in detail in Section 5.17. These impacts would be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the proposed 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 are still unclear (see Section 5.17.1.1.4). While some degree of social disruption is likely to accompany large-scale in-migration during the boom phase, there is insufficient evidence to predict the extent to which specific communities are likely to be impacted, which population groups within each community are likely to be most affected, and the extent to which social disruption is likely to persist beyond the end of the boom period (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it has been suggested that social disruption is likely to occur once an arbitrary population growth rate associated with solar energy development projects has been reached, with an annual rate of between 5 and 10% growth in population assumed to result in a breakdown in social structures, with a consequent increase in alcoholism, depression, suicide, social conflict, divorce, delinquency, and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

In overall terms, the in-migration of workers and their families into the ROI would represent an increase of 1.1 % in ROI population during construction of the trough technology, with 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 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

*C*attle ranching and farming supported 489 jobs, and $4.9 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 94 jobs and $1.6 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 $1,560 annually on land dedicated to solar developments in the SEZ.

10.2.19.2.2 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 1,129 jobs (Table 10.2.19.2-1), assuming that one 244-MW facility was constructed. Construction activities would constitute 3.5% of total ROI employment. A solar development would also produce $61.9 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of $2.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 742 persons in-migrating to the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (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 371 rental units expected to be occupied in the ROI. This occupancy rate would represent 17.5% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such

TABLE 10.2.19.2-1 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed De Tilla Gulch SEZ with Trough Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	666	53
Total	1,129	79
Income[b]		
Total	61.9	2.6
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	2.4	0.1
BLM Payments[b]		
Rental	NA[c]	0.1
Capacity[d]	NA	1.6
In-migrants (no.)	742	34
Vacant housing[e] (no.)	371	30
Local community service employment		
Teachers (no.)	9	0
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 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 NA = not applicable.

d The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

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

employment would be required to meet existing levels of service in the ROI. Accordingly, nine new teachers, one physician, and one public safety employee (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 1.1% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using solar trough technologies would be 79 jobs (Table 10.2.19.2-1). Such a solar development would also produce $2.6 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.1 million, and solar generating capacity payments would total at least $1.6 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 34 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 accommodation (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 30 owner-occupied units expected to be occupied in the ROI.

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

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technologies would be 450 jobs (Table 10.2.19.2-2), assuming that one 135-MW facility was constructed. Construction activities would constitute 1.4 % of total ROI employment. Such a solar development would also produce $24.6 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of $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 295 persons in-migrating to the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (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 7.0% of the vacant rental units expected to be available in the ROI.

TABLE 10.2.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed De Tilla Gulch SEZ with Power Tower Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	265	27
Total	450	38
Income[b]		
Total	24.6	1.2
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	1.0	<0.1
BLM Payments[b]		
Rental	NA[c]	0.1
Capacity[d]	NA	0.9
In-migrants (no.)	295	17
Vacant housing[e] (no.)	148	16
Local community service employment		
Teachers (no.)	3	0
Physicians (no.)	1	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 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] NA = not applicable.

[d] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

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

In addition to the potential impact on housing markets, in-migration would affect community service (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 0.4% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using power tower technologies would be 38 jobs (Table 10.2.19.2-2). Such a solar development would also produce $1.2 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of 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 $0.1 million, and solar generating capacity payments would total at least $0.9 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 17 persons in-migrating to the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (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 16 owner-occupied units expected to be required in the ROI.

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

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of dish engine technologies would be 183 jobs (Table 10.2.19.2-3), assuming that one 135-MW facility was constructed. Construction activities would constitute 0.6% of total ROI employment. Such a solar development would also produce $10.0 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of $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 120 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 accommodation (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 10.2.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed De Tilla Gulch SEZ with Dish Engine Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	108	27
Total	183	37
Income[b]		
Total	10.0	1.2
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	0.4	<0.1
BLM Payments[b]		
Rental	NA[c]	0.1
Capacity[d]	NA	0.9
In-migrants (no.)	120	17
Vacant housing[e] (no.)	60	15
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 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] NA = not applicable.

[d] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

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

with 60 rental units expected to be occupied in the ROI. This occupancy rate would represent 2.8% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI. This increase would represent 0.2% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using dish engine technologies would be 37 jobs (Table 10.2.19.2-3). Such a solar development would also produce $1.2 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of 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 $0.1 million, and solar generating capacity payments would total at least $0.9 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 17 persons in-migrating to the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (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 15 owner-occupied units expected to be required in the ROI.

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

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of PV technologies would be 85 jobs (Table 10.2.19.2-4), assuming that one 135-MW facility was constructed. Construction activities would constitute 0.3% of total ROI employment. Such a solar development would also produce $4.7 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of $0.2 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 56 persons in-migrating to the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary

TABLE 10.2.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed De Tilla Gulch SEZ with PV Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	50	3
Total	85	4
Income[b]		
Total	4.7	0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	0.2	<0.1
BLM Payments[b]		
Rental	NA[c]	0.1
Capacity[d]	NA	0.7
In-migrants (no.)	56	2
Vacant housing[e] (no.)	28	2
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 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 NA = not applicable.

d The BLM annual capacity payment was based on a fee of $5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), assuming full build-out of the site.

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

accommodation (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 28 rental units expected to be occupied in the ROI. This occupancy rate would represent 1.3% 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, one new teacher would be required in the ROI. This increase would represent 0.1% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using PV technologies would be four jobs (Table 10.2.19.2-4). Such a solar development would also produce $0.1 million in income. Direct sales taxes would be less than $0.1 million, with direct income taxes of 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 $0.1 million, and solar generating capacity payments would total at least $0.7 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 two persons in-migrating to the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (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 two 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.

10.2.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed De Tilla Gulch SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would reduce the potential for socioeconomic impacts during all project phases.

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10.2.20 Environmental Justice

10.2.20.1 Affected Environment

E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (*Federal Register*, Vol. 59, page 7629, Feb. 11, 1994) formally requires federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the CEQ's *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description of the geographic distribution of low-income and minority populations in the affected area is undertaken; (2) an assessment is conducted to determine whether the impacts of 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 origin may choose up to six racial groups as the basis of their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or "Other Race" (U.S. Bureau of the Census 2009k).

The CEQ guidance proposed that minority populations should be identified where either (1) the minority population of the affected area exceeds 50%, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The PEIS applies both criteria in using the Census Bureau data for census block groups, wherein consideration is given to the minority population that is both over 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 below the age of 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (U.S. Bureau of the Census 2009l).

The data in Table 10.2.20.1-1 show the minority and low-income composition of total population located in the 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, 27.8% of the population is classified as minority, while 13.0% is classified as low-income. However, the number of minority or 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 minority or low-income populations in the SEZ 50-mi (80-km) radius based on 2000 Census data and CEQ guidelines.

Figures 10.2.20.1-1 and 10.2.20.1-2 show the locations of the minority and low-income population groups in the 50-mi (80-km) radius around the boundary of the SEZ.

A small number of block groups in the 50-mi (80-km) radius have minority populations that make up more than 50% of the total population. These are located in Conejos and Costilla Counties and in the cities of Alamosa (Alamosa County), Monte Vista and Del Norte (both in Rio Grande County), Center (Saguache County), and in the vicinity of Canon City (Freemont County).

TABLE 10.2.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed De Tilla Gulch SEZ

Parameter	Colorado
Total population	100,184
White, non-Hispanic	72,351
Hispanic or Latino	21,894
Non-Hispanic or Latino minorities	5,939
One race	4,637
Black or African American	2,832
American Indian or Alaskan Native	1,155
Asian	498
Native Hawaiian or other Pacific Islander	37
Some other race	115
Two or more races	1,302
Total minority	27,833
Low-income	12,995
Percent minority	27.8
State percent minority	25.5
Percent low-income	13.0
State percent low-income	9.3

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

Low-income populations in the 50-mi (80-km) radius are limited to one block group, in the City of Alamosa, which has a low-income population share that is more than 20 percentage points higher than the state average.

10.2.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy developments are described in detail in Section 5.18. These impacts would 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 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

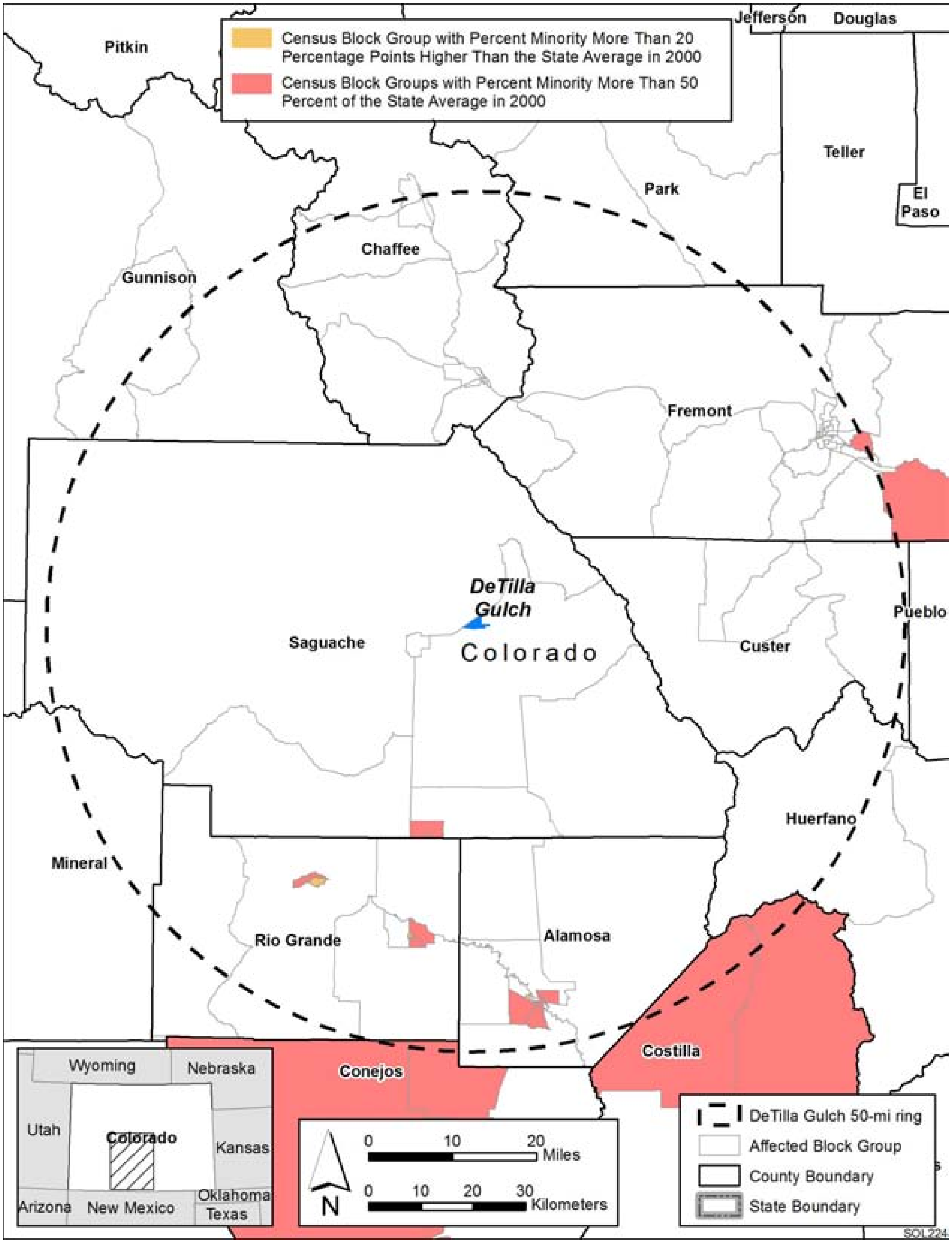

FIGURE 10.2.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed De Tilla Gulch SEZ

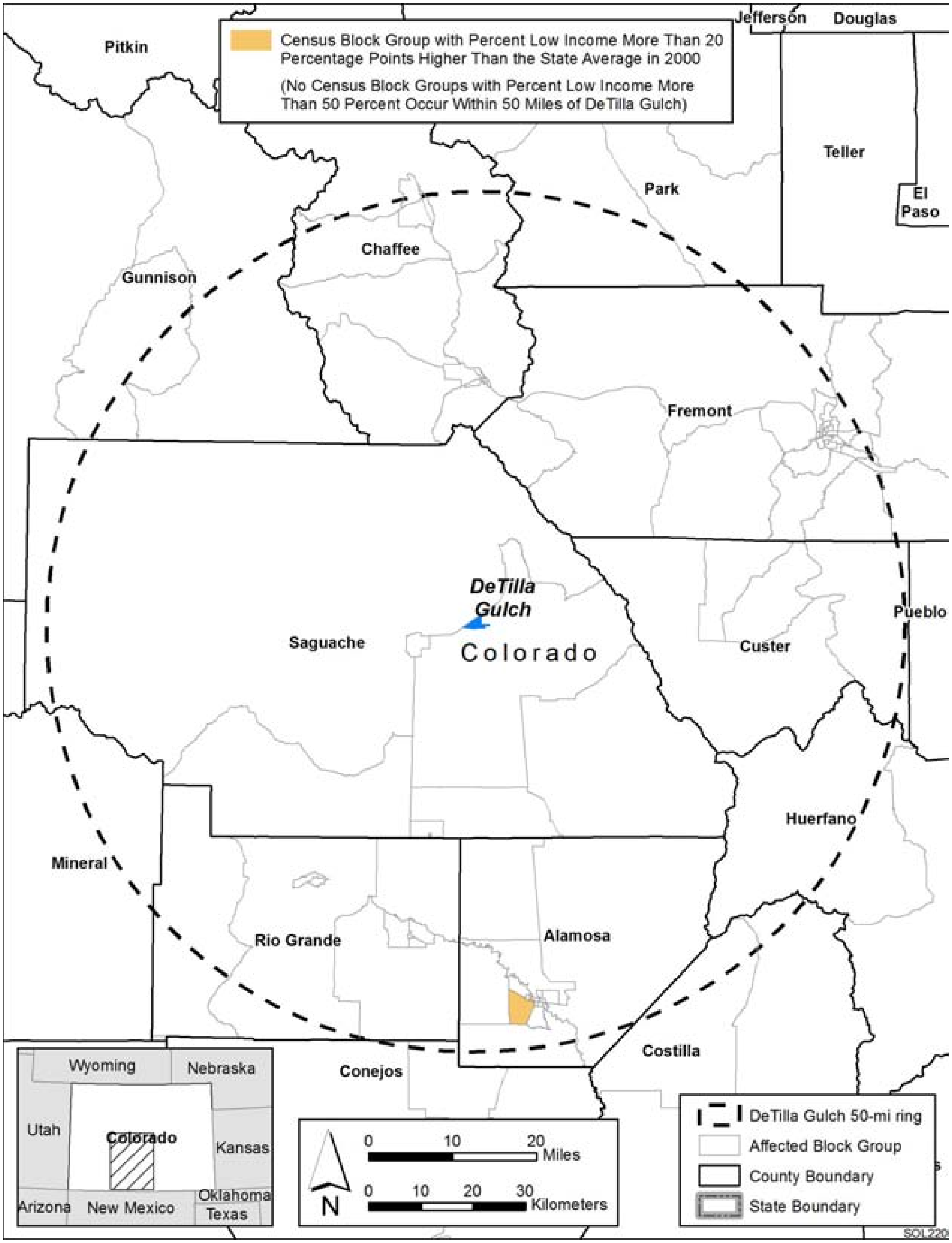

FIGURE 10.2.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed De Tilla Gulch SEZ

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, as defined by CEQ guidelines (Section 10.2.20.1), within the 50-mi (80-km) radius around the boundary of the SEZ; meaning that any adverse impacts of solar projects could disproportionately affect minority populations. Because there are also low-income populations within the 50-mi (80-km) radius, there could also be impacts on low-income populations.

10.2.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing environmental justice impacts have been identified for the proposed De Tilla Gulch 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.

10.2.21 Transportation

The proposed De Tilla Gulch SEZ is accessible by road. One U.S. highway serves the area. A small municipal airport is located 12 km (7.5 mi) west of the SEZ. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

10.2.21.1 Affected Environment

U.S. 285, a two-lane highway, passes along the northwestern border of the proposed De Tilla Gulch SEZ as shown in Figure 10.2.21.1-1. The small town of Saguache is located a few miles to the southwest of the SEZ along U.S. 285. CR 55, running north to south, passes through the western edge of the SEZ, and CR AA passes below the southern border running east to west. With the exception of two small areas outside of the SEZ, all OHV trails in the San Luis Valley are designated as limited use (BLM 2009). Annual average traffic volumes for the major roads for 2008 are provided in Table 10.2.21.1-1.

The SLRG Railroad serves the area (SLRG 2009). This regional railroad has rail sidings in the towns of Monte Vista and Alamos approximately 45 and 55 mi (72 and 89 km), respectively, to the south of the SEZ along U.S. 285 and CO 17, respectively. A freight dock and warehouse are also available in Alamosa. The SLRG Railroad runs to the east from the SEZ for a distance of approximately 60 mi (97 km,) where it connects to the UP Railroad in Walsenburg.

The nearest public airport is the Saguache Municipal Airport, approximately 7.5 mi (12 km) to the west of the SEZ near the town of Saguache. The airport has one 7,745-ft (2,361-m) gravel runway in good condition (FAA 2009). San Luis Valley Regional Airport, located 55 mi (89 km) south of the SEZ in Alamosa, has two runways, one of which is restricted to light aircraft. One regional airline provides daily scheduled service to Denver. No commercial cargo was shipped to or from the San Luis Valley Regional Airport in 2008, while about 7,800 passengers departed from or arrived at the airport in 2008 (BTS 2008).

10.2.21.2 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). This would represent up to approximately two times the AADT values summarized in Table 10.2.21.2-1 for U.S. 285, or up to approximately three times the amount of traffic currently using State Highway 17, depending on the distribution of new worker traffic between these two routes. Local road improvements would be necessary in any portion of the SEZ along U.S. 285 that might be developed so as not to overwhelm the local roads near any site access point(s). CR 55 and any other access roads connected to it would require road improvements to handle the additional traffic.

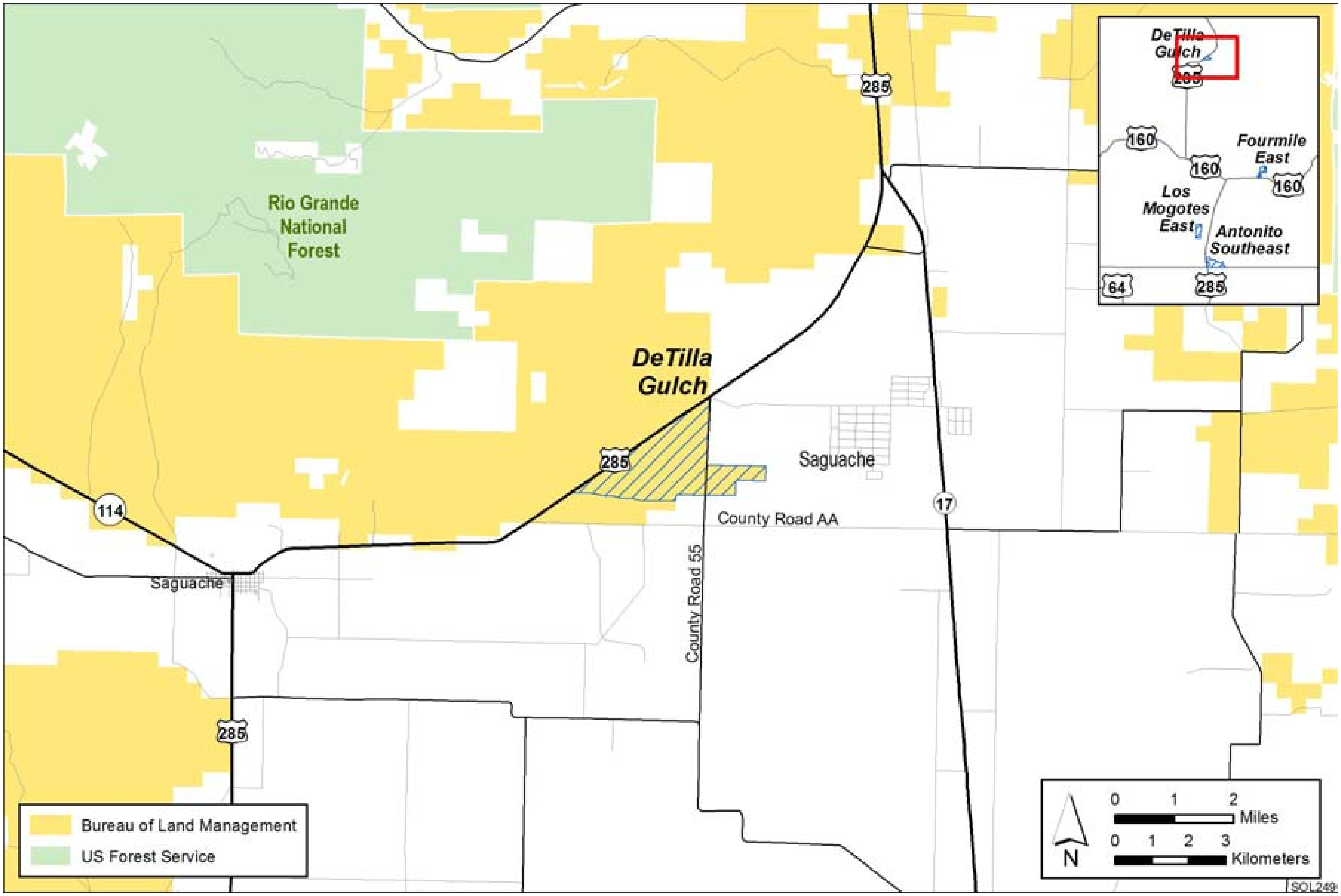

FIGURE 10.2.21.1-1 Local Transportation Network Serving the Proposed De Tilla Gulch SEZ

TABLE 10.2.21.2-1 Annual Average Daily Traffic on Major Roads near the Proposed De Tilla Gulch SEZ, 2008

Road	General Direction	Location	AADT (Vehicles)
U.S. 285	North–South/Southwest–Northeast	Junction with State Highway 114	2,000
		Section bordering SEZ	1,700
CO 17	North–South	Junction with CR AA	1,100

Source: CDOT (undated).

10.2.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the proposed De Tilla Gulch SEZ. The programmatic design features discussed 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 the proposed solar facility within the SEZ, more specific access locations and local road improvements would be implemented.

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10.2.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed De Tilla Gulch SEZ in the northern part of the San Luis Valley, Colorado. The CEQ guidelines for implementing NEPA define cumulative impacts as environmental impacts resulting from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to what agency (federal or nonfederal), organization, or person undertakes them. The time frame of this cumulative impact 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 De Tilla Gulch SEZ is located in Saguache County, Colorado, and is situated near the north end of the San Luis Valley in an area that is rural in character. The northwest border of the SEZ follows the alignment of U.S. 285. The SEZ is bounded to the north and west by BLM-administered public land and to the south and east by private land. The SEZ and surrounding area include grazing allotments and are rural and undeveloped, but just to the east there is a small landfill site located on private land. The San Luis Valley is a known oil and gas production area, and the areas around the SEZ have historically been leased for oil and gas although there currently are no active leases in the vicinity of the SEZ. There also are no active mining claims in the vicinity of the SEZ. The SEZ is within a DoD airspace consultation area.

The geographic extent of the cumulative impact analyses for potentially affected resources near the De Tilla Gulch SEZ is identified in Section 10.2.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 10.2.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 10.2.22.4. Cumulative impacts for each resource area are discussed in Section 10.2.22.3.

10.2.22.1 Geographic Extent of the Cumulative Impacts Analysis

Table 10.2.22.1-1 presents the geographic extent of the cumulative impacts analysis for the potentially affected resources evaluated near the De Tilla Gulch SEZ. These geographic areas define the geographic boundaries of areas 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 cultural resources). Lands around the SEZ are privately owned, administered by the USFS, NPS, or the BLM. The BLM administers approximately 16% of the lands within a 50-mi (80-km) radius of the De Tilla Gulch SEZ.

TABLE 10.2.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed De Tilla Gulch SEZ

Resource Area	Geographic Extent
Lands and Realty	Northern San Luis Valley
Specially Designated Areas and Lands with Wilderness Characteristics	Northern San Luis Valley
Rangeland Resources	Northern San Luis Valley
Recreation	Northern San Luis Valley
Military and Civilian Aviation	Northern San Luis Valley
Soil Resources	Areas within and adjacent to the De Tilla Gulch SEZ
Minerals	Northern San Luis Valley
Water Resources	
Surface Water	San Luis Creek, Saguache Creek, San Luis Lake
Groundwater	Upper 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 De Tilla Gulch SEZ, including Saguache, Chaffee, Fremont, Custer, Huerfano, Alamosa, and Rio Grande Counties, Colorado.
Air Quality and Climate	San Luis Valley and beyond
Visual Resources	Viewshed within a 25-mi (40-km) radius of the De Tilla Gulch SEZ
Acoustic Environment (noise)	Areas adjacent to the De Tilla Gulch SEZ
Paleontological Resources	Areas within and adjacent to the De Tilla Gulch SEZ
Cultural Resources	Areas within and adjacent to the De Tilla Gulch SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the De Tilla Gulch 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 De Tilla Gulch SEZ
Socioeconomics	Alamosa, Chaffee, Saguache, and Rio Grande Counties
Environmental Justice	Saguache, Chaffee, Fremont, Custer, Huerfano, Alamosa, and Rio Grande Counties
Transportation	U.S. 285

10.2.22.2 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 include the following:

- Proposals for which NEPA documents are in preparation or finalized;
- Proposals in a detailed design phase;
- Proposals listed in formal NOIs published in the Federal Register or state publications;
- Proposals for which enabling 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 Lexam Explorations, Inc., oil and gas drilling project at the Baca National Wildlife Refuge) were not included in the cumulative impacts analysis.

The ongoing and reasonably foreseeable future actions described below are grouped into two categories: (1) actions that relate to energy production and distribution, including potential solar energy projects under the proposed action (Section 10.2.22.2.1), and (2) other ongoing and reasonably foreseeable actions, including those related to mining and mineral processing, grazing management, transportation, water management, and conservation (Section 10.2.22.2.2). Together, these actions and trends have the potential to affect human and environmental receptors within the San Luis Valley over the next 20 years.

10.2.22.2.1 Energy Production and Distribution

Reasonably foreseeable future actions related to energy development and distribution within the San Luis Valley are identified in Table 10.2.22.2-1 and are described in the following sections. Figure 10.2.22.2-1 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 rural electric providers must provide 10% of their electricity from renewable sources by 2020 (Pew Center on Global Climate Change 2009).

TABLE 10.2.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed De Tilla Gulch 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	Underway	Land use, ecological resources, visual	San Luis Valley GDA
Greater Sandhill Solar Project; 17 MW, PV	Underway	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)

Also in 2007, the General Assembly of Colorado passed Colorado Senate Bill (SB) 07-100 that 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 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 eight wind GDAs (mainly on the Eastern Plain) and two solar

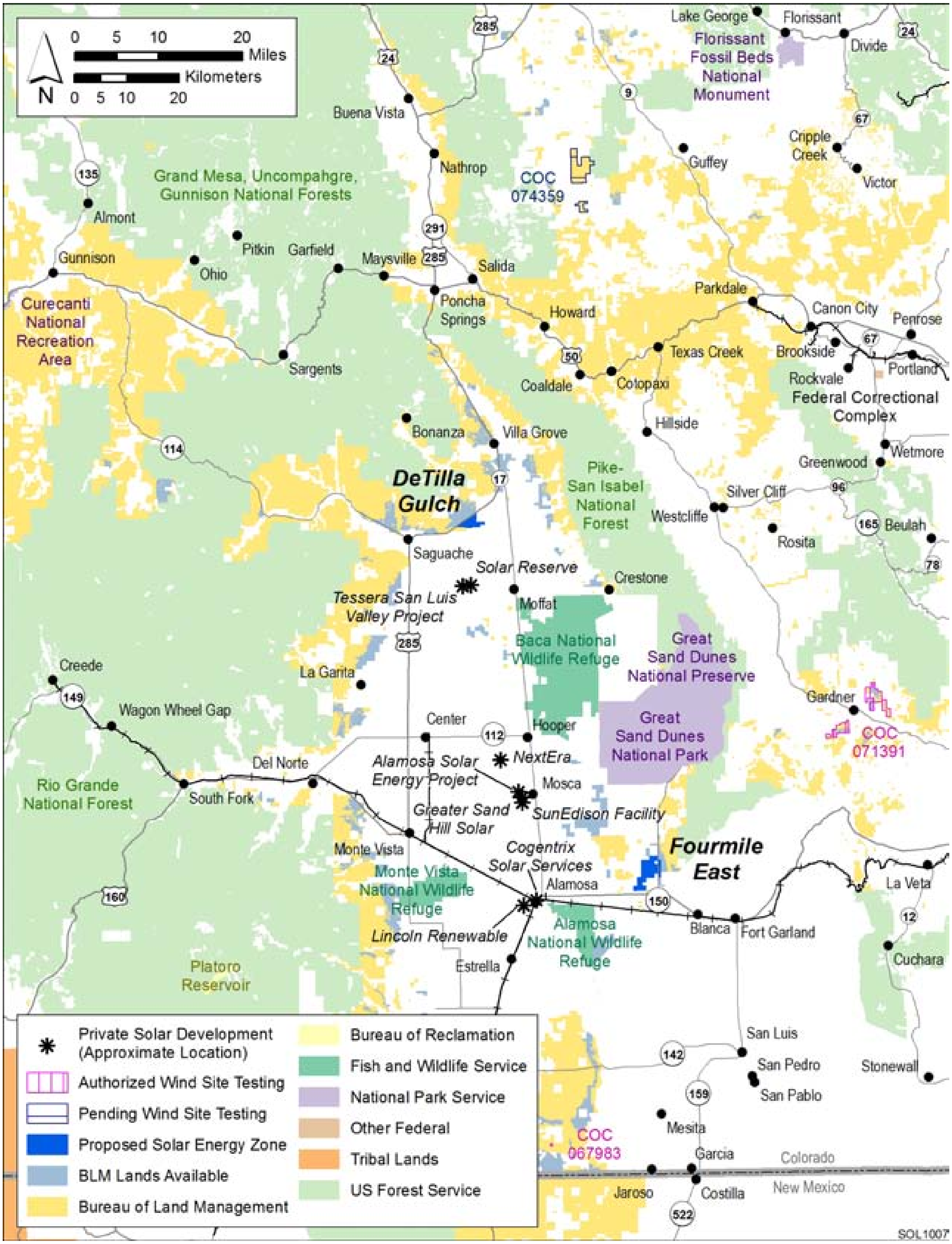

FIGURE 10.2.22.2-1 Existing and Proposed Energy Development Projects within the San Luis Valley

GDAs. 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 De Tilla Gulch SEZ, the BLM has proposed three other SEZs in the San Luis Valley: the Antonito Southeast SEZ (9,729 acres [39.4 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 10.2.22.2-1). 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 Antonito Southeast and Los Mogotes SEZs are located about 80 mi (130 km) and 70 mi (110 km), respectively, to the south of the De Tilla Gulch SEZ, and the Fourmile East SEZ is about 50 mi (80 km) to the southeast.

Solar Energy Development. Several solar power projects are planned or underway in the San Luis Valley GDA. These include the following:

- *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 Highway 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 5 mi (7 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 million to build. It would use only 10 ac-ft/yr (12,000 m^3/yr) of water for operation and maintenance, and would 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 expected to be not 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 (1.5 million m^3/yr). An onsite 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.* Cogentrix 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 workers 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 Systems

Colorado SB 07-100 also directed rate-regulated utilities, such as Xcel Energy's Public Service Company of Colorado (Public Service), to develop plans to construct or expand 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's 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 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).

10.2.22.2.2 Other Actions

Other ongoing and reasonably foreseeable future actions within the San Luis Valley are identified in Table 10.2.22.2-2 and are described in the following sections.

Mining and Mineral Processing

Currently, there are no mining or mineral processing activities in the immediate vicinity of the proposed De Tilla Gulch SEZ.

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

TABLE 10.2.22.2-2 Reasonably Foreseeable Future Actions near the Proposed De Tilla Gulch SEZ and in the San Luis Valley

Description	Status	Resources Affected	Primary Impact Location
Transportation			
Travel Management Plan (BLM)	Proposed	Transportation, ecological resources, recreation	San Luis Valley
Water Management			
Rio Grande Compact	Ongoing	Water, ecological resources	San Luis Valley
San Luis Valley Project—Closed Basin Division Project (BOR)	Ongoing	Water, ecological resources	San Luis Valley
Sub-District 1 Water Management Plan (RGWCD)	Underway	Land use, water, ecological resources, socioeconomics	San Luis Valley
Conservation			
Old Spanish National Historic Trail Comprehensive Management Plan (BLM and NPS)	Proposed	Cultural, visual resources	San Luis Valley (and immediately south of the De Tilla Gulch SEZ)
Sangre de Cristo National Heritage Area	Ongoing	Cultural, visual resources	San Luis Valley (areas along the east side)

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 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 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 enter and leave 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 RGWCD, and the 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 gauge) that depends on the volume of water measured each year at the Del Norte, Colorado, streamflow gauge. 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 gauging 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—Closed Basin Division. Managed by the BOR, the Closed Basin Division Project withdraws groundwater from the unconfined aquifer in the northern part of the Rio Grande Basin to help Colorado meet its commitment to the states of New Mexico and Texas under the Rio Grande Compact. A series of salvage wells completed at depths of 85 to 110 ft (26 to 34 m) and with yields ranging from 50 to 1,100 gpm (190 to 4,200 L/min) pump groundwater into 115 mi (185 km) of pipeline laterals that connect to a polyvinyl-chloride-lined conveyance channel with a design capacity of 45 to 160 ft^3/s (1.3 to 4.5 m^3/s). Because the water quality varies, the pumped waters are blended in order to meet the quality terms of the Rio Grande Compact. The 42-mi (68-km) conveyance channel transports the water to the Rio Grande, and also delivers water to the Alamosa National Wildlife Refuge, Blanca WHA, and San Luis Lake. Currently, water production averages less than 20,000 ac-ft/yr (25 million m^3/yr) (BOR 2009; USACE 2007; SLV Development Resources Group 2007).

Sub-District Water Management Plan. On May 11, 2009, the RGWCD submitted a revised draft Proposed Plan of Water Management to Colorado's Division 3 Water Court for approval on behalf of the Board of Managers of Special Improvement District 1 (also referred to as Subdistrict 1). Subdistrict 1 is composed of landowners within the RGWCD who rely on wells in the closed basin for all or part of their irrigation water supply. Because consumption within the subdistrict has increased (and currently exceeds the rate of natural recharge) and water levels within the unconfined aquifer are declining, its members are concerned about the sustainability of the water supply from the unconfined aquifer and are proposing reductions in total groundwater consumption to avoid adverse impacts, such as loss of well productivity, on irrigated agriculture in the San Luis Valley. The main objective of the management plan is to set up a voluntary system of self-regulation by using economic incentives to promote responsible irrigation water management and protect senior surface water rights as an alternative to state-imposed regulations that would limit well pumping within the subdistrict (RGWCD 2009).

The management plan proposes to permanently reduce the number of irrigated acres by 40,000, and Subdistrict 1 has made a proposal to the USDA for help in paying farmers to take their land out of production. By fallowing 40,000 acres (162 km^2) of irrigated cropland, the subdistrict hopes to mitigate depletions to the surface water system caused by well pumping, replenish groundwater in the unconfined aquifer, and eventually maintain a sustainable irrigation water supply. Achieving these goals would also ensure that Colorado meets its obligations under the Rio Grande Compact (RGWCD 2009; Hildner 2009a). On February 18, 2009, the Division 3 Water Court requested an amendment to lay out the time frame and methodology to determine and replace prior injurious depletions to the Rio Grande, its tributaries, and senior water rights holders. An amended plan was accepted by the State Engineer's office in May 2009 (Hildner 2009b).

Conservation

Several conservation-related plans and projects are being implemented in the San Luis Valley, including the following.

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 National Heritage Area was designated an NHA in March 2009. NHAs are designated by Congress and are intended to encourage the conservation of historic, cultural, and natural resources within the area of their designation. NHAs are managed by the NPS (Heide 2009; NPS 2009).

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 2009; 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.

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 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 De Tilla Gulch SEZ.

10.2.22.3 General Trends

Table 10.2.22.3-1 lists general trends within the San Luis Valley with the potential to contribute to cumulative impacts; the trends are discussed in the following sections.

TABLE 10.2.22.3-1 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

10.2.22.3.1 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 10.2.22.3-2). The growth rate in Saguache County over the same 6-year period was 11%. Virtually all of this growth was in unincorporated areas. Population growth 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 rate of 1.0% (2006 to 2011) and 1.5% (2012 to 2016). In the 10.2-year period between 2006 and 2016, population growth within Saguache County is projected to be 15.4% (SLV Development Resources Group 2007).

10.2.22.3.2 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 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

TABLE 10.2.22.3-2 Population Change in the San Luis Valley Counties and Colorado from 2000 to 2006, with Population Forecast to 2016

	Population			Population Forecast		
	2000	2006	Percent Increase 2000 to 2006	2011	2016	Percent 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).

fastest growth projected for the commercial sector (at 1.1% each year). Transportation, residential, and industrial energy consumption are expected to grow by about 0.5%, 0.4%, and 0.1% each year, respectively (EIA 2009).

10.2.22.3.3 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 River (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 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. Data from 2007, however, 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 10.2.22.3-3 compares daily water use by sector. Total daily water withdrawals and

TABLE 10.2.22.3-3 Daily Water Use by Sector in Colorado, 1995

	Withdrawals						
			Sector (Mgal)				
Region	Total (Mgal)	Percent 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).

consumptive use are highest in Conejos County, a county that has a large share of its crops in alfalfa (accounting for greater 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 formally 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).

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 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 10.2.22.3-3). 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).

10.2.22.3.4 Climate Change

According to a recent report prepared for the CWCB (Ray et al. 2008), temperatures in Colorado have 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). In 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 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).[18] 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

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[18] The effects of climate change are not as well studied in the Rio Grande Basin as in the Upper Colorado River Basin.

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.

10.2.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed De Tilla Gulch 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 1,217 acres (4.9 km^2) (80% of the entire proposed SEZ). For purposes of analysis, it is also assumed that the entire developable land in the SEZ would be disturbed annually and 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. An existing 115-kV line crosses the SEZ; therefore, for this analysis, the impacts of construction and operation of new transmission lines were not assessed. Similarly, the existing road access should be adequate to support the construction and operation of solar energy facilities. U.S. 285 runs along the northwest boundary of the SEZ. This and two county roads provide good access to the SEZ. No new road construction outside of the SEZ would be needed for development to occur in the SEZ.

Cumulative impacts would result from the construction, operation, and decommissioning of solar energy development projects within the proposed SEZ and any associated transmission lines and access roads outside the SEZ when added to impacts from other past, present, and reasonably foreseeable future actions described in the previous section in each resource area. 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.

10.2.22.4.1 Lands and Realty

The area covered by the proposed De Tilla Gulch SEZ is largely undeveloped and is rural in nature. There is currently a locally designated transmission corridor that covers about two-thirds of the SEZ. This represents a potential conflict with future solar development in the SEZ. 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 SEZ 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 De Tilla Gulch SEZ could be significant, particularly if the SEZ is fully developed with solar projects.

10.2.22.4.2 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 the BLM-administered portions of the Sangre de Cristo Wilderness, Great Sand Dunes National Park, Black Canyon WSA, and several USFS roadless areas. In addition, the Old Spanish National Historic Trail passes about 0.25 mi (0.4 km) from the southern boundary of the SEZ. 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.

10.2.22.4.3 Rangeland Resources

The SEZ includes a major portion of a currently unused grazing allotment in the area. If utility-scale solar facilities were constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. If water rights supporting agricultural use were purchased to support solar development, some areas that are currently farmed by using that water would be converted to dryland uses.

Because there are no wild horse HMAs in the vicinity of the proposed SEZ, solar energy development would not contribute to cumulative impacts on wild horses and burros managed by the BLM.

10.2.22.4.4 Recreation

It is likely that limited outdoor recreation (e.g., backcountry driving and small game hunting) 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, increased availability of 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 10.2.22.4.2). 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.

10.2.22.4.5 Military and Civilian Aviation

The SEZ is located near an MTR, is under SUA, and is identified as being a "consultation area" for DoD. The Saguache Municipal Airport is located about 8 mi (12 km) from the SEZ. Recent information from DoD indicates that there are no concerns about solar development in the SEZ. Considering other ongoing and reasonably foreseeable future actions discussed in Section 10.2.22.2, the cumulative impacts on military and civilian aviation from solar energy development in the proposed SEZ would be small.

10.2.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project would contribute to the soil loss due to wind erosion. Construction of any 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 10.2.22.4.12). Programmatic and SEZ-specific 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, SEZ 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.

10.2.22.4.7 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.

10.2.22.4.8 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 10.2.9.2. 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 about 377 to 418 ac-ft (465,000 to 515,000 m^3). During operations, the amount of water needed would be a strong function of the cooling technology employed, ranging from 7 ac-ft/yr (9 thousand m^3/yr) for PV systems to as high as 3,656 ac-ft/yr (4.5 million m^3/yr) for wet-cooled technologies. The amount of water needed during decommissioning would be similar to or less than the amount used during construction. These numbers would compare with 1,560 ac-ft/day (570,544 ac-ft/yr) in Saguache County that was withdrawn from surface water and groundwater resources in 2005. Therefore, cumulatively, the additional water resource needed for solar facilities in the SEZ would constitute a relatively small increment (0.001 to 0.6%, the ratio of the annual operations water requirement to the annual amount withdrawn in Saguache County). However, as discussed in Section 10.2.9.1.3, 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 having augmentation water plans that can affect the process of securing water supplies (see Sections 10.2.9.1.3 and 10.2.9.2.4). The strict management of water resources in the Rio Grande Basin acts to ensure that any impacts from a new water use would continue to be equivalent to or less than those from current uses, and no net increase would occur in the total amount of water used.

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 4 to 45 ac-ft (4,900 to 55,500 m^3) during the peak construction year and would range from less than 1 to 3 ac-ft/yr (up to 3,700 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 from 38 to 69 ac-ft/yr (46,900 to 85,100 m^3) 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.

10.2.22.4.9 Vegetation

The proposed De Tilla Gulch SEZ is located within the San Luis Shrublands and Hills ecoregion, which supports shrublands, grasslands, and 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. Implementation of programmatic and SEZ-specific design features would reduce the impacts from solar energy projects and thus reduce the overall cumulative impacts on plant communities and habitats.

10.2.22.4.10 Wildlife and Aquatic Biota

As discussed in Section 10.2.11, a number of amphibian, reptile, bird, and mammal species occur in and around the proposed De Tilla Gulch SEZ. The construction of utility-scale solar energy projects in the SEZ and any associated roads 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, affected 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 implementation of programmatic and SEZ-specific design features would reduce the severity of impacts on wildlife. These features and measures may include pre-disturbance biological surveys to identify key habitat areas used by wildlife followed by avoidance or minimization of disturbance to those habitats.

The other three proposed SEZs in San Luis Valley (Antonito Southeast, Fourmile East, and Los Mogotes East) and the operating and the planned solar facilities near the Fourmile East SEZ are likely too far away from the De Tilla Gulch SEZ to have cumulative impacts on wildlife and aquatic biota. Additionally, many of the wildlife species have extensive available habitat within the affected counties (e.g., elk and pronghorn). Nevertheless, other ongoing and reasonably foreseeable future actions (Section 10.2.22.2) could 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 De Tilla Gulch SEZ would encompass an area of severe winter range for elk and winter range for pronghorn. The implementation of programmatic and SEZ-specific design features would reduce the impacts from solar energy projects and thus reduce the overall cumulative impacts on wildlife.

There are no permanent water bodies or perennial streams within the boundaries of the proposed SEZ. Several intermittent drainages cross the site, but they do not support aquatic communities. Two perennial streams are located outside but within 5 mi (8 km) of the SEZ (Section 10.2.11.4). There are no wetlands on the SEZ, but a number of small wetlands occur near the SEZ to the northwest. 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. Although there may be a small net increase in impacts on aquatic biota in certain areas around the SEZ, since the groundwater use should not change because of regulations governing use in the San Luis Valley, the overall cumulative impacts on aquatic biota and habitats from groundwater drawdown should not occur. Design features to prevent erosion and sedimentation could reduce cumulative impacts on stream habitat and aquatic biota.

10.2.22.4.11 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 De Tilla Gulch SEZ. Another species (the Gunnison sage-grouse) that may occur in the SEZ is under review by the USFWS to determine whether it should be listed as endangered or threatened under the ESA. Three species occurring on or in the vicinity of the SEZ are listed as threatened or endangered by the State of Colorado (southwestern willow flycatcher, Rio Grande sucker, and bald eagle). In addition, there are seven species that are listed as sensitive 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 could be minimized if design features were implemented, including avoidance of occupied or suitable habitats, avoidance of occupied areas, 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.

Solar facilities in the proposed Antonito Southeast, Fourmile East, and Los Mogotes East SEZs are likely too far away from the De Tilla Gulch SEZ to have cumulative impacts on special status species. Also, the operating and planned solar facilities on private lands near the Fourmile East SEZ are small and therefore not likely to result in cumulative impacts on special status species. However, depending on other projects occurring in the area at a given time, there may still be some cumulative impacts on protected species. 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.

10.2.22.4.12 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 μg/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.

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 10.2.13, 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 De Tilla Gulch SEZ were fully developed with solar facilities up to 80% of its size, the quantity of pollutants avoided could be as large as 0.9% of all emissions from the current electric power systems in Colorado.

10.2.22.4.13 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 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, because the site is within the viewshed of several specially designated areas, indicating high visual sensitivity.

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 development. Some of the affected lands outside the SEZ would include potentially sensitive scenic resource areas, including the Sangre de Cristo Wilderness, Great Sand Dunes National Park, Black Canyon WSA, and the Old Spanish National Historic Trail. 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 developments, 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 developments 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.

10.2.22.4.14 Acoustic Environment

The areas around the proposed De Tilla Gulch SEZ and in the San Luis Valley area, in general, are relatively quiet. The existing noise sources around the SEZ include road traffic, aircraft flyover, agricultural activities, animal noise, and nearby landfill activities. 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 the SEZ), 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.

10.2.22.4.15 Paleontological Resources

Little surveying for paleontological resources has been conducted in the San Luis Valley. For reasons described in Section 10.2.16, impacts on significant paleontological resources are possible in the proposed SEZ. However, the specific sites selected for future projects would be surveyed, if determined necessary by 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.

10.2.22.4.16 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, the area occupied by the proposed SEZ has not been surveyed for cultural resources, and therefore no archeological sites have been recorded within the SEZ. There are two routes of a historic trail, the Congressionally designated Old Spanish National Historic Trail to the south and east of the De Tilla Gulch SEZ and the West Fork of the North Branch of the Old Spanish Trail to the southwest of 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 impacts on the Old Spanish Trail. 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.

10.2.22.4.17 Native American Concerns

Government-to-government consultation is underway with Native American governments with possible traditional ties to the San Luis Valley. To date, no specific concerns regarding the proposed De Tilla Gulch SEZ have been raised to the BLM. The Cheyenne and Arapaho, Northern Cheyenne, and Northern Arapaho have judicially established Tribal land claims north of the SEZ; on the basis of available maps, however, the claim does not appear to include any portions of the SEZ and should not contribute to any impacts on that claim. The San Luis Lakes, the Great Sand Dunes, and Blanca Peak have been identified within the valley as culturally significant locations for the Navajo, Ute, and Tewa peoples from the Northern Pueblos. Blanca Peak is also potentially significant to the Jicarilla Apache. It is possible that the development of utility-scale solar energy projects in the De Tilla Gulch 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 these locations 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' issues of concern tied to solar energy development in the San Luis Valley.

10.2.22.4.18 Socioeconomics

Solar energy development projects in the proposed De Tilla Gulch SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZs and in the surrounding multicounty ROI. The effects could be positive (e.g., creation of jobs and generation of extra income, increased revenues to local governmental organizations through additional taxes paid by the developers and workers) or negative (e.g., added strain on social institutions such as schools, police protection, and health care facilities). Impacts from solar development would be most intense during facility construction, but of greatest duration during operations. Construction would temporarily increase the number of workers in the area needing housing and services in combination with temporary workers involved in other new developments in the area, including other renewable energy development. The number of workers involved in the construction of solar projects in the peak construction year could range from about 50 to 700 depending on the technology being employed, with solar PV facilities at the low end and solar trough facilities at the high end. The total number of jobs created in the area could range from approximately 85 (solar PV) to as high as 1,100 (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 developments in the area. The number of workers needed at the solar facilities would be in the range of 3 to 50, with approximately 4 to 80 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.

10.2.22.4.19 Environmental Justice

Both minority and low-income populations have been identified within 50 mi (80 km) of the proposed SEZ. Any impacts from solar development could have cumulative impacts on minority and low-income populations in combination with other development in the area. Such impacts could be both positive, such as from increased economic activity, and negative, such as visual impacts, noise, 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 and low-income populations. As the overall scale and environmental impacts of potential developments within the ROI are expected to be generally low, it is not expected that the proposed De Tilla Gulch SEZ would contribute to cumulative impacts on minority and low-income populations.

10.2.22.4.20 Transportation

A two-lane highway (U.S. 285) passes along the northwest border of the proposed De Tilla Gulch SEZ. The SLRG Railroad also serves the area. The AADT on U.S. 285 in the town of Saguache where it intersects with CO 114 is currently about 2,000. 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 U.S. 285 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 developments in the area. Local road improvements, including improvements to site access roads from U.S. 285, may be necessary to handle the additional traffic. Any impacts during construction activities would be temporary. The impacts could be mitigated to some degree by staggered work hours and ride-sharing programs. 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.

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10.2.23 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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