DES 10-59 • DOE/EIS-0403 December 2010

Draft Programmatic Environmental Impact Statement for

Solar Energy Development in Six Southwestern States

Volume 4
Chapter 10: Colorado Proposed Solar Energy Zones

U.S. DEPARTMENT OF ENERGY

NATIONAL SYSTEM OF PUBLIC LANDS

On the cover:
Typical Solar Fields for Various Technology Types (clockwise from upper left):
Solar Parabolic Trough (Source: Hosoya et al. 2008),
Solar Power Tower (Credit: Sandia National Laboratories. Source: NREL 2010a),
Photovoltaic (Credit: Arizona Public Service. Source: NREL 2010b), and
Dish Engine (Credit: R. Montoya. Source: Sandia National Laboratories 2008).
Reference citations are available in Chapter 1.

Background photo: Parabolic trough facility from an elevated viewpoint
(Credit: Argonne National Laboratory)

Draft Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States (DES 10-59; DOE/EIS-0403)

Responsible Agencies: The U.S. Department of the Interior (DOI) Bureau of Land Management (BLM) and the U.S. Department of Energy (DOE) are co-lead agencies. Nineteen cooperating agencies participated in the preparation of this PEIS: U.S. Department of Defense; U.S. Bureau of Reclamation; U.S. Fish and Wildlife Service; U.S. National Park Service; U.S. Environmental Protection Agency, Region 9; U.S. Army Corps of Engineers, South Pacific Division; Arizona Game and Fish Department; California Energy Commission; California Public Utilities Commission; Nevada Department of Wildlife; N-4 Grazing Board, Nevada; Utah Public Lands Policy Coordination Office; Clark County, Nevada, including Clark County Department of Aviation; Dona Ana County, New Mexico; Esmeralda County, Nevada; Eureka County, Nevada; Lincoln County, Nevada; Nye County, Nevada; and Saguache County, Colorado.

Locations: Arizona, California, Colorado, Nevada, New Mexico, and Utah.

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Abstract: The BLM and DOE are considering taking actions to facilitate solar energy development in compliance with various orders, mandates, and agency policies. For the BLM, these actions include the evaluation of a new BLM Solar Energy Program applicable to all utility-scale solar energy development on BLM-administered lands in six southwestern states (Arizona, California, Colorado, Nevada, New Mexico, and Utah). For DOE, they include the evaluation of developing new program guidance relevant to DOE-supported solar projects. The Draft PEIS assesses the environmental, social, and economic effects of the agencies' proposed actions and alternatives.

For the BLM, the Draft PEIS analyzes a no action alternative, under which solar energy development would continue on BLM-administered lands in accordance with the terms and conditions of the BLM's existing solar energy policies, and two action alternatives for implementing a new BLM Solar Energy Program. Under the solar energy development program alternative (BLM's preferred alternative), the BLM would establish a new Solar Energy Program of administration and authorization policies and required design features and would exclude solar energy development from certain BLM-administered lands. Under this alternative, approximately 22 million acres of BLM-administered lands would be available for right-of-way (ROW) application. A subset of these lands, about 677,400 acres, would be identified as solar energy zones (SEZs), or areas where the BLM would prioritize solar energy and associated transmission infrastructure development. Under the SEZ program alternative, the same policies and design features would be adopted, but development would be excluded from all BLM-administered lands except those located within the SEZs.

For DOE, the Draft PEIS analyzes a no action alternative, under which DOE would continue to conduct environmental reviews of DOE-funded solar projects on a case-by-case basis, and one action alternative, under which DOE would develop programmatic guidance to further integrate environmental considerations into its analysis and selection of solar projects that it will support.

The EPA Notice of Availability (NOA) of the Draft PEIS was published in the *Federal Register* on December 17, 2010. Comments on the Draft PEIS are due by March 17, 2011.

SOLAR PEIS CONTENTS

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Reader's Guide

The detailed analysis of the proposed solar energy zones (SEZs) in Colorado, provided in Sections 10.1 through 10.4, will be used to inform BLM decisions regarding the size, configuration, and/or management of these SEZs. These sections also include proposed mitigation requirements (termed "SEZ-specific design features"). Please note that the SEZ-specific summaries of Affected Environment use the descriptions of Affected Environment for the six-state study area presented in Chapter 4 of the PEIS as a basis. Also note that the SEZ-specific design features have been proposed with consideration of the general impact analyses for solar energy facilities presented in Chapter 5, and on the assumption that all programmatic design features presented in Appendix A, Section A.2.2, will be required for projects that will be located within the SEZs.

BLM will implement its SEZ-specific decisions through the BLM Record of Decision for the Final PEIS. Comments received during the review period for the Draft PEIS will inform BLM decisions.

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NOTATION

The following is a list of acronyms and abbreviations, chemical names, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

AADT	annual average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
AC	alternating current
ACC	air-cooled condenser
ACEC	Area of Critical Environmental Concern
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AERMOD	AMS/EPA Regulatory Model
AFC	Application for Certification
AGL	above ground level
AIRFA	American Indian Religious Freedom Act
AMA	active management area
AML	animal management level
ANHP	Arizona National Heritage Program
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
APP	Avian Protection Plan
AQCR	Air Quality Control Region
AQRV	air quality-related value
ARB	Air Resources Board
ARRA	American Recovery and Reinvestment Act of 2009
ARRTIS	Arizona Renewable Resource and Transmission Identification Subcommittee
ARS	Agricultural Research Service
ARZC	Arizona and California
ATSDR	Agency for Toxic Substances and Disease Registry
AUM	animal unit month
AVWS	Audio Visual Warning System
AWBA	Arizona Water Banking Authority
AWEA	American Wind Energy Association
AWRM	Active Water Resource Management
AZ DOT	Arizona Department of Transportation
AZDA	Arizona Department of Agriculture
AZGFD	Arizona Game and Fish Department
AZGS	Arizona Geological Survey

BA	biological assessment
BAP	base annual production
BEA	Bureau of Economic Analysis
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BO	biological opinion
BOR	U.S. Bureau of Reclamation
BPA	Bonneville Power Administration
BRAC	Blue Ribbon Advisory Council on Climate Change
BSE	Beacon Solar Energy
BSEP	Beacon Solar Energy Project
BTS	Bureau of Transportation Statistics
CAA	Clean Air Act
CAAQS	California Air Quality Standards
Caltrans	California Department of Transportation
C-AMA	California-Arizona Maneuver Area
CAP	Central Arizona Project
CARB	California Air Resources Board
CAReGAP	California Regional Gap Analysis Project
CASQA	California Stormwater Quality Association
CASTNET	Clean Air Status and Trends NETwork
CAWA	Colorado Agricultural Water Alliance
CCC	Civilian Conservation Corps
CDC	Centers for Disease Control and Prevention
CDCA	California Desert Conservation Area
CDFG	California Department of Fish and Game
CDOT	Colorado Department of Transportation
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Public Health and Environment
CDWR	California Department of Water Resources
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CES	constant elasticity of substitution
CESA	California Endangered Species Act
CESF	Carrizo Energy Solar Farm
CFR	*Code of Federal Regulations*
CGE	computable general equilibrium
CIRA	Cooperative Institute for Research in the Atmosphere
CLFR	compact linear Fresnel collector
CPC	Center for Plant Conservation
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNHP	Colorado National Heritage Program

Colorado DWR	Colorado Department of Water Resources
CPUC	California Public Utilities Commission
CPV	concentrating photovoltaic
CRBSCF	Colorado River Basin Salinity Control Forum
CREZ	competitive renewable energy zone
CRSCP	Colorado River Salinity Control Program
CSA	Candidate Study Area
CSC	Coastal Services Center
CSFG	carbon-sequestration fossil generation
CSP	concentrating solar power
CSQA	California Stormwater Quality Association
CSRI	Cultural Systems Research, Incorporated
CTG	combustion turbine generator
CTPG	California Transmission Planning Group
CTSR	Cumbres & Toltec Scenic Railroad
CUP	Conditional Use Permit
CVP	Central Valley Project
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
CWHRS	California Wildlife Habitat Relationship System
DC	direct current
DHS	U.S. Department of Homeland Security
DNA	Determination of NEPA Adequacy
DNI	direct normal insulation
DNL	day-night average sound level
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
DRECP	California Desert Renewable Energy Conservation Plan
DSM	demand side management
DTC/C-AMA	Desert Training Center/California–Arizona Maneuver Area
DWMA	Desert Wildlife Management Area
EA	environmental assessment
ECAR	East Central Area Reliability Coordination Agreement
ECOS	Environmental Conservation Online System (USFWS)
EERE	Energy Efficiency and Renewable Energy (DOE)
Eg	band gap energy
EIA	Energy Information Administration
EIS	environmental impact statement
EISA	Energy Independence and Security Act of 2007
EMF	electromagnetic field
E.O.	Executive Order

EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EQIP	Environmental Quality Incentives Program
ERCOT	Electric Reliability Council of Texas
ERO	Electric Reliability Organization
ERS	Economic Research Service
ESA	Endangered Species Act of 1973
ESRI	Environmental Systems Research Institute
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FLPMA	Federal Land Policy and Management Act of 1976
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRCC	Florida Reliability Coordinating Council
FSA	Final Staff Assessment
FTE	full-time equivalent
FY	fiscal year
G&TM	Generation and Transmission Modeling
GCRP	U.S. Global Climate Research Program
GDA	generation development area
GHG	greenhouse gas
GIS	geographic information system
GPS	global positioning system
GTM	Generation and Transmission Model
GUAC	Groundwater Users Advisory Council
GWP	global warming potential
HA	herd area
HAP	hazardous air pollutant
HAZCOM	hazard communication
HCE	heat collection element
HCP	Habitat Conservation Plan
HMA	Herd Management Area
HMMH	Harris Miller Miller & Hanson, Inc.
HRSG	heat recovery steam generator
HSPD	Homeland Security Presidential Directive
HTF	heat transfer fluid
HVAC	heating, ventilation, and air-conditioning

I	Interstate
IARC	International Agency for Research on Cancer
IBA	important bird area
ICE	internal combustion engine
ICWMA	Imperial County Weed Management Area
IEC	International Electrochemical Commission
IFR	instrument flight rule
IID	Imperial Irrigation District
IM	Instruction Memorandum
IMPS	Iron Mountain Pumping Station
IMS	interim mitigation strategy
INA	Irrigation Non-Expansion Area
IOP	Interagency Operating Procedure
IOU	investor-owned utility
IPPC	Intergovernmental Panel on Climate Change
ISA	Independent Science Advisor; Instant Study Area
ISB	Intermontane Seismic Belt
ISCC	integrated solar combined cycle
ISDRA	Imperial Sand Dunes Recreation Area
ISEGS	Ivanpah Solar Energy Generating System
ITP	incidental take permit
IUCNNR	International Union for Conservation of Nature and Natural Resources
IUCNP	International Union for Conservation of Nature Pakistan
KGA	known geothermal resources area
KML	keyhole markup language
KOP	key observation point
KSLA	known sodium leasing area
LCC	Landscape Conservation Cooperative
LCOE	levelized cost of energy
L_{dn}	day-night average sound level
LDWMA	Low Desert Weed Management Area
L_{eq}	equivalent sound pressure level
LLA	limited land available
LLRW	low-level radioactive waste (waste classification)
LRG	Lower Rio Grande
LSA	lake and streambed alteration
LSE	load-serving entity
LTVA	long-term visitor area
MAAC	Mid-Atlantic Area Council
MAIN	Mid-Atlantic Interconnected Network
MAPP	methyl acetylene propadiene stabilizer; Mid-Continent Area Power Pool
MCAS	Marine Corps Air Station
MCL	maximum contaminant level

MFP	Management Framework Plan
MIG	Minnesota IMPLAN Group
MLA	maximum land available
MOA	military operating area
MOU	Memorandum of Understanding
MPDS	maximum potential development scenario
MRA	Multiple Resource Area
MRI	Midwest Research Institute
MRO	Midwest Reliability Organization
MSDS	Material Safety Data Sheet
MSL	mean sea level
MTR	military training route
MWA	Mojave Water Agency
MWD	Metropolitan Water District
MWMA	Mojave Weed Management Area
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission (California)
NAIC	North American Industrial Classification System
NASA	National Aeronautics and Space Administration
NCA	National Conservation Area
NCCAC	Nevada Climate Change Advisory Committee
NCDC	National Climatic Data Center
NCES	National Center for Education Statistics
NDCNR	Nevada Department of Conservation and Natural Resources
NDEP	Nevada Division of Environmental Protection
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NDWP	Nevada Division of Water Planning
NDWR	Nevada Division of Water Resources
NEAP	Natural Events Action Plan
NEC	National Electric Code
NED	National Elevation Database
NEP	Natural Events Policy
NEPA	National Environmental Policy Act of 1969
NERC	North American Electricity Reliability Corporation
NHA	National Heritage Area
NHNM	National Heritage New Mexico
NHPA	National Historic Preservation Act of 1966
NID	National Inventory of Dams
NM DOT	New Mexico Department of Transportation
NLCS	National Landscape Conservation System
NMAC	*New Mexico Administrative Code*
NMBGMR	New Mexico Bureau of Geology and Mineral Resources

NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMED-AQB	New Mexico Environment Department-Air Quality Board
NMFS	National Marine Fisheries Service
NMOSE	New Mexico Office of the State Engineer
NMSU	New Mexico State University
NNHP	Nevada Natural Heritage Program
NNL	National Natural Landmark
NNSA	National Nuclear Security Administration
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NP	National Park
NPL	National Priorities List
NPS	National Park Service
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	*National Register of Historic Places*
NRS	*Nevada Revised Statutes*
NSC	National Safety Council
NSO	no surface occupancy
NSTC	National Science and Technology Council
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
NVCRS	Nevada Cultural Resources Inventory System
NV DOT	Nevada Department of Transportation
NWCC	National Wind Coordinating Committee
NWI	National Wetlands Inventory
NWPP	Northwest Power Pool
NWR	National Wildlife Refuge
NWSRS	National Scenic River System
O&M	operation and maintenance
ODFW	Oregon Department of Fish and Wildlife
OHV	off-highway vehicle
ONA	Outstanding Natural Area
ORC	organic Rankine cycle
OSE/ISC	Office of the State Engineer/Interstate Stream Commission
OSHA	Occupational Safety and Health Administration
OTA	Office of Technology Assessment
PA	Programmatic Agreement
PAD	Preliminary Application Document
PAH	polycyclic aromatic hydrocarbon

PAT	peer analysis tool
PCB	polychlorinated biphenyl
PCM	purchase change material
PCS	power conditioning system
PCU	power converting unit
PEIS	programmatic environmental impact statement
PFYC	potential fossil yield classification
PIER	Public Interest Energy Research
P.L.	Public Law
PLSS	Public Land Survey System
PM	particulate matter
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of 2.5 μm or less
PM_{10}	particulate matter with a mean aerodynamic diameter of 10 μm or less
POD	plan of development
POU	publicly owned utility
PPA	Power Purchase Agreement
PPE	personal protective equipment
PSD	Prevention of Significant Deterioration
PURPA	Public Utility Regulatory Policy Act
PV	photovoltaic
PVID	Palo Verde Irrigation District
PWR	public water reserve
QRA	qualified resource area
R&I	relevance and importance
RCI	residential, commercial, and industrial (sector)
RCRA	Resource Conservation and Recovery Act of 1976
RD&D	research, development, and demonstration; research, development, and deployment
RDBMS	Relational Database Management System
RDEP	Restoration Design Energy Project
REA	Rapid Ecoregional Assessment
REAT	Renewable Energy Action Team
REDI	Renewable Energy Development Infrastructure
ReEDS	Regional Energy Deployment System
REPG	Renewable Energy Policy Group
RETA	Renewable Energy Transmission Authority
RETAAC	Renewable Energy Transmission Access Advisory Committee
RETI	Renewable Energy Transmission Initiative
REZ	renewable energy zone
RF	radio frequency
RFC	Reliability First Corporation
RFDS	reasonably foreseeable development scenario
RGP	Rio Grande Project
RGWCD	Rio Grande Water Conservation District

RMP	Resource Management Plan
RMPA	Rocky Mountain Power Area
RMZ	Resource Management Zone
ROD	Record of Decision
ROI	region of influence
ROS	recreation opportunity spectrum
ROW	right-of-way
RPG	renewable portfolio goal
RPS	Renewable Portfolio Standard
RRC	Regional Reliability Council
RSEP	Rice Solar Energy Project
RSI	Renewable Systems Interconnection
RTTF	Renewable Transmission Task Force
RV	recreational vehicle
SAAQS	State Ambient Air Quality Standards
SAMHSA	Substance Abuse and Mental Health Services Administration
SCADA	supervisory control and data acquisition
SCE	Southern California Edison
SCRMA	Special Cultural Resource Management Area
SDRREG	San Diego Regional Renewable Energy Group
SDWA	Safe Drinking Water Act of 1974
SEGIS	Solar Energy Grid Integration System
SEGS	Solar Energy Generating System
SEI	Sustainable Energy Ireland
SEIA	Solar Energy Industrial Association
SES	Stirling Energy Systems
SETP	Solar Energy Technologies Program (DOE)
SEZ	solar energy zone
SHPO	State Historic Preservation Office(r)
SIP	State Implementation Plan
SLRG	San Luis & Rio Grande
SMA	Special Management Area
SMP	suggested management practice
SNWA	Southern Nevada Water Authority
SPP	Southwest Power Pool
SRMA	Special Recreation Management Area
SSA	Socorro Seismic Anomaly
SSI	self-supplied industry
ST	solar thermal
STG	steam turbine generator
SUA	special use airspace
SWAT	Southwest Area Transmission
SWIP	Southwest Intertie Project
SWPPP	Stormwater Pollution Prevention Plan
SWReGAP	Southwest Regional Gap Analysis Project

TAP	toxic air pollutant
TCC	Transmission Corridor Committee
TDS	total dissolved solids
TEPPC	Transmission Expansion Planning Policy Committee
TES	thermal energy storage
TSA	Transportation Security Administration
TSCA	Toxic Substances Control Act of 1976
TSDF	treatment, storage, and disposal facility
TSP	total suspended particulates
UACD	Utah Association of Conservation Districts
UBWR	Utah Board of Water Resources
UDA	Utah Department of Agriculture
UDEQ	Utah Department of Environmental Quality
UDNR	Utah Department of Natural Resources
UDOT	Utah Department of Transportation
UDWQ	Utah Division of Water Quality
UDWR	Utah Division of Wildlife Resources
UGS	Utah Geological Survey
UNEP	United Nations Environmental Programme
UNPS	Utah Native Plant Society
UP	Union Pacific
UREZ	Utah Renewable Energy Zone
USACE	U.S. Army Corps of Engineers
USC	*United States Code*
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Utah DWR	Utah Division of Water Rights
UTTR	Utah Test and Training Range
UWS	Underground Water Storage, Savings and Replenishment Act
VACAR	Virginia-Carolinas Subregion
VCRS	Visual Contrast Rating System
VFR	visual flight rule
VOC	volatile organic compound
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WA	Wilderness Area
WAPA	Western Area Power Administration
WECC	Western Electricity Coordinating Council
WECC CAN	Western Electricity Coordinating Council – Canada
WEG	wind erodibility group
WGA	Western Governors' Association

WGFD	Wyoming Game and Fish Department
WHA	wildlife habitat area
WHO	World Health Organization
WRAP	Water Resources Allocation Program; Western Regional Air Partnership
WRCC	Western Regional Climate Center
WREZ	Western Renewable Energy Zones
WRRI	Water Resources Research Institute
WSA	Wilderness Study Area
WSC	wildlife species of special concern
WSMR	White Sands Missile Range
WSR	Wild and Scenic River
WSRA	Wild and Scenic Rivers Act of 1968
WWII	World War II
YPG	Yuma Proving Ground
ZITA	zone identification and technical analysis
ZLD	zero liquid discharge

CHEMICALS

CH_4	methane	NO_2	nitrogen dioxide
CO	carbon monoxide	NO_x	nitrogen oxides
CO_2	carbon dioxide		
CO_2e	carbon dioxide equivalent	O_3	ozone
H_2S	hydrogen sulfide	Pb	lead
Hg	mercury		
		SF_6	sulfur hexafluoride
N_2O	nitrous oxide	SO_2	sulfur dioxide
NH_3	ammonia	SO_x	sulfur oxides

UNITS OF MEASURE

ac-ft	acre-foot (feet)	°F	degree(s) Fahrenheit
bhp	brake horsepower	ft	foot (feet)
		ft^2	square foot (feet)
°C	degree(s) Celsius	ft^3	cubic foot (feet)
cf	cubic foot (feet)		
cfs	cubic foot (feet) per second	g	gram(s)
cm	centimeter(s)	gal	gallon(s)
		GJ	gigajoule(s)
dB	decibel(s)	gpcd	gallon per capita per day
dBA	A-weighted decibel(s)	gpd	gallon(s) per day

gpm	gallon(s) per minute
GW	gigawatt(s)
GWh	gigawatt hour(s)
GWh/yr	gigawatt hour(s) per year
h	hour(s)
ha	hectare(s)
Hz	hertz
in.	inch(es)
J	joule(s)
K	degree(s) Kelvin
kcal	kilocalorie(s)
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
km^2	square kilometer(s)
kPa	kilopascal(s)
kV	kilovolt(s)
kVA	kilovolt-ampere(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
kWp	kilowatt peak
L	liter(s)
lb	pound(s)
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
mg	milligram(s)
Mgal	million gallons
mi	mile(s)
mi^2	square mile(s)
min	minute(s)
mm	millimeter(s)
MMt	million metric ton(s)
MPa	megapascal(s)
mph	mile(s) per hour
MW	megawatt(s)
MWe	megawatt(s) electric
MWh	megawatt-hour(s)
ppm	part(s) per million
psi	pound(s) per square inch
psia	pound(s) per square inch absolute
rpm	rotation(s) per minute
s	second(s)
scf	standard cubic foot (feet)
TWh	terawatt hours
VdB	vibration velocity decibel(s)
W	watt(s)
yd^2	square yard(s)
yd^3	cubic yard(s)
yr	year(s)
μg	microgram(s)
μm	micrometer(s)

ENGLISH/METRIC AND METRIC/ENGLISH EQUIVALENTS

The following table lists the appropriate equivalents for English and metric units.

Multiply	By	To Obtain
English/Metric Equivalents		
acres	0.004047	square kilometers (km^2)
acre-feet (ac-ft)	1,234	cubic meters (m^3)
cubic feet (ft^3)	0.02832	cubic meters (m^3)
cubic yards (yd^3)	0.7646	cubic meters (m^3)
degrees Fahrenheit (ºF) –32	0.5555	degrees Celsius (ºC)
feet (ft)	0.3048	meters (m)
gallons (gal)	3.785	liters (L)
gallons (gal)	0.003785	cubic meters (m^3)
inches (in.)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
miles per hour (mph)	1.609	kilometers per hour (kph)
pounds (lb)	0.4536	kilograms (kg)
short tons (tons)	907.2	kilograms (kg)
short tons (tons)	0.9072	metric tons (t)
square feet (ft^2)	0.09290	square meters (m^2)
square yards (yd^2)	0.8361	square meters (m^2)
square miles (mi^2)	2.590	square kilometers (km^2)
yards (yd)	0.9144	meters (m)
Metric/English Equivalents		
centimeters (cm)	0.3937	inches (in.)
cubic meters (m^3)	0.00081	acre-feet (ac-ft)
cubic meters (m^3)	35.31	cubic feet (ft^3)
cubic meters (m^3)	1.308	cubic yards (yd^3)
cubic meters (m^3)	264.2	gallons (gal)
degrees Celsius (ºC) +17.78	1.8	degrees Fahrenheit (ºF)
hectares (ha)	2.471	acres
kilograms (kg)	2.205	pounds (lb)
kilograms (kg)	0.001102	short tons (tons)
kilometers (km)	0.6214	miles (mi)
kilometers per hour (kph)	0.6214	miles per hour (mph)
liters (L)	0.2642	gallons (gal)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
metric tons (t)	1.102	short tons (tons)
square kilometers (km^2)	247.1	acres
square kilometers (km^2)	0.3861	square miles (mi^2)
square meters (m^2)	10.76	square feet (ft^2)
square meters (m^2)	1.196	square yards (yd^2)

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

10.1 ANTONITO SOUTHEAST

10.1.1 Background and Summary of Impacts

10.1.1.1 General Information

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

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

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

The proposed Antonito Southeast SEZ and other relevant information are shown in Figure 10.1.1.1-1. The criteria used to identify the SEZ as an appropriate location for solar energy development included proximity to existing transmission lines or designated corridors, proximity to existing roads, a slope of generally less than 2%, and an area of more than 2,500 acres (10 km^2). In addition, the area was identified as being relatively free of other types of conflicts, such as U.S. Fish and Wildlife Service- (USFWS-) designated critical habitat for threatened and endangered species, Areas of Critical Environmental Concern (ACECs), Special Recreation Management Areas (SRMAs), and National Landscape Conservation System (NLCS) lands (see Section 2.2.2.2 for the complete list of exclusions). Although these classes of restricted lands were excluded from the proposed Antonito Southeast SEZ, other restrictions

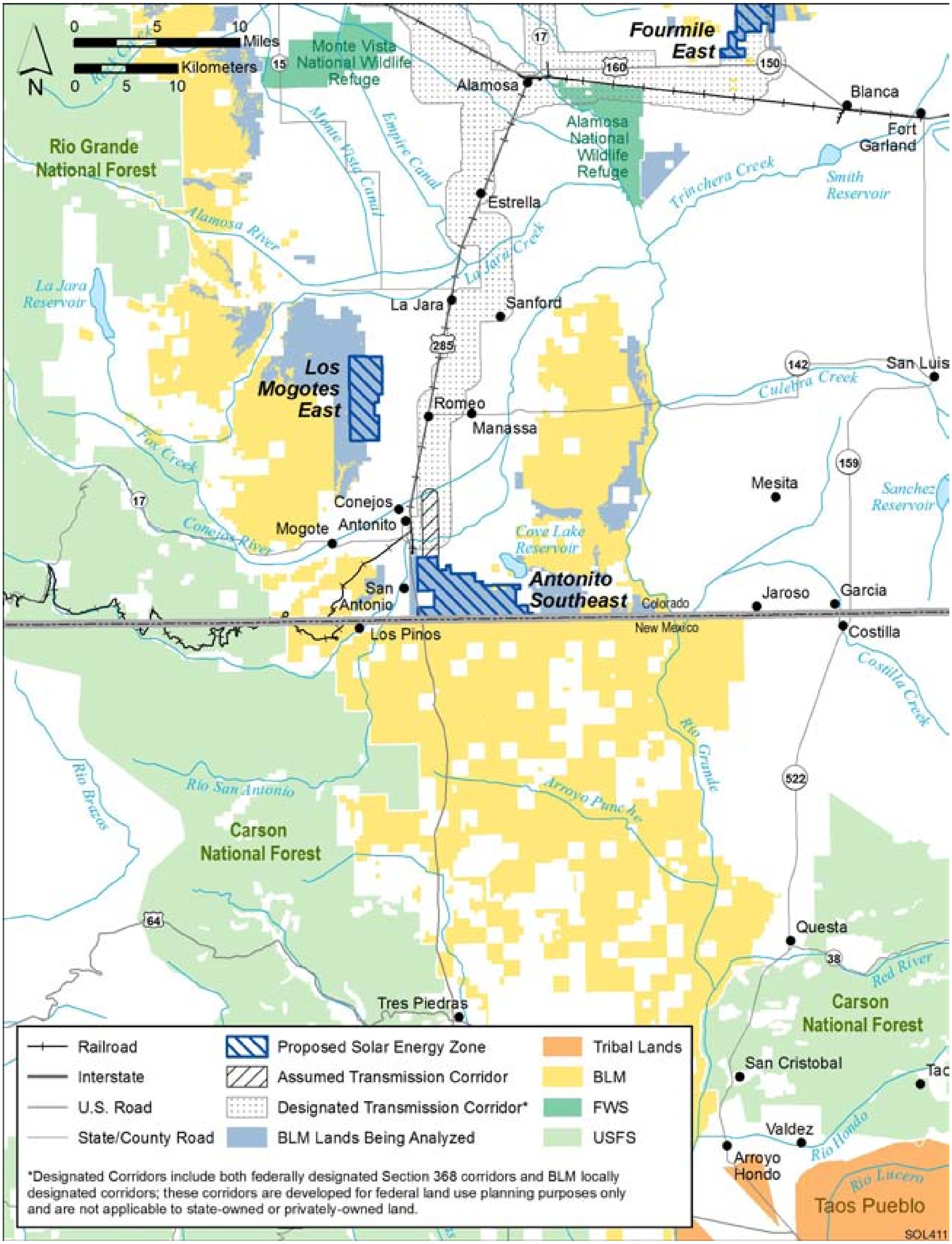

FIGURE 10.1.1.1-1 Proposed Antonito Southeast SEZ

might be appropriate. The analyses in the following sections evaluate the affected environment and potential impacts associated with utility-scale solar energy development in the proposed SEZ for important environmental, cultural, and socioeconomic resources.

As initially announced in the *Federal Register* on June 30, 2009, the proposed Antonito Southeast SEZ encompassed 9,598 acres (39 km^2). Subsequent to the study area scoping period, the boundaries were altered slightly to include some small higher slope areas internal to and at the borders of the site. Although these higher slope areas would not be amenable to solar development, inclusion in the SEZ would facilitate straightforward administration of the entire area by the U.S. Department of the Interior (DOI) Bureau of Land Management (BLM). The revised SEZ is approximately 131 acres (0.5 km^2) larger than the original SEZ area as published in June 2009.

10.1.1.2 Development Assumptions for the Impact Analysis

Maximum development of the proposed Antonito Southeast SEZ was assumed to be 80% of the total SEZ area over a period of 20 years, a maximum of 7,783 acres (31.5 km^2). These values are shown in Table 10.1.1.2-1, along with other development assumptions. Full development of the Antonito Southeast SEZ would allow development of facilities with an estimated total of 865 MW of electrical power capacity if power tower, dish engine, or photovoltaic (PV) technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 1,557 MW of power if solar trough technologies were used, assuming 5 acres/MW (0.02 km^2/MW) of land required.

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

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

TABLE 10.1.1.2-1 Proposed Antonito Southeast SEZ—Assumed Development Acreages, Maximum Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S., or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line ROW and Road ROW	Distance to Nearest BLM-Designated Transmission Corridor[e]
9,729 acres and 7,783 acres[a]	865 MW[b] 1,557 MW[c]	Adjacent (U.S. 285)	4 mi[d] and 69 kV	121 acres and 0 acres	NA[f]

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

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

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

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

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

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

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

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

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

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

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

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Aquatic Biota[b]	Water quantity in Alta Lake and nearby rivers could be affected by alterations to neighboring topography, and by usage of significant amounts of surface water or groundwater to provide power plant cooling water or other needs. Withdrawing water from the Rio San Antonio could affect water levels and aquatic organisms within the river.	All aquatic habitats within the SEZ (e.g., Alta Lake) and transmission line corridor should be avoided to the extent practicable. Transmission line towers should be sited and constructed to minimize impacts on aquatic habitats and span them whenever practicable.
Special Status Species[b]	Potentially suitable habitat for 38 special status species occurs in the affected area of the Antonito Southeast SEZ. For all special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects.	Pre-disturbance surveys should be conducted within the SEZ and transmission corridor (i.e., area of direct effects) to determine the presence and abundance of special status species. Disturbance of occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that uses one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies. Avoiding or minimizing disturbance of wetland, riparian, grassland, sagebrush, and woodland habitats in the area of direct effect could reduce impacts on 19 special status species. Transmission towers should be sited to allow spanning of wetlands and riparian areas whenever such habitats must be crossed.

TABLE 10.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Antonito Southeast SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		Consultations with the USFWS and CDOW should be conducted to address the potential for impacts on the southwestern willow flycatcher, a species listed as endangered under the ESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements. Coordination with the USFWS and CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and northern leopard frog—species that are either candidates or under review for listing under the ESA. Coordination would identify an appropriate survey protocol, avoidance measures, and, potentially, translocation or compensatory mitigation. Harassment or disturbance of federally listed species, candidates for federal listing, BLM designated sensitive species, state-listed species, rare species, and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and CDOW.

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

TABLE 10.1.1.3-1 (Cont.)

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

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

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

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

Only those design features specific to the Antonito Southeast SEZ are included in Sections 10.1.2 through 10.1.21 and in the summary table. The detailed programmatic design features for each resource area required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in this and other SEZs.

10.1.2 Lands and Realty

10.1.2.1 Affected Environment

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

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

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

10.1.2.2 Impacts

10.1.2.2.1 Construction and Operations

Development of the proposed Antonito Southeast SEZ for utility-scale solar energy production would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is undeveloped and rural, utility-scale solar energy development would be a new and discordant land use to the area. It also is possible that, with landowner agreement, the 1,280 acres (5.2 km2) of state lands and private lands adjacent or near the SEZ could be developed in the same or a complementary manner as the public lands. Similarly, development of additional industrial or support activities also could be induced on private and state lands near the SEZ.

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

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

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

10.1.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

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

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

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

10.1.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for impacts on authorizations within the SEZ under the BLM Lands and Realty Program. Possible non-mitigable impacts are related to construction of additional transmission lines that would connect the SEZ to the regional grid and to induced changes to existing land uses on state and private lands.

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

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

10.1.3 Specially Designated Areas and Lands with Wilderness Characteristics

10.1.3.1 Affected Environment

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

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

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

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

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

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

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

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

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

10.1.3.2 Impacts

10.1.3.2.1 Construction and Operations

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

ACECs

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

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

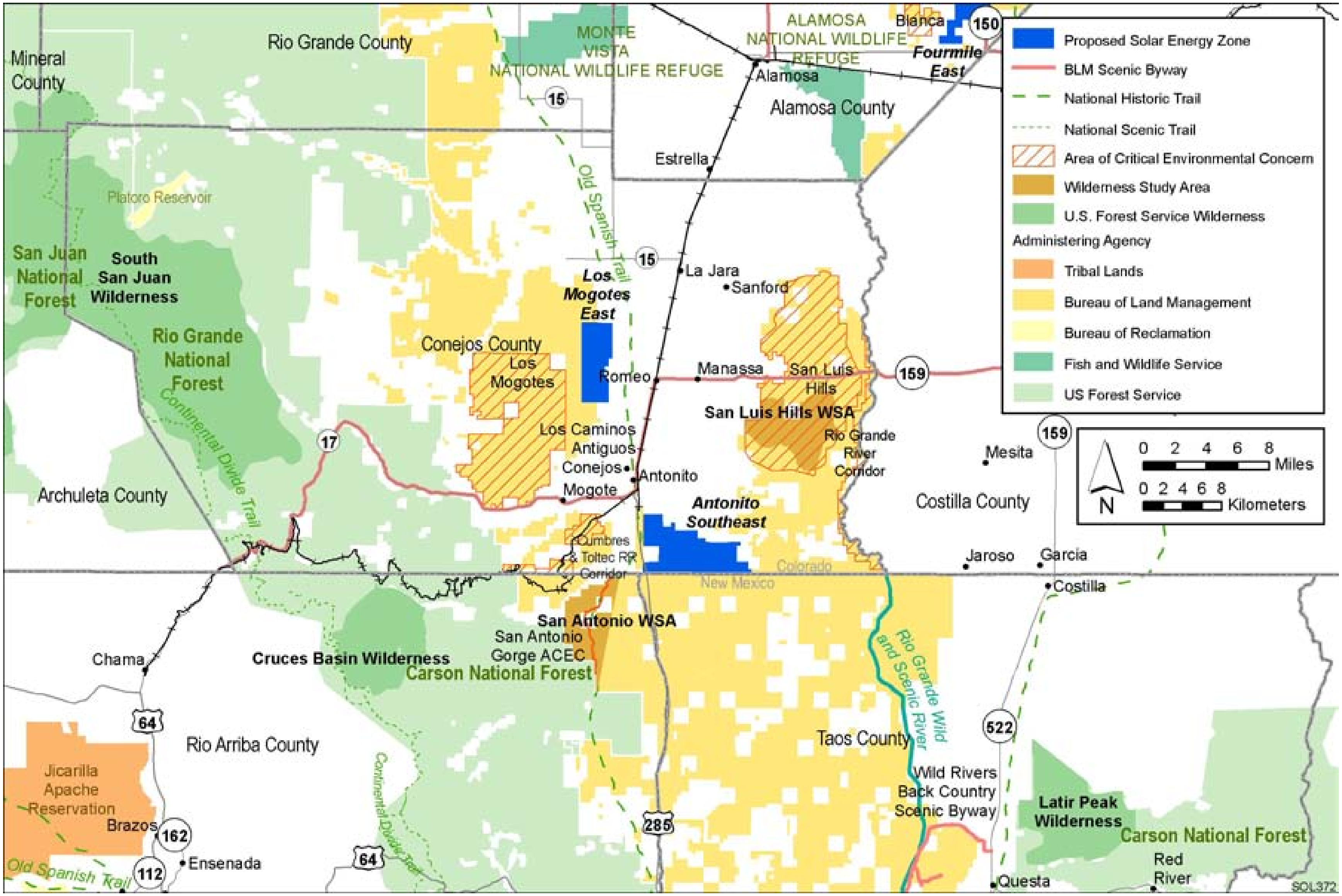

FIGURE 10.1.3.2-1 Specially Designated Areas in the Vicinity of the Proposed Antonito Southeast SEZ

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

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

WSAs

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

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

Rio Grande Natural Area

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

Rio Grande WSR

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

Rio Grande SRMA

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

USFS Wilderness and Roadless Areas

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

Los Caminos Antiguos Scenic Byway

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

Sangre de Cristo National Heritage Area (NHA)

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

West Fork of the North Branch of the Old Spanish Trail

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

10.1.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

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

10.1.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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

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

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

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

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10.1.4 Rangeland Resources

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

10.1.4.1 Livestock Grazing

10.1.4.1.1 Affected Environment

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

10.1.4.1.2 Impacts

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

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

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

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

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

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

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

10.1.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, could minimize disruption of grazing operations; however, it may not be possible to fully mitigate the economic loss to the holders of grazing permits and the social impacts from loss of grazing rights.

10.1.4.2 Wild Horses and Burros

10.1.4.2.1 Affected Environment

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

10.1.4.2.2 Impacts

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

10.1.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary to protect or minimize impacts on wild horses and burros.

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10.1.5 Recreation

10.1.5.1 Affected Environment

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

10.1.5.2 Impacts

10.1.5.2.1 Construction and Operations

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

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

10.1.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

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

10.1.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

10.1.6 Military and Civilian Aviation

10.1.6.1 Affected Environment

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

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

10.1.6.2 Impacts

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

10.1.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. The programmatic design features described in Appendix A, Section A.2.2 would require early coordination with the DoD to identify and mitigate, if possible, potential impacts on the use of MTRs.

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10.1.7 Geologic Setting and Soil Resources

10.1.7.1 Affected Environment

10.1.7.1.1 Geologic Setting

Regional Geology

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

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

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

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

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

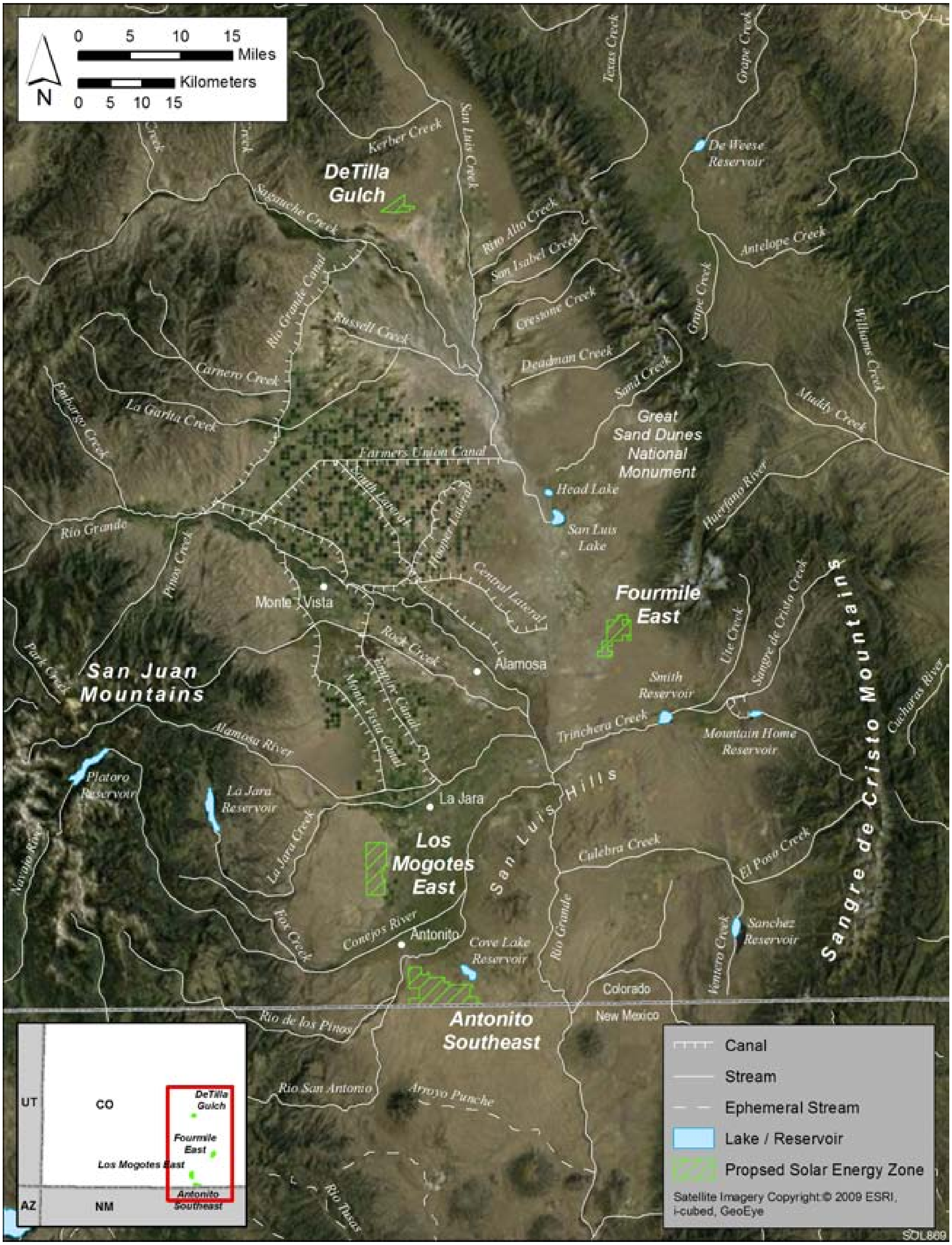

FIGURE 10.1.7.1-1 Physiographic Features of the San Luis Valley

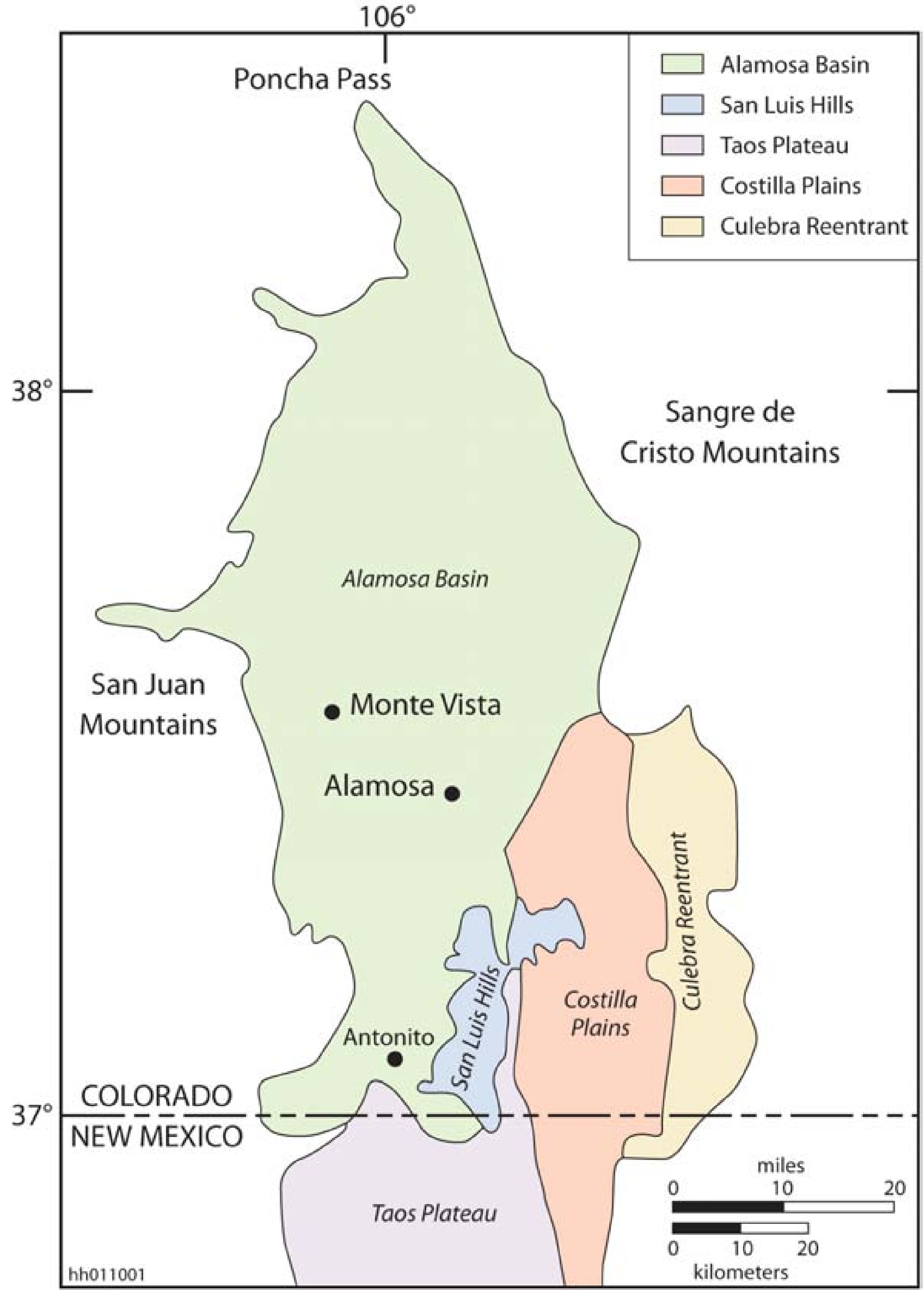

FIGURE 10.1.7.1-2 Physiographic Subdivisions within the San Luis Basin (modified from Burroughs 1981)

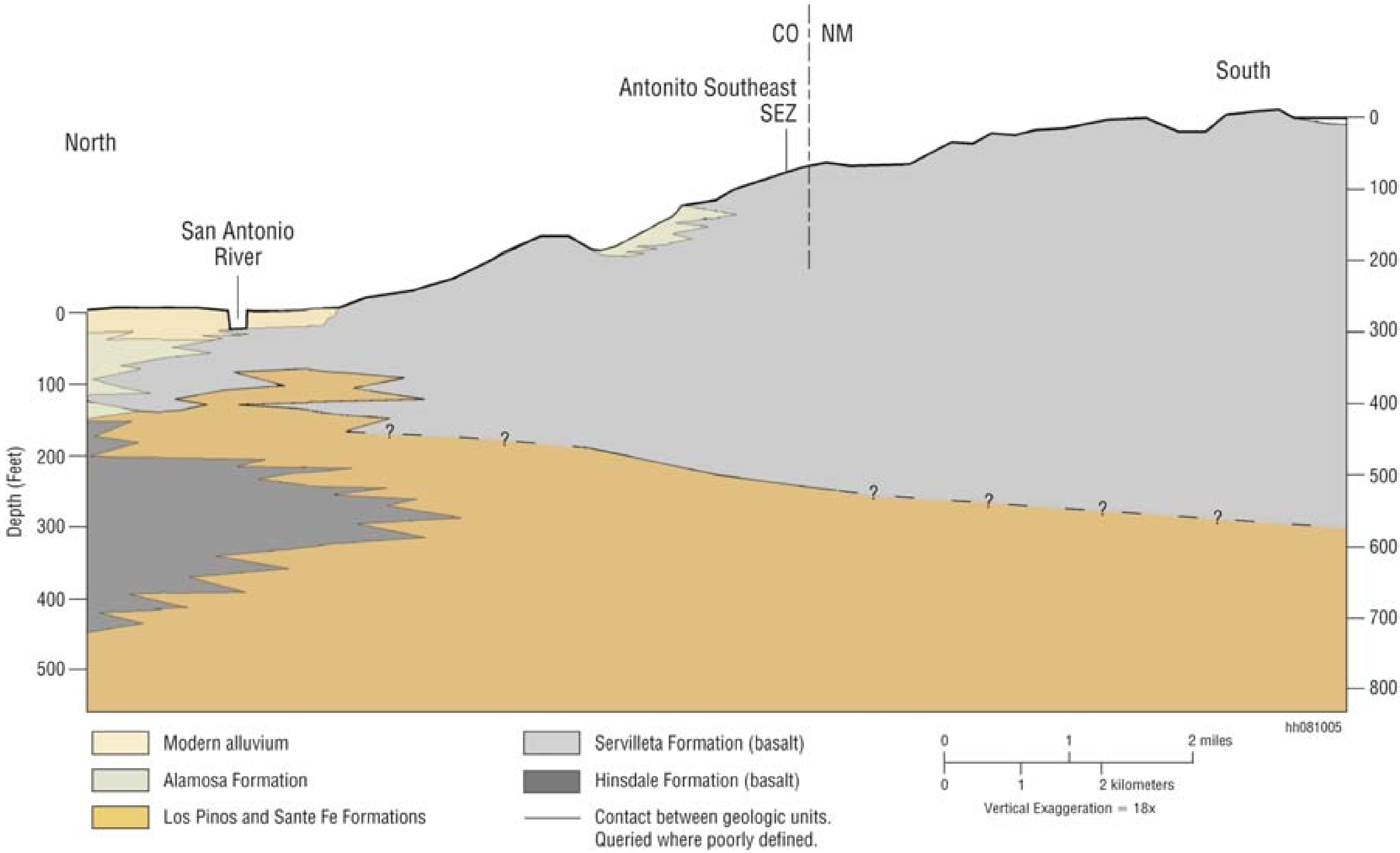

FIGURE 10.1.7.1-3 Generalized Geologic Cross Section (North to South) across the Taos Plateau and the Southern Part of the Alamosa Basin (see Figure 10.1.7.1-6 for Section Location [modified from Harmon 2009])

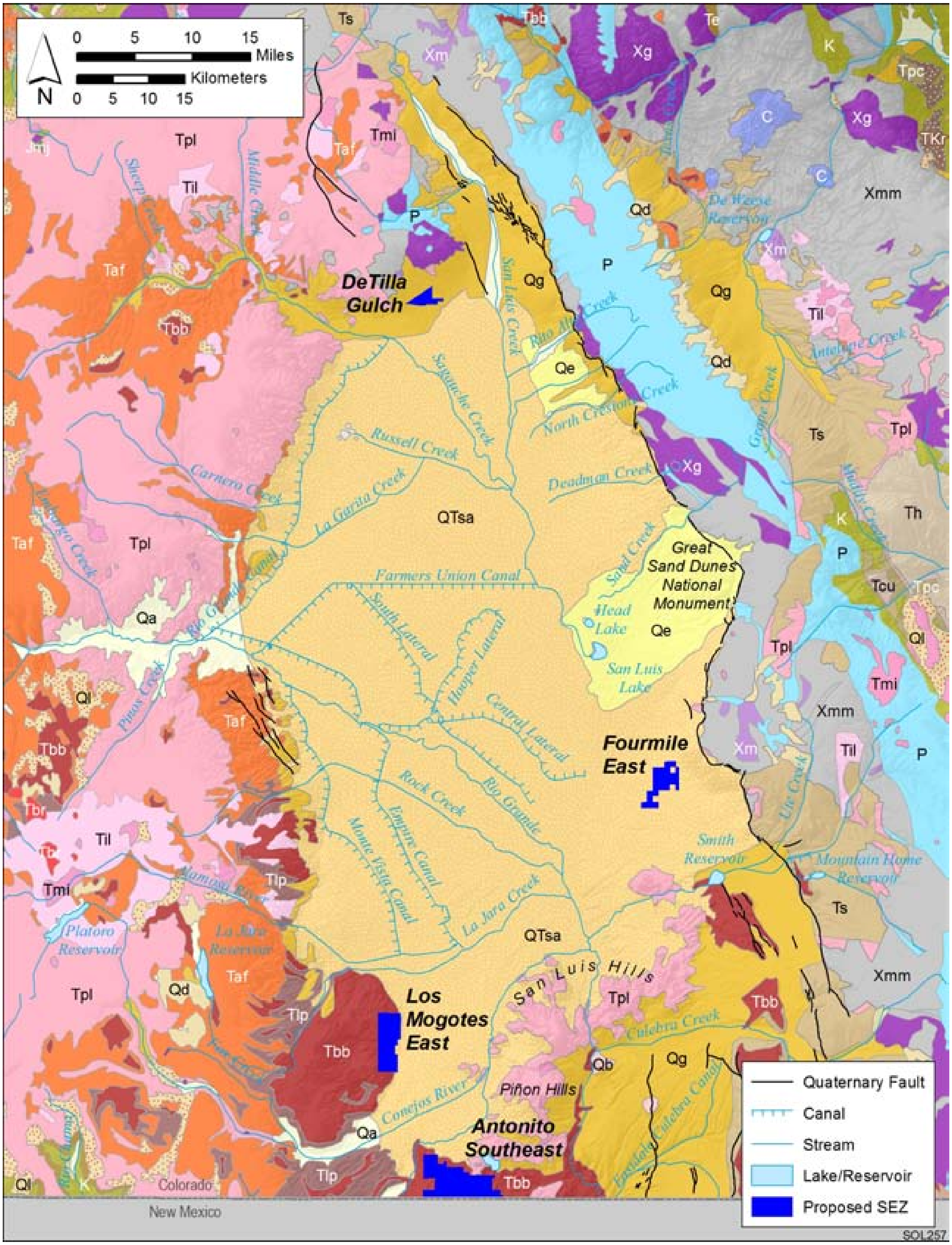

FIGURE 10.1.7.1-4 Geologic Map of the San Luis Valley and Vicinity (adapted from Stoeser et al. 2007 and Tweto 1979)

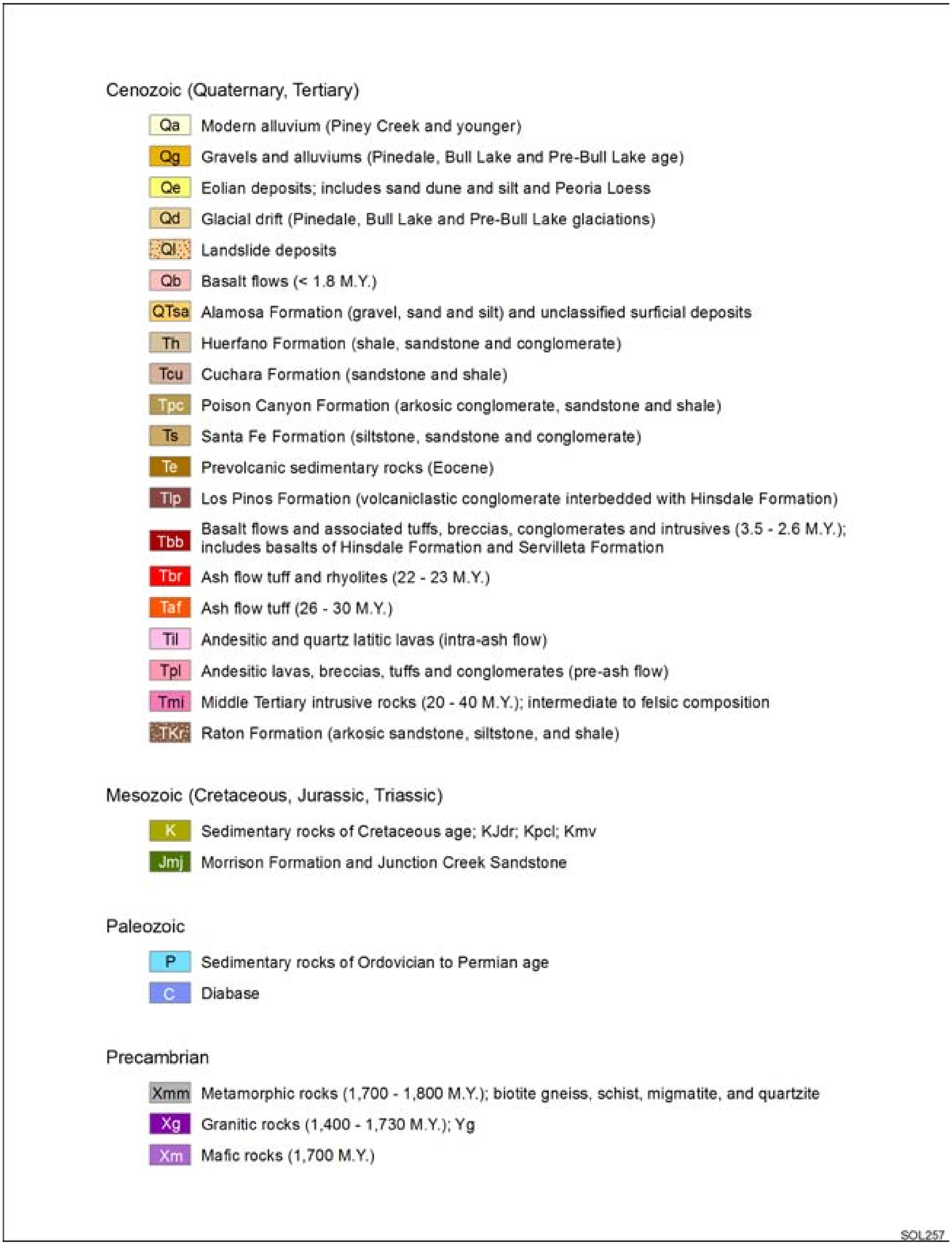

FIGURE 10.1.7.1-4 (Cont.)

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

Topography

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

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

Geologic Hazards

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

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

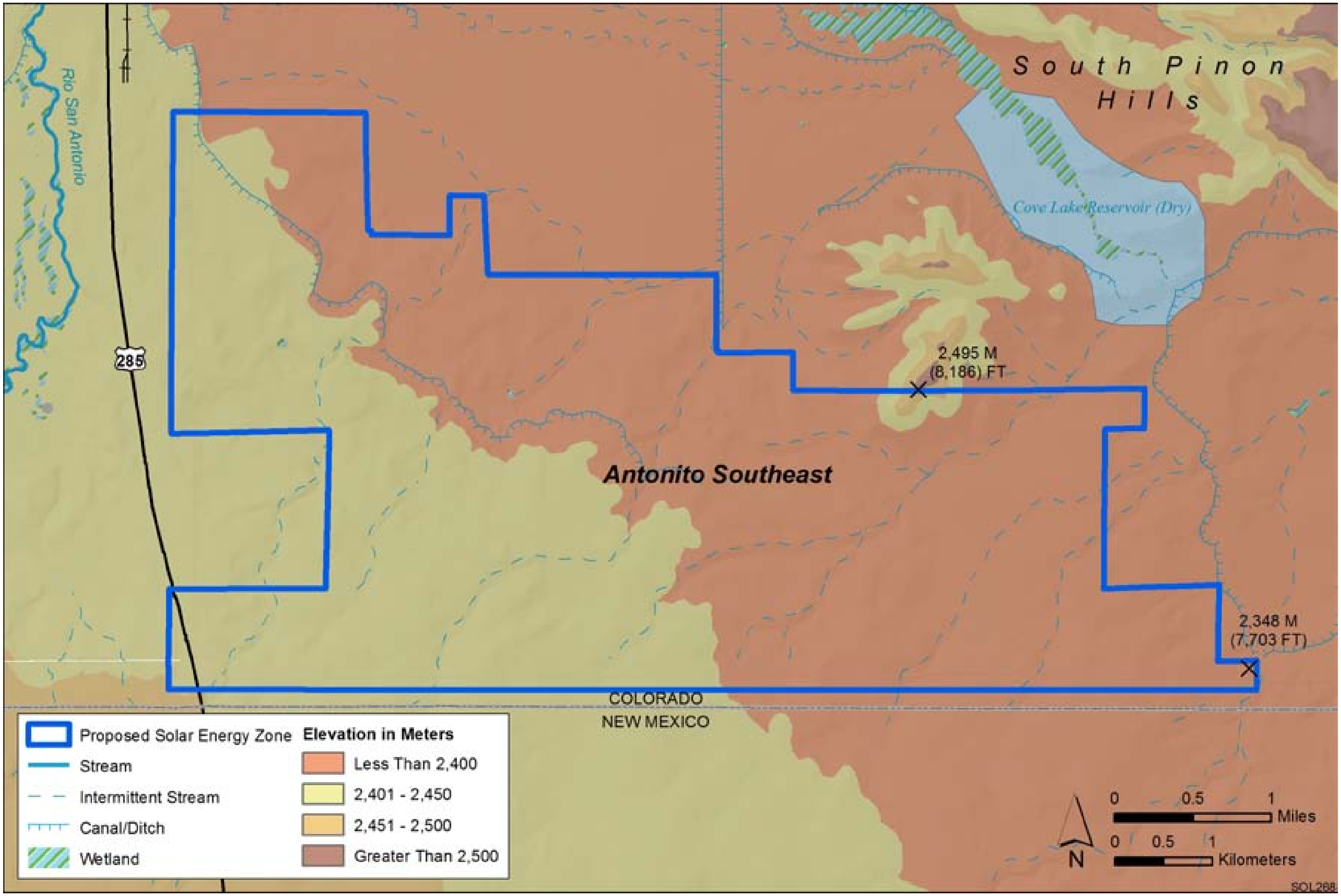

FIGURE 10.1.7.1-5 General Terrain of the Proposed Antonito Southeast SEZ

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

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

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

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

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

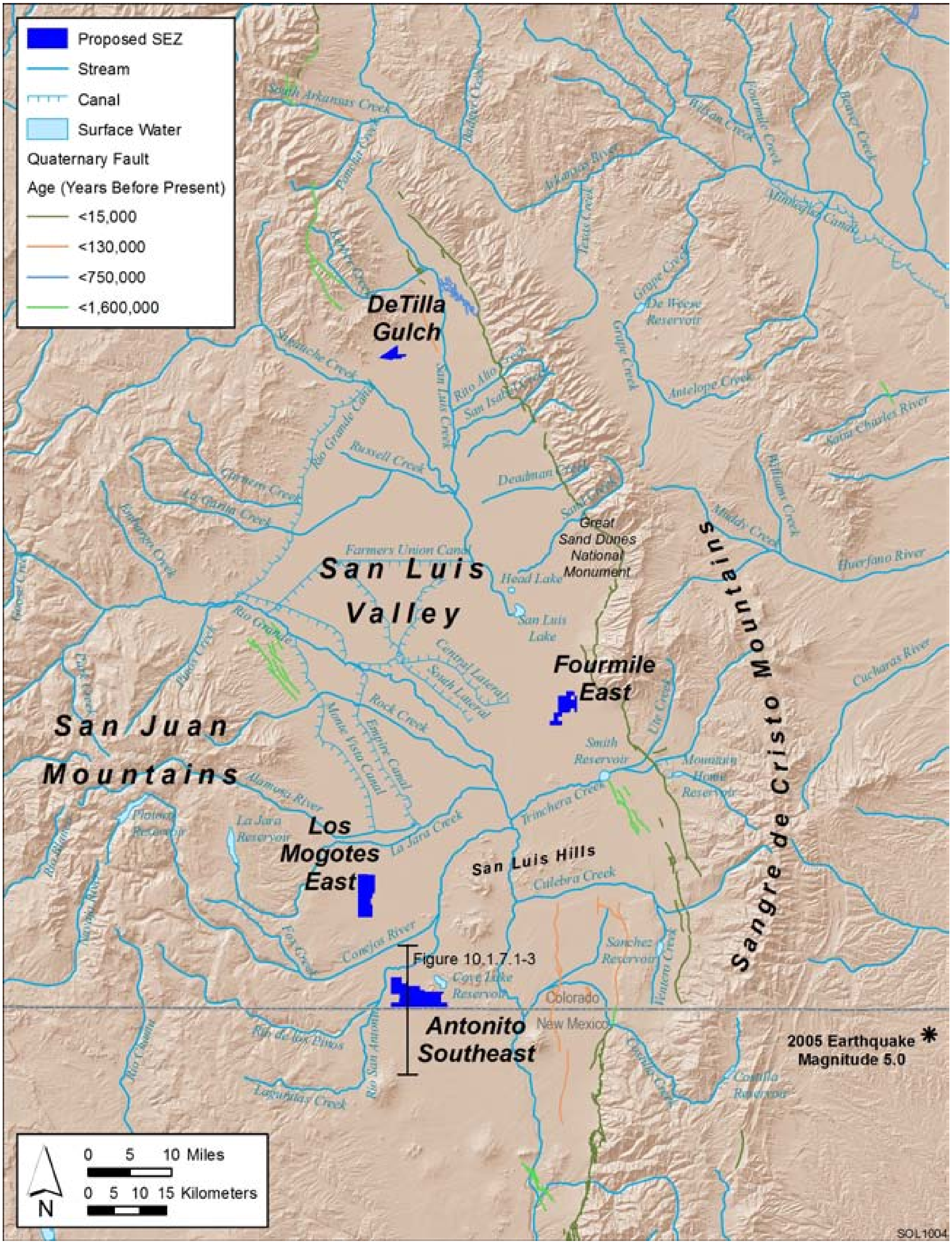

FIGURE 10.1.7.1-6 Quaternary Faults in the San Luis Valley (USGS and CGS 2009; USGS 2010a)

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

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

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

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

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

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

10.1.7.1.2 Soil Resources

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

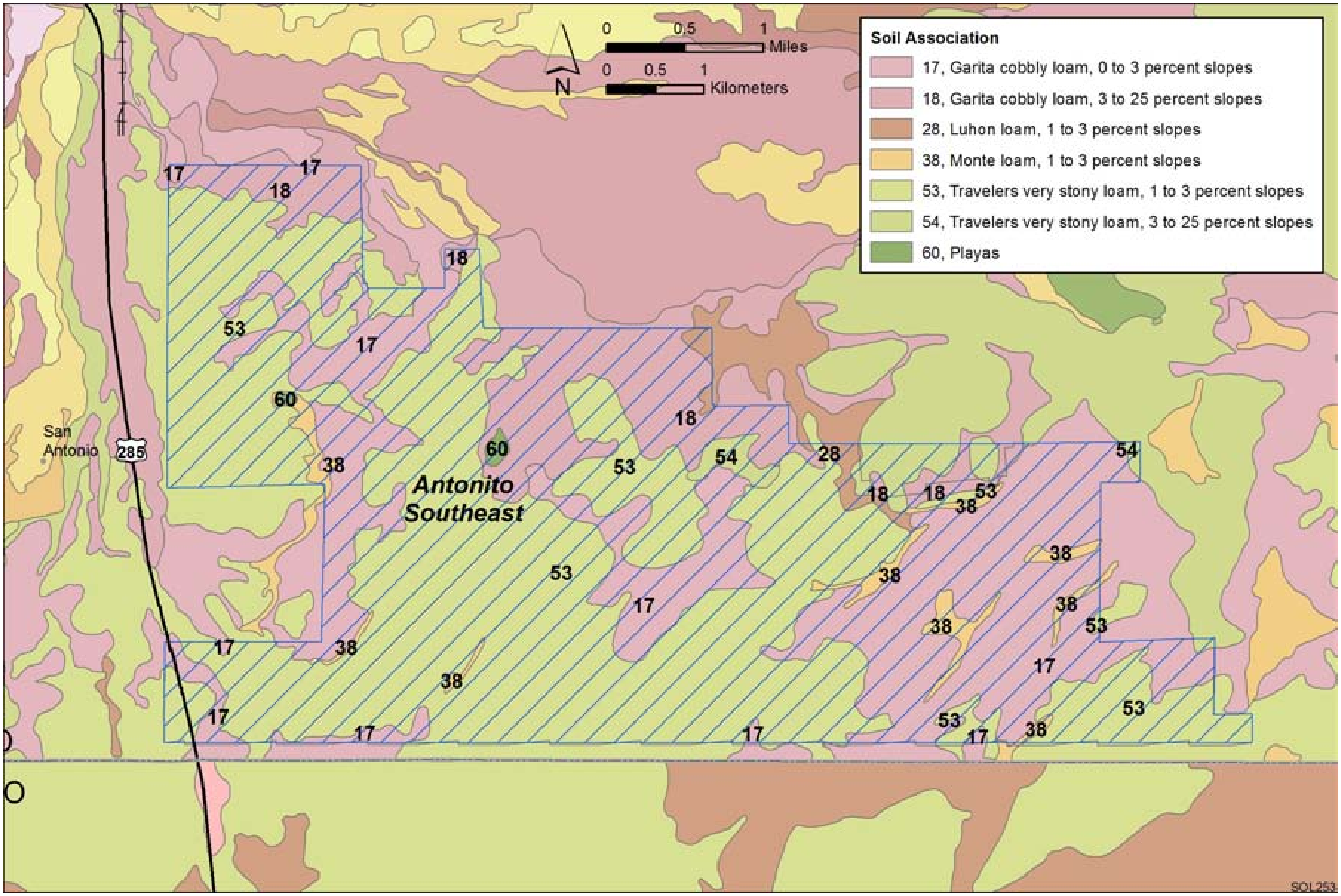

FIGURE 10.1.7.1-7 Soil Map for the Proposed Antonito Southeast SEZ (NRCS 2008)

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

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

TABLE 10.1.7.1-1 (Cont.)

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

[a] Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K and represent soil loss caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed by ground disturbance. A rating of “slight“ indicates that erosion is unlikely under ordinary climatic conditions.

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

[c] WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEG 4, 86 tons per acre per year; and WEG 8, 0 tons per acre per year.

[d] Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Source: NRCS (2009).

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

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

10.1.7.2 Impacts

Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase of a solar project. These impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. Such impacts are common to all utility-scale solar energy facilities in varying degrees and are described in more detail for the four phases of development in Section 5.7 .1.

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

10.1.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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10.1.8 Minerals (Fluids, Solids, and Geothermal Resources)

10.1.8.1 Affected Environment

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

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

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

10.1.8.2 Impacts

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

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

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

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

10.1.8.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary to protect mineral resources. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for impacts on mineral leasing.

10.1.9 Water Resources

10.1.9.1 Affected Environment

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

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

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

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

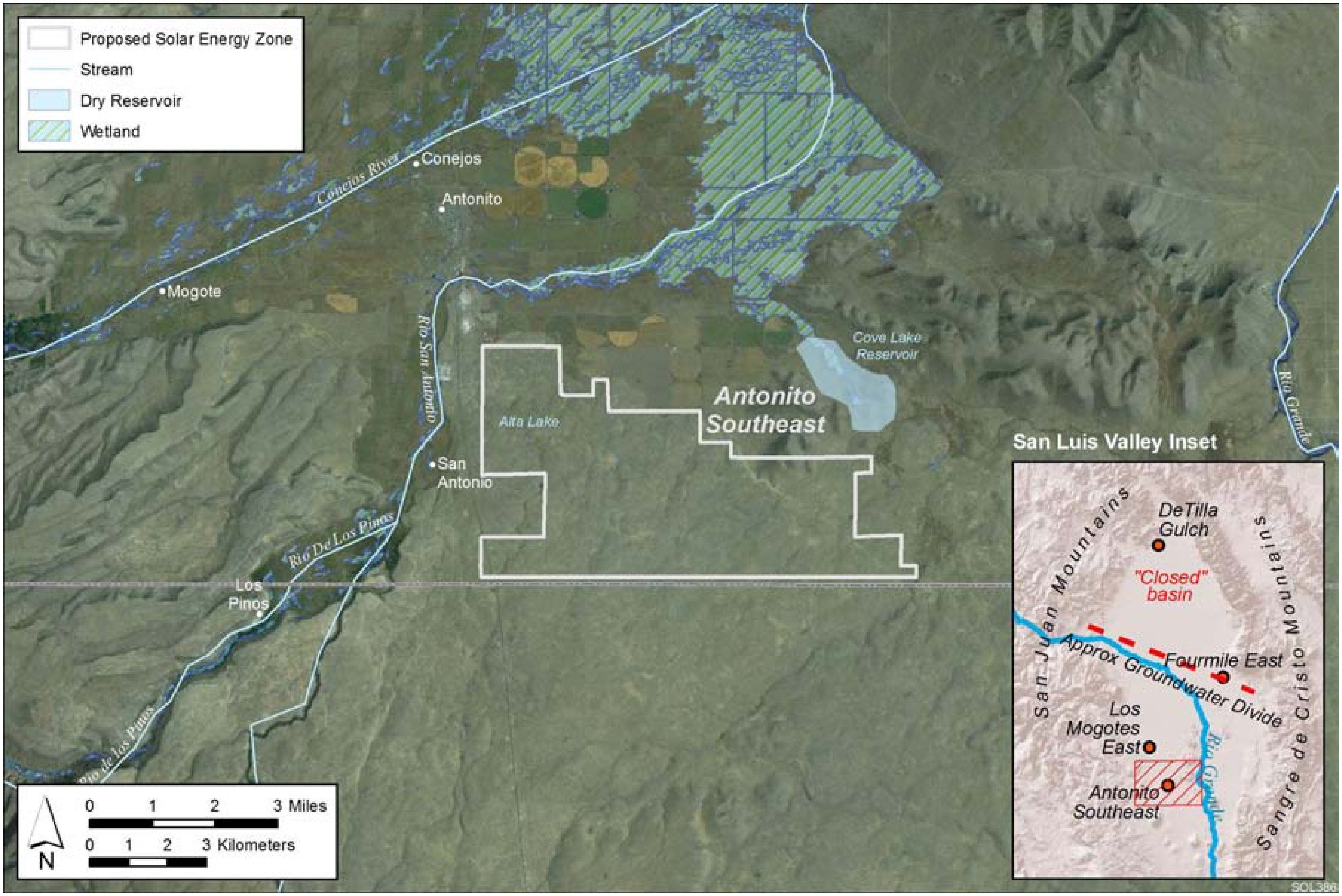

FIGURE 10.1.9.1-1 Surface Water Features near the Proposed Antonito Southeast SEZ

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

10.1.9.1.2 Groundwater

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

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

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

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

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

10.1.9.1.3 Water Use and Water Rights Management

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

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

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

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

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

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

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

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

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

10.1.9.2 Impacts

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

10.1.9.2.1 Land Disturbance Impacts on Water Resources

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

10.1.9.2.2 Water Use Requirements for Solar Energy Technologies

Analysis Assumptions

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

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

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

- The maximum land disturbance for an individual solar facility during the peak construction year is 3,000 acres (12 km^2);

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- Assumptions on individual facility size and land requirements (Appendix M), along with the assumed number of projects and maximum allowable land disturbance, result in the potential to disturb up to 31% of the SEZ total area during the peak construction year; and

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

Site Characterization

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

Construction

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

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

Normal Operations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

f NA = not applicable.

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

differences between the water requirements reported in Table 10.1.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per MW. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

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

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

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

Decommissioning/Reclamation

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

10.1.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed Antonito Southeast SEZ is located adjacent to U.S. 285, and approximately 4 mi (6 km) from existing transmission lines, as described in Section 10.1.1.2. Impacts associated with the construction of roads and transmission lines primarily deal with water use demands for construction, water quality concerns relating to potential chemical spills, and land disturbance effects on the natural hydrology. Water needed for road modification and transmission line construction activities (e.g., for soil compaction, dust suppression, and potable supply for workers) could be trucked to the construction area from an off-site source. As a result, water use impacts would be negligible. Impacts on surface water and groundwater quality resulting from spills would be minimized by implementing the mitigation measures described in Section 5.9.3 (e.g., cleaning up spills as soon as they occur). Ground-disturbing activities that have the potential to increase sediment and dissolved solid loads in downstream waters would be conducted following the mitigation measures outlined in Section 5.9.3 to minimize impacts associated with alterations to natural drainage pathways and hydrologic processes.

10.1.9.2.4 Summary of Impacts on Water Resources

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

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

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

10.1.9.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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

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

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

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

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

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

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

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10.1.10 Vegetation

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

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

10.1.10.1 Affected Environment

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

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

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

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

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

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

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

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

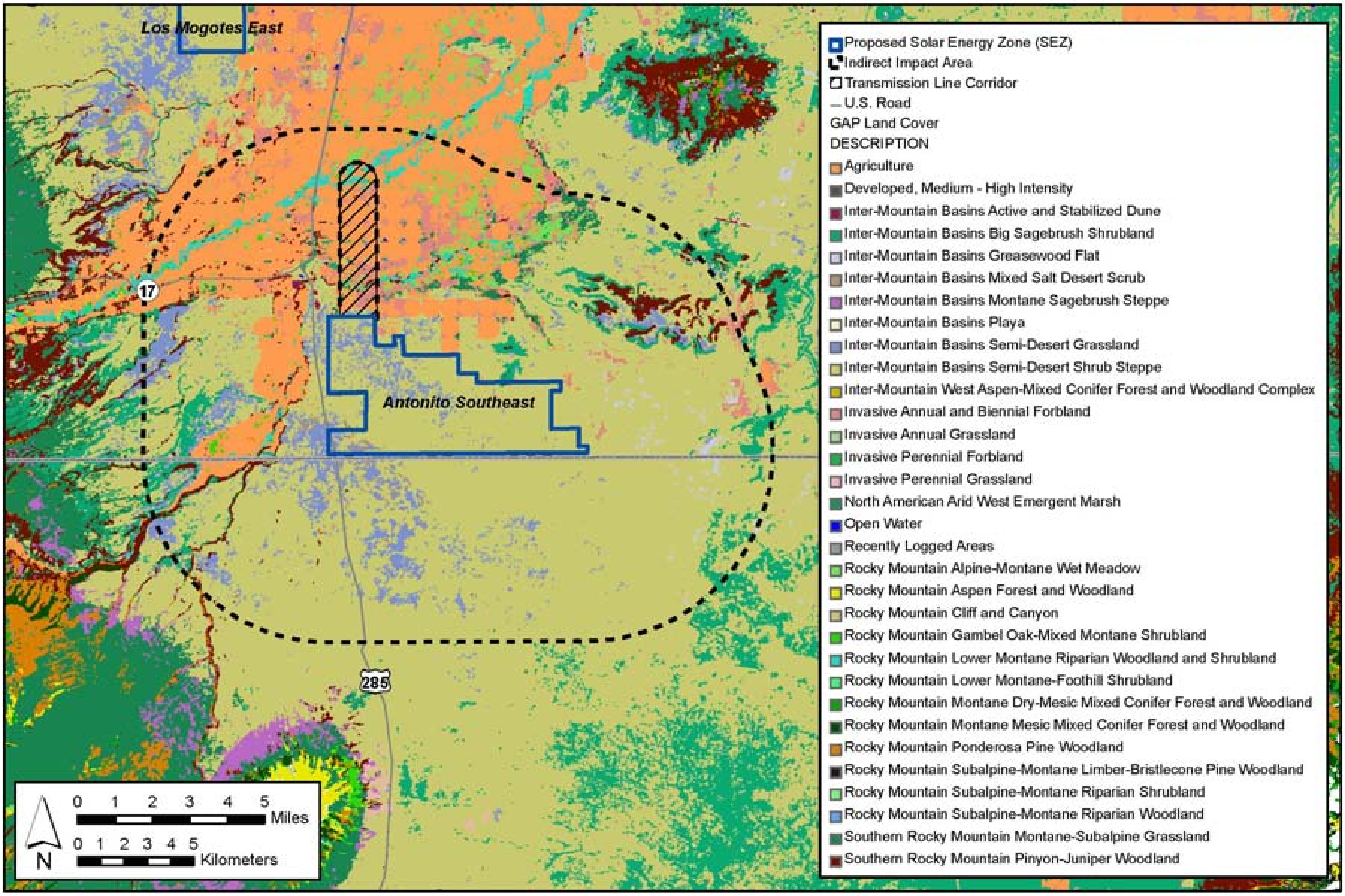

FIGURE 10.1.10.1-1 Land Cover Types within the Proposed Antonito Southeast SEZ (Source: USGS 2004)

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

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S079 Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	8,320 acres[g] (1.4%, 3.5%)	67,741 acres (11.0%)	6 acres (<0.1%)	Moderate
S090 Inter-Mountain Basins Semi-Desert Grassland: Consists of perennial bunchgrasses as dominants or co-dominants. Scattered shrubs or dwarf shrubs may also be present.	1,278 acres (1.9%, 5.1%)	6,643 acres (10%)	1 acre (<0.1%)	Moderate
S065 Inter-Mountain Basins Mixed Salt Desert Scrub: Generally consists of open shrublands which include at least one species of Atriplex along with other shrubs. Perennial grasses dominate a sparse to moderately dense herbaceous layer.	72 acres (5.1%, 6.8%)	393 acres (28.1%)	0 acres	Moderate
N80 Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	27 acres (<0.1%, 1.4%)	24,101 acres (4.6%)	69 acres (<0.1%)	Small
S054 Inter-Mountain Basins Big Sagebrush Shrubland: Dominated by basin big sagebrush (*Artemisia tridentata tridentata*), Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), or both. Other shrubs may be present. Perennial herbaceous plants are present but not abundant.	16 acres (<0.1%, <0.1%)	4,226 acres (0.6%)	1 acre (<0.1%)	Small
D09 Invasive Annual and Biennial Forbland: Areas dominated by annual and biennial non-native forb species.	3 acres (<0.1%, 0.4%)	4,508 acres (9.2%)	20 acres (<0.1%)	Small

TABLE 10.1.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S085 Southern Rocky Mountain Montane-Subalpine Grassland: Typically occurs as a mosaic of two or three plant associations on well-drained soils. The dominant species is usually a bunchgrass.	<1 acre (<0.1%, <0.1%)	1,277 acres (0.4%)	1 acre (<0.1%)	Small
S093 Rocky Mountain Lower Montane Riparian Woodland and Shrubland: Occurs on streambanks, islands, and bars, in areas of annual or episodic flooding, and often occurs as a mosaic of tree-dominated communities with diverse shrubs.	0 acres	1,606 acres (5.6%)	7 acres (<0.1%)	Small
S102 Rocky Mountain Alpine-Montane Wet Meadow: Occurs on wet soils in very low-velocity areas along ponds, lakes, streams, and toeslope seeps. This cover type is dominated by herbaceous species, and often occurs as a mosaic of several plant associations. The dominant species are often grass or grass-like plants.	0 acres	1,769 acres (1.6%)	3 acres (<0.1%)	Small
S038 Southern Rocky Mountain Pinyon-Juniper Woodland: Occurs on dry mountains and foothills. The dominant trees are twoneedle pinyon (*Pinus edulis*) or oneseed juniper (*Juniperus monosperma*), or both. Rocky Mountain juniper (*Juniperus scopulorum*) may be a dominant in higher elevation occurrences. An understory may be absent or dominated by shrubs or graminoids.	0 acres	2,572 acre (0.6%)	1 acre (<0.1%)	Small

TABLE 10.1.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S046 Rocky Mountain Gambel Oak-Mixed Montane Shrubland: Occurs on dry foothills and lower mountain slopes. Gambel oak (*Quercus gambelii*) may be the only dominant species or share dominance with other shrubs.	0 acres	322 acres (0.2%)	1 acre (<0.1%)	Small
S036 Southern Rocky Mountain Ponderosa Pine Woodland: Occurs on dry slopes. Ponderosa pine (*Pinus ponderosa*, primarily var *scopulorum*, and var *brachyptera*) is the dominant species. Other tree species may be present. The understory is usually shrubby and grasses may be present.	0 acres	94 acres (<0.1%)	<1 acre (<0.1%)	Small
S096 Inter-Mountain Basins Greasewood Flat: Dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*) and generally occurring in areas with saline soils, a shallow water table, and intermittent flooding, although remaining dry for most growing seasons. This community type generally occurs near drainages or around playas. These areas may include, or may be co-dominated by, other shrubs, and may include a graminoid herbaceous layer.	0 acres	606 acres (0.4%)	<1 acre (<0.1%)	Small
N11 Open Water: Plant or soil cover is generally less than 25%.	0 acres	14 acres (0.1%)	<1 acre (<0.1%),	Small
S012 Inter-Mountain Basins Active and Stabilized Dune: Includes Dune and sandsheet areas that are unvegetated or sparsely vegetated, with up to 30 % plant cover, but generally less than 10%. Plant communities consist of patchy or open grassland, shrubland, or shrub steppe, with species often adapted to the shifting sandy substrate.	0 acres	87 acres (1.6%)	0 acres	Small

TABLE 10.1.10.1-1 (Cont.)

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

TABLE 10.1.10.1-1 (Cont.)

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

Footnotes on next page.

TABLE 10.1.10.1-1 (Cont.)

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

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

[c] Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region. Wetlands within the SEZ, such as Alta Lake, are not mapped as wetland cover types by SWReGAP.

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

[e] For transmission, direct effects were estimated within a 4-mi (6.5-km) long, 250-ft (76-m) wide transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide transmission corridor. Impacts are for the area of the cover type within the assumed ROW and the percentage that area represents of all occurrences of that cover type within the SEZ region.

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

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

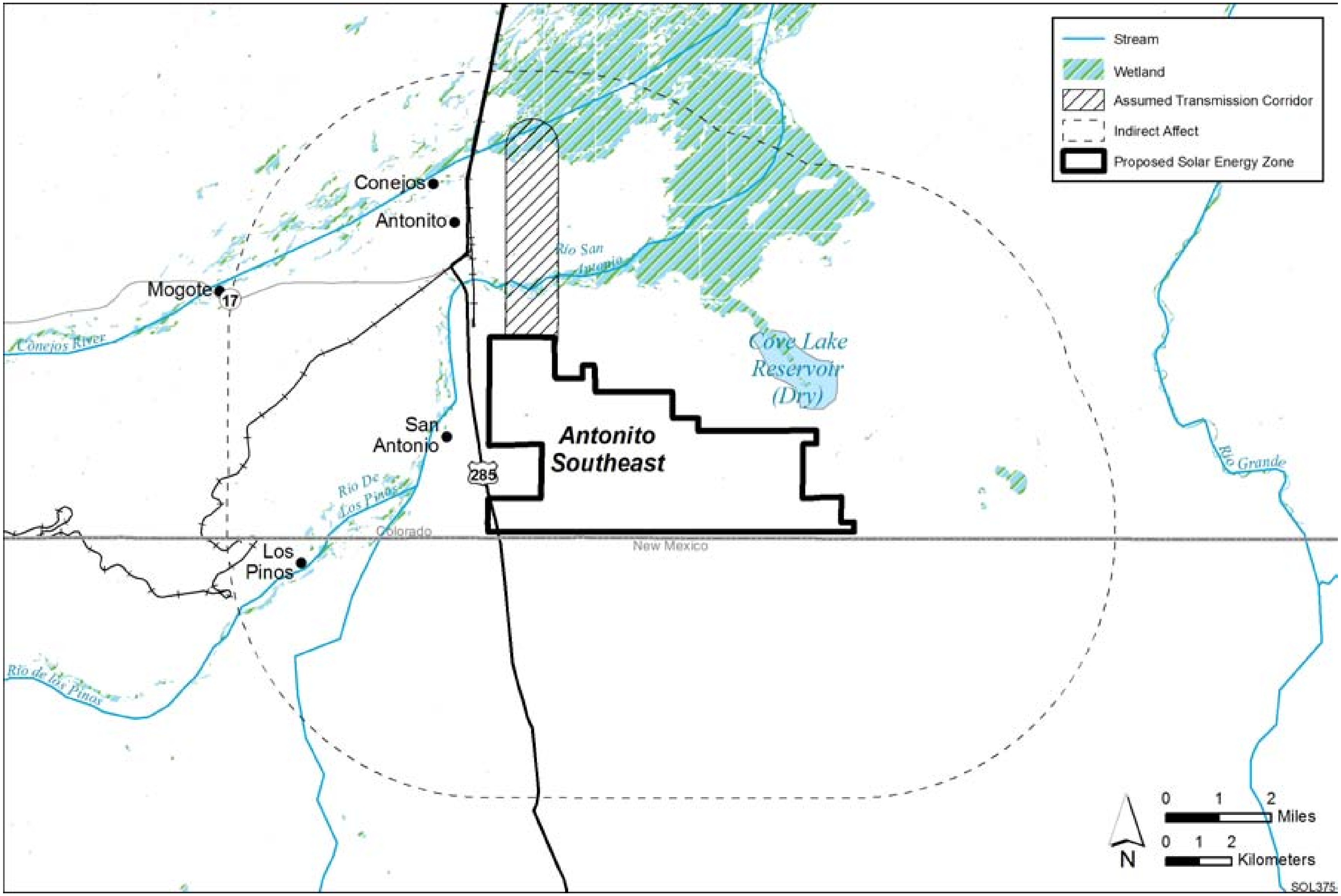

FIGURE 10.1.10.1-2 Wetlands within the Proposed Antonito Southeast SEZ (Source: USFWS 2009a)

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

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

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

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

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

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

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

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

TABLE 10.1.10.1-2 Colorado Noxious Weeds Occurring in Conejos County

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

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

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

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

Source: BLM (2010a).

10.1.10.2 Impacts

The construction of solar energy facilities within the Antonito Southeast SEZ would result in direct impacts on plant communities because of the removal of vegetation within the facility footprint during land-clearing and land-grading operations. Approximately 80% of the SEZ (7,783 acres [31.5 km^2]) would be expected to be cleared with full development of the SEZ. The plant communities affected would depend on facility locations and could include any of the communities occurring on the SEZ. Therefore, for this analysis, all the area of each cover type within the SEZ is considered to be directly affected by removal with full development of the SEZ.

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

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

10.1.10.2.1 Impacts on Native Species

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

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

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

Re-establishment of shrub or grassland communities in temporarily disturbed areas would likely be very difficult because of the arid conditions and may require extended periods of time. In addition, noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation.

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

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

The deposition of fugitive dust from disturbed soil areas in habitats outside a solar project area could result in reduced productivity or changes in plant community composition. Communities that would be most likely affected north–northeast of the SEZ, the predominant downwind direction, are those of the Inter-Mountain Basins Semi-Desert Shrub Steppe cover type. Inter-Mountain Basins Greasewood Flat, Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Semi-Desert Grassland, and Southern Rocky Mountain Pinyon-Juniper Woodland also occur to the east.

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

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

10.1.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

Executive Order (E.O.) 13112, "Invasive Species," directs federal agencies to prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause (*Federal Register*, Volume 64, page 61,836, Feb. 8, 1999). Potential impacts resulting from noxious weeds and invasive plant species as a result of solar energy facility development are described in Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in and adjacent to the affected area of the proposed Antonito Southeast SEZ, such that weeds could be transported into areas previously relatively weed-free, and this could result in reduced restoration success and possible widespread habitat degradation.

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

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

10.1.10.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would reduce the potential for impacts on plant communities. While some SEZ-specific design features are best established when project details are considered, some design features can be identified at this time, as follows:

- An Integrated Vegetation Management Plan, addressing invasive species control, and an Ecological Resources Mitigation and Monitoring Plan, addressing habitat restoration, should be approved and implemented to increase the potential for successful restoration of Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Semi-Desert Grassland habitats and minimize the potential for the spread of invasive species, such as Russian thistle or cheatgrass. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

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

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

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

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

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

10.1.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Antonito Southeast SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from the Colorado Natural Diversity Information Source Species Page (CDOW 2009) and the SWReGAP (USGS 2007). Land cover types potentially suitable for each species were determined from the SWReGAP (USGS 2004, 2005, 2007). Big game activity areas were determined from Colorado Natural Diversity Information Source Data (CDOW 2008). The amount of aquatic habitat within the SEZ region was determined by estimating the length of linear perennial stream and canal features and the area of standing water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the proposed SEZ using available GIS surface water datasets.

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 250-ft (76-m) wide portion of an assumed 4-mi (6.4-km) long transmission line corridor. The maximum developed area within the SEZ would be 7,783 acres (31.5 km^2).

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

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

10.1.11.1 Amphibians and Reptiles

10.1.11.1.1 Affected Environment

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

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

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

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

10.1.11.1.2 Impacts

The types of impacts that amphibians and reptiles could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 and through the application o fany additional mitigation. Section 10.1.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed Antonito Southeast SEZ.

The assessment of impacts on amphibian and reptile species is based on available information on the presence of species in the affected area as presented in Section 10.1.11.1.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific

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

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Amphibians					
Woodhouse's toad (*Bufo woodhousii*)	Mesic areas near streams and rivers. Often in agricultural areas and river floodplains. Prefers sandy areas. Can move several hundred meters between breeding and nonbreeding habitats. About 2,613,200 acres[h] of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	106,645 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	87 acres of potentially suitable habitat lost and 1758 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoid wetland and riparian habitats.
Lizards					
Eastern fence lizard (*Sceloporus undulatus*)	Sunny, rocky habitats of cliffs, talus, old lava flows and cones, canyons, and outcrops. Various vegetation adjacent or among rocks include montane forests, woodlands, semidesert shrubland, and various forbs and grasses. About 1,831,800 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	79,256 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	9 acres of potentially suitable habitat lost and 181 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Many-lined skink (Eumeces multivirgatus)	Mesic areas along streams and dense grassland edges of playas. Also loose sandy soils and prairie dog colonies; occasionally vacant lots in cities and residential areas. Most abundant where there is water or moist subsoil. About 1,005,200 acres of potentially suitable habitat occurs in the SEZ region.	1,278 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	9,216 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	2 acres of potentially suitable habitat in area of potential direct effect and 40 acres of potentially suitable habitat in area of indirect effect.	Small overall impact. Avoidance of riparian areas and prairie dog colonies would reduce the potential for impact.

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TABLE 10.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
Short-horned lizard (*Phrynosoma hernandesi*)	Short-grass prairies, sagebrush, semidesert shrublands, shale barrens, pinyon-juniper and pine-oak woodlands, oak-grass associations, and open conifer forests in mountainous areas. About 3,432,600 acres of potentially suitable habitat occurs in the SEZ region.	1,294 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat)	17,891 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 322 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Snakes					
Gophersnake (*Pituophis catenifer*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 2,273,200 acres of potentially suitable habitat occurs in the SEZ region.	1,321 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	34,685 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	80 acres of potentially suitable habitat in area of potential direct effect and 1,610 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Western rattlesnake (*Crotalus viridis*)	Most terrestrial habitats. Typically inhabits plains grasslands, sandhills, semidesert and mountain shrublands, riparian areas, and montane woodlands. About 3,675,900 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	105,793 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	87 acres of potentially suitable habitat in area of potential direct effect and 1,750 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Western terrestrial garter snake (*Thamnophis elegans*)	Most terrestrial and wetland habitats near bodies of water, but can be found many miles from water. About 2,712,600 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	75,300 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 362 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoidance of wetlands and riparian areas would reduce the potential for impact.

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

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

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 acres of direct effect within the SEZ was assumed.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 7,783 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For transmission line development, direct effects were estimated within a 4-mi (6.4-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

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

Footnotes continued on next page.

TABLE 10.1.11.1-1 (Cont.)

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

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

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

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

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

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

10.1.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would reduce the potential for effects on amphibians and reptiles, especially for those species that utilize habitat types that can be avoided (e.g., dry lakes). Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While some SEZ-specific design features are best established when project details are considered, some design features can be identified at this time, as follows:

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

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

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

If these SEZ-specific design features are implemented in addition to other programmatic design features, impacts on amphibian and reptile species could be reduced. Any residual impacts on amphibians and reptiles are anticipated to be small given the relative abundance of potentially suitable habitats in the SEZ region. However, as potentially suitable habitats for a number of the amphibian and reptile species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

10.1.11.2 Birds

10.1.11.2.1 Affected Environment

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

Waterfowl, Wading Birds, and Shorebirds

As discussed in Section 4.10.2.2.2, waterfowl (ducks, geese, and swans), wading birds (herons and cranes), and shorebirds (avocets, gulls, plovers, rails, sandpipers, stilts, and terns) are among the most abundant groups of birds in the six-state study area. However, within the proposed Antonito Southeast SEZ, waterfowl, wading bird, and shorebird species would be mostly absent to uncommon. Alta Lake, particularly when standing water is present, may attract shorebird species such as the killdeer (*Charadrius vociferus*) and mountain plover (*Charadrius montanus*). However, it is probably not an important habitat for shorebirds because of its small size. Due to its special status standing, the mountain plover is discussed in Section 10.1.12. Bodies of water such as the Rio San Antonio, located about 1 mi (1.6 km) from the western and northern borders of the proposed Antonito Southeast SEZ, provide more productive habitat for waterfowl, wading birds, and shorebirds.

Neotropical Migrants

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

Birds of Prey

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

Upland Game Birds

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

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

10.1.11.2.2 Impacts

The types of impacts that birds could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 and through the application of any additional mitigation measures. Section 10.1.11.2.3, below, identifies design features of particular relevance to the proposed Antonito Southeast SEZ.

The assessment of impacts on bird species is based on available information on the presence of species in the affected area, as presented in Section 10.1.11.2.1 following the analysis approach described in Appendix M. Additional National Environmental Policy Act

TABLE 10.1.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Antonito Southeast SEZ

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

TABLE 10.1.11.2-1 (Cont.)

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

TABLE 10.1.11.2-1 (Cont.)

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

TABLE 10.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Vesper sparrow *(Pooecetes gramineus)*	Breeds in grasslands, open shrublands mixed with grasslands, and open pinyon-juniper woodlands. Occurs in open riparian and agricultural areas during migration. About 2,409,500 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	106,186 acres of potentially suitable habitat (4.4% of available potentially suitable habitat)	107 acres of potentially suitable habitat in area of potential direct effect and 2,153 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Western meadowlark *(Sturnella neglecta)*	Agricultural areas, especially in winter. Also inhabits native grasslands, croplands, weedy fields, and less commonly in semidesert and sagebrush shrublands. About 2,440,200 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	104,652 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	89 acres of potentially suitable habitat in area of potential direct effects and 1,791 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Birds of Prey					
American kestrel *(Falco sparverius)*	Wide variety of open to semi-open habitats including agricultural areas, grasslands, riparian forest edges, and urban areas. Occurs in most habitats, especially during migration. About 4,362,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	107,795 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	95 acres of potentially suitable habitat in area of potential direct effects and 1,911 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Golden eagle *(Aquila chrysaetos)*	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 4,777,000 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	109,256 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	98 acres of potentially suitable habitat in area of potential direct effects and 1,972 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.

TABLE 10.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Red-tailed hawk *(Buteo jamaicensis)*	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 3,214,300 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	101,658 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effects and 1,690 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Swainson's hawk *(Buteo swainsoni)*	Grasslands, agricultural areas, shrublands, and riparian forests. Nests in trees in or near open areas. Migrants occur often occur in treeless areas. Large flocks often occur in agricultural areas near locust infestations. About 1,638,700 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	99,416 acres of potentially suitable habitat (6.1% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effect and 1,690 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoidance of nest trees would further reduce the potential for impact.
Turkey vulture *(Cathartes aura)*	Occurs in areas of pastured rangeland, non-intensive agriculture, or wild areas with rock outcrops suitable for nesting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally transmission line support towers. About 1,053,800 acres of potentially suitable habitat occurs in the SEZ region.	99 acre of potentially suitable habitat lost (<0.01% of available potentially suitable habitat)	25,210 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	84 acres of potentially suitable habitat in area of potential direct effects and 1,690 acres of potentially suitable habitat in area of indirect effects	Small overall impact.

TABLE 10.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Upland Game Birds					
Mourning dove *(Zenaida macroura)*	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 3,427,400 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	110,006 acres of potentially suitable habitat (3.2% of available potentially suitable habitat)	115 acres of potentially suitable habitat in area of potential direct effect and 2,314 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

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

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

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 acres of direct effect within the SEZ was assumed.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 7,783 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For transmission line development, direct effects were estimated within a 4-mi (6.4-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

Footnotes continued on next page.

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TABLE 10.1.11.2-1 (Cont.)

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

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

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

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

(NEPA) assessments and coordination with federal or state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on birds (see Section 10.1.11.2.3).

In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), and from disturbance, injury, or mortality to individual birds. Table 10.1.11.2-1 summarizes the potential impacts on birds resulting from solar energy development in the proposed Antonito Southeast SEZ. Direct impacts on bird species would be small, as only 0.5% or less of potentially suitable habitats identified for each species would be lost. Larger areas of potentially suitable habitat for bird species occur within the area of potential indirect effects (e.g., up to 6.0% of available potentially suitable habitat for Swainson's hawk). Other impacts on birds could result from collision with the transmission line and buildings, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (for example, impacts caused by dust generation, erosion, and sedimentation) are expected to be negligible with implementation of programmatic design features.

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

10.1.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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

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

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

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

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

If these SEZ-specific design features are implemented in addition to programmatic design features, impacts on bird species could be reduced. Any residual impacts on birds are anticipated to be small given the relative abundance of potentially suitable habitats in the SEZ region. However, as potentially suitable habitats for a number of the bird species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

10.1.11.3 Mammals

10.1.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Antonito Southeast SEZ. The list of mammal species potentially present in the SEZ area was determined from the Colorado Natural Diversity Information Source (CDOW 2009) and habitat information from CDOW (2009), USGS (2007), and NatureServe (2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005, 2007). See Appendix M for additional information on the approach used. The following discussion emphasizes big game and other mammal species that (1) have key habitats within or near the SEZ, (2) are important to humans (e.g., big game, small game, and furbearer species), and/or (3) are representative of other species that share similar habitats.

Big Game

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

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

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

Source: CDOW (2008).

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

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

TABLE 10.1.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Big Game (Cont.)					
Elk (Cervis canadensis)	Semi-open forest, mountain meadows, foothills, plains, valleys, and alpine tundra. Uses open spaces such as alpine pastures, marshy meadows, river flats, brushy clean cuts, forest edges, and semidesert areas. Abundant in Conejos County. About 3,023,300 acres of potentially suitable habitat occurs in the SEZ region.	16 acres of potentially suitable habitat lost (<0.001% of available potentially suitable habitat)	9,987 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	8 acres of potentially suitable habitat in area of potential direct effects and 161 acres of potentially suitable habitat in area of indirect effects	Small overall impact.
Mule deer (*Odocoileus hemionus*)	Most habitats including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. Common in Conejos County. About 4,459,300 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	107,771 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	95 acres of potentially suitable habitat in area of potential direct effects and 1,911 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Pronghorn (*Antilocapra americana*)	Grasslands and semidesert shrublands on rolling topography that affords good visibility. Most abundant in shortgrass or midgrass prairies and least common in xeric habitats. Common in Conejos County. About 2,312,600 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	102,881 acres of potentially suitable habitat (4.4% of available potentially suitable habitat)	86 acres of potentially suitable habitat in area of potential direct effects and 1,730 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.1.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers					
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 4,548,100 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	88,814 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	23 acres of potentially suitable habitat in area of potential direct effects and 463 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Coyote (*Canis latrans*)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, they are restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 4,964,800 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	113,150 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	120 acres of potentially suitable habitat in area of potential direct effect and 2,414 acres of potentially suitable habitat in area of indirect effects	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Desert cottontail (*Sylvilagus audubonii*)	Grasslands, especially in prairie dog colonies. Also in other habitats such as montane shrublands, riparian lands, semidesert shrublands, pinyon-juniper woodlands, and various woodland-edge habitats. Can occur in areas with minimal vegetation as long as adequate cover is present. About 3,085,700 acres of potentially suitable habitat occurs in the SEZ region.	7,783 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	106,349 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	93 acres of potentially suitable habitat in area of potential direct effects and 1,871 acres of potentially suitable habitat in area of indirect effects	Small overall impact. Avoidance of prairie dog colonies would further reduce the potential for impact.

TABLE 10.1.11.3-2 (Cont.)

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

TABLE 10.1.11.3-2 (Cont.)

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

TABLE 10.1.11.3-2 (Cont.)

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

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TABLE 10.1.11.3-2 (Cont.)

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

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

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

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations. A maximum of 7,783 acres of direct effect within the SEZ was assumed.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 7,783 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For transmission line development, direct effects were estimated within a 4-mi (6.4-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

Footnotes continued on next page.

TABLE 10.1.11.3-2 (Cont.)

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

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

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

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

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

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

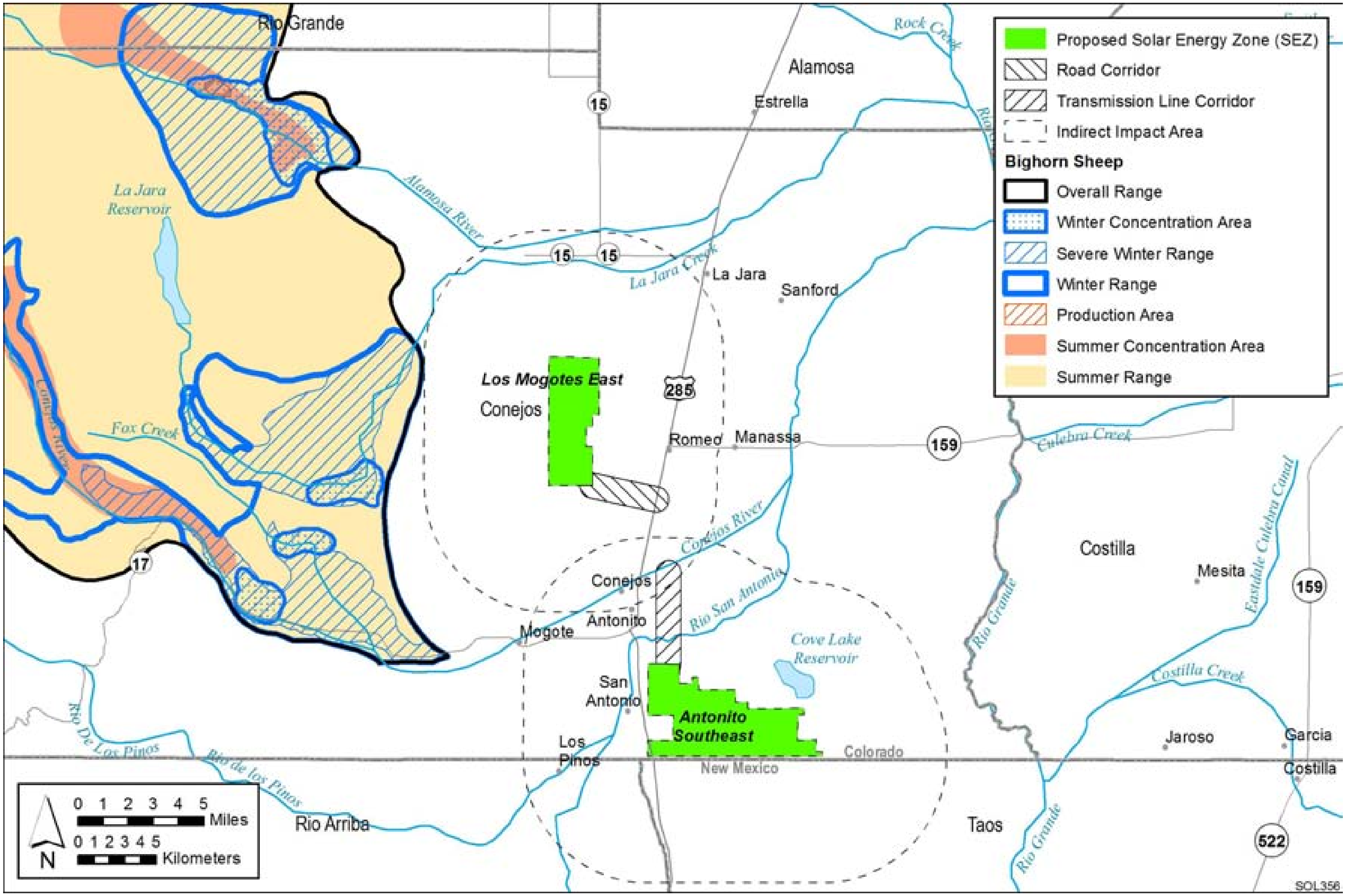
Bighorn Sheep. No mapped activity areas for the bighorn sheep occur in the proposed Antonito Southeast SEZ (Figure 10.1.11.3-1). The nearest that the SEZ is located to any bighorn sheep activity areas is 8 mi (13 km) east of the overall range, winter range, severe winter range, and summer range. Since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

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

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

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

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



1

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

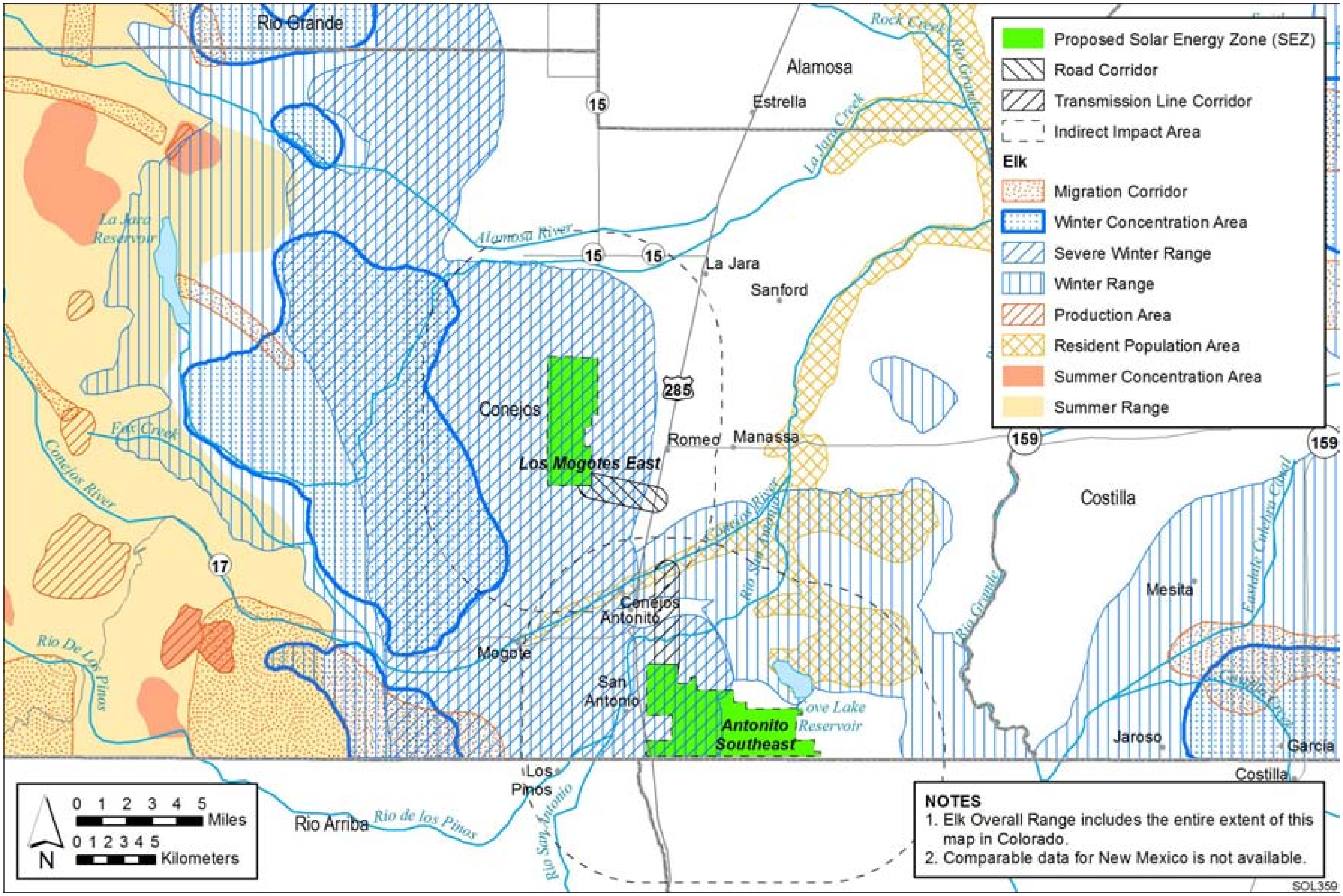


FIGURE 10.1.11.3-2 Elk Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

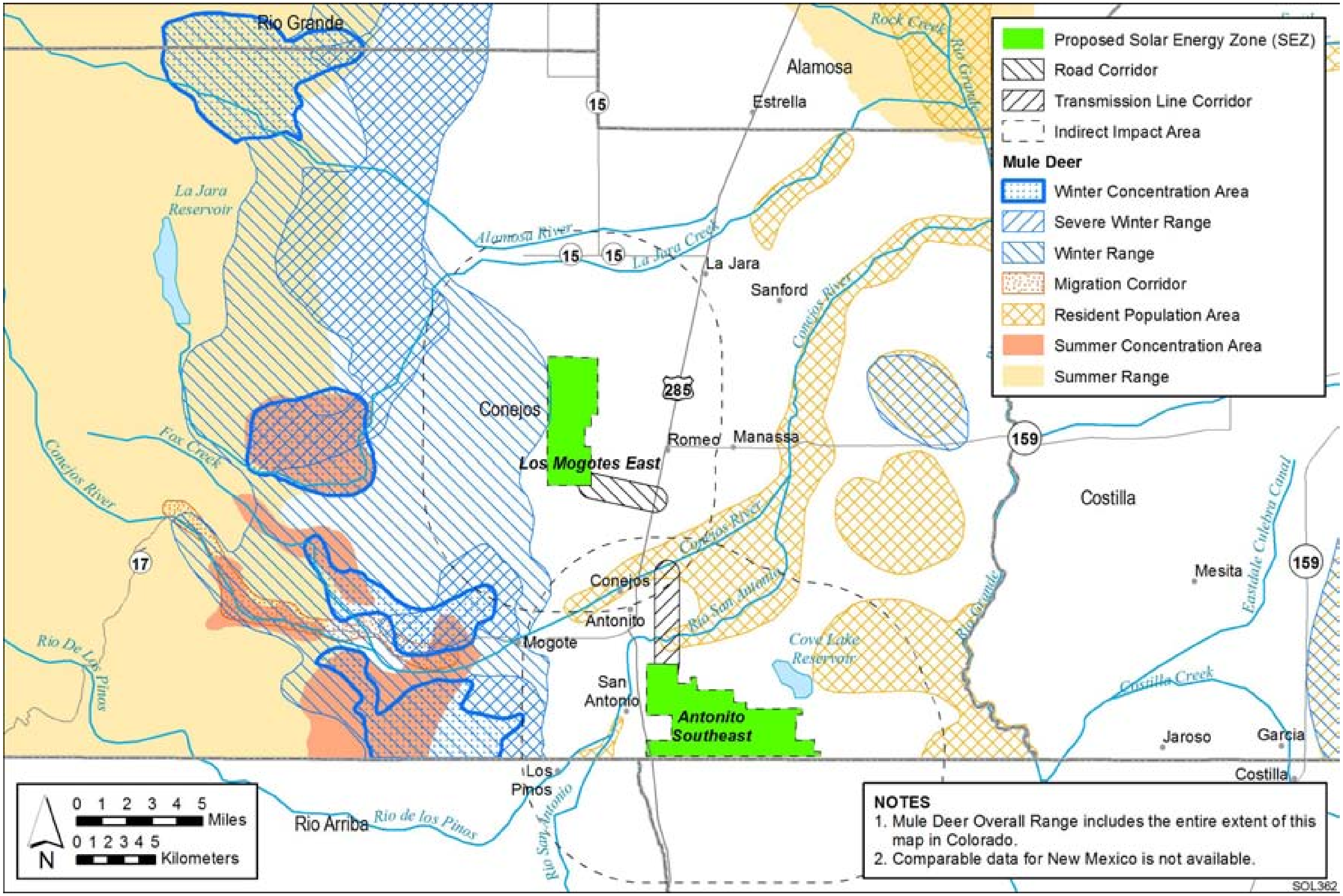


FIGURE 10.1.11.3-3 Mule Deer Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

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

Other Mammals

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

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

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

10.1.11.3.2 Impacts

The types of impacts that mammals could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 and through the application of additional mitigation measures. Section 10.1.11.3.3, below, identifies SEZ-specific design features of particular relevance to the proposed Antonito Southeast SEZ.

The assessment of impacts on mammal species is based on available information on the presence of species in the affected area as presented in Section 10.1.11.3.1, following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on mammals (see Section 10.1.11.3.3).

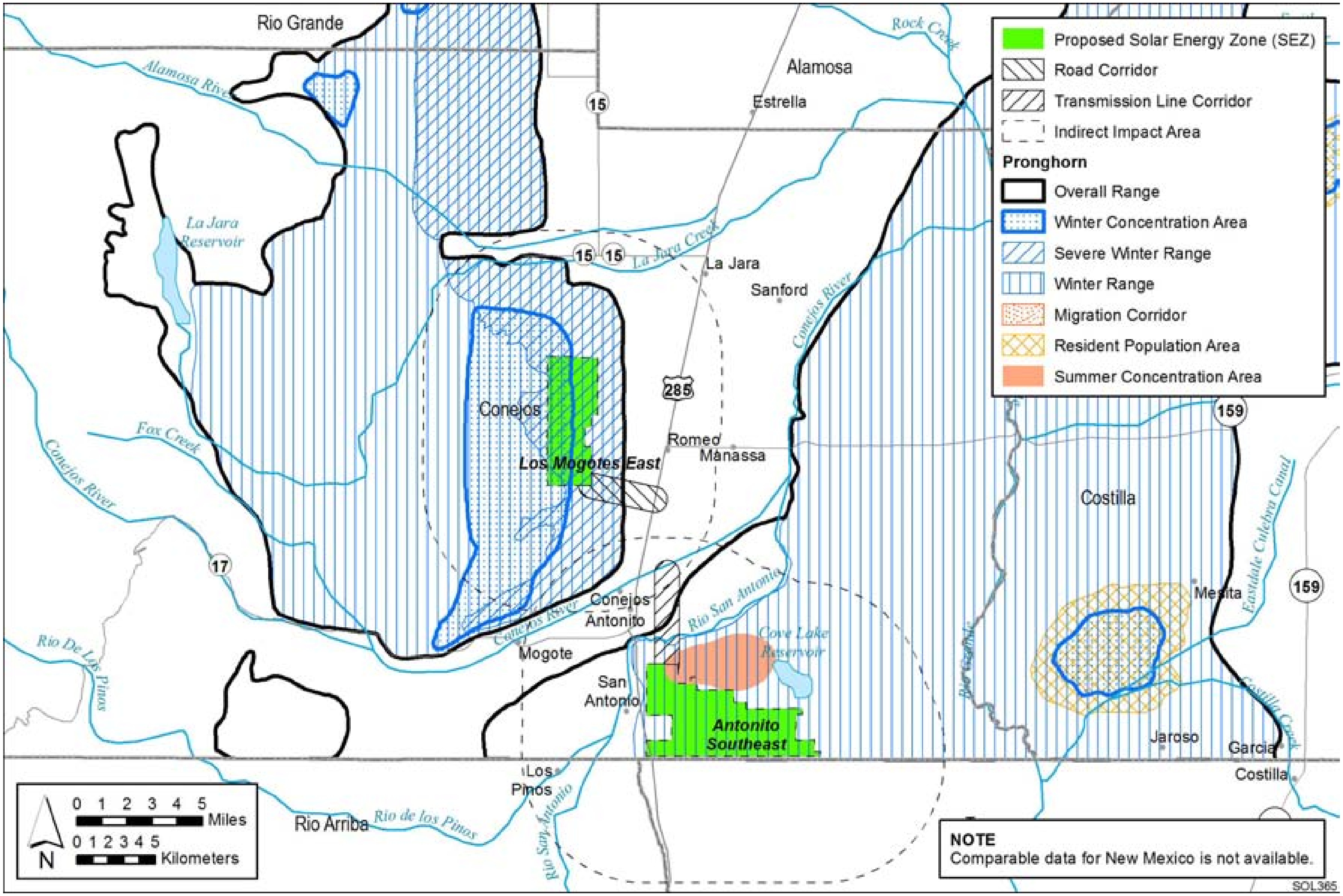


FIGURE 10.1.11.3-4 Pronghorn Activity Areas within the Region That Encompasses the Proposed Antonito Southeast SEZ (Source: CDOW 2008)

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

American Black Bear

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

Bighorn Sheep

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

Cougar

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

Elk

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

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

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

TABLE 10.1.11.3-3 (Cont.)

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

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

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

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

[d] The area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff, dust, noise, lighting, etc. from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ boundary or transmission line ROW.

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

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

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

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

Source: CDOW (2008).

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

Mule Deer

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

Pronghorn

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

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

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

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

a Activity areas are described in Table 10.1.11.3-1.

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

Footnotes continued on next page.

TABLE 10.1.11.3-4 (Cont.)

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

[d] The area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff, dust, noise, lighting, etc. from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ boundary or transmission line ROW.

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

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

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

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

Source: CDOW (2008).

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

Summary

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

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

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

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

a Activity areas are described in Table 10.1.11.3-1.

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

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

Footnotes continued on next page.

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TABLE 10.1.11.3-5 (Cont.)

[d] The area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff, dust, noise, lighting, etc. from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ boundary or transmission line ROW.

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

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

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

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

Source: CDOW (2009).

areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for mammal species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

10.1.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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

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

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

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

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

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

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

10.1.11.4 Aquatic Biota

10.1.11.4.1 Affected Environment

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

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

Animals that live in fishless ephemeral or nonpermanent pools, such as Alta Lake, are typically invertebrates that are either aquatic opportunists (i.e., species that occupy both temporary and permanent waters) or specialists adapted to living in temporary aquatic environments (Graham 2001). Although most ephemeral aquatic habitats are populated with widespread species, some contain species endemic to particular geographic regions or even specific habitats (Graham 2001). No surveys of organisms that inhabit Alta Lake have been conducted. However, on the basis of information for other ephemeral pools in the American Southwest, ostracods (seed shrimp) and small planktonic crustaceans (e.g., copepods or cladocerans) are expected to be present, and larger branchiopod crustaceans such as fairy shrimp could occur (Graham 2001). Various types of insects that have aquatic larval stages are also likely to occur, depending on pool longevity, nearness to permanent water, and the abundance of other invertebrates for prey (Graham 2001). Examples of insects that are likely to be present in Alta Lake include dragonflies and a variety of midges and other fly larvae.

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

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

10.1.11.4.2 Impacts

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

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

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

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

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

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

As described in Section 5.10.3, water quality in aquatic habitats could be affected by the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site characterization, construction, operation, or decommissioning of a solar energy facility. Depending upon the types and quantity, contaminants that directly entered Alta Lake could have a considerable impact on the aquatic biota there because of the small size of the lake and low potential for the dilution of contaminants. Because of the distance from the Antonito Southeast SEZ to the nearest streams, the potential for solar energy development activities within the SEZ to introduce contaminants into stream habitats would be low.

10.1.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for effects on aquatic biota and aquatic habitats from development and operation of solar energy facilities. While some SEZ-specific design features are best established when project details are being considered, some design features can be identified at this time, as follows:

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

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

If these SEZ-specific design features are implemented in addition to programmatic design features and if the utilization of water from groundwater or surface water sources is adequately controlled to maintain sufficient water levels in nearby aquatic habitats, the potential impacts on aquatic biota and habitats from solar energy development at the Antonito Southeast SEZ would be small.

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

This section addresses special status species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Antonito Southeast SEZ. Special status species include the following types of species[5]:

- Species listed as threatened or endangered under the Endangered Species Act (ESA);
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the states of Colorado or New Mexico[6];
- Species that are listed by the BLM as sensitive; and
- Species that have been ranked by the states of Colorado or New Mexico as S1 or S2, or listed as species of concern by the state of Colorado or the USFWS; hereafter referred to as "rare" species.

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

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

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

10.1.12.1 Affected Environment

The affected area considered in our assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). For the Antonito Southeast SEZ, the area of direct effect included the SEZ and the areas within the transmission corridor where ground-disturbing activities are assumed to occur. No new access road developments are expected to be needed to serve development on the SEZ due to the proximity of existing infrastructure (refer to Section 10.1.1.2 for development assumptions).The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and the portion of the transmission corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. Indirect effects considered in the assessment included effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ and transmission corridor, but do not include ground-disturbing activities. The potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

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

All special status species that are known to occur within the Antonito Southeast SEZ region (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest location, and habitats, in Appendix J. Of these species, there are 38 that could occur on or in the affected area, based on recorded occurrences or the presence of suitable habitat in the area. These species, their status, and their habitats are presented in Table 10.1.12.1-1. For many of the species listed in the table, their predicted potential occurrence in the affected area is based only on a general correspondence between mapped SWReGAP land cover types and descriptions of species habitat preferences. This overall approach to identifying species in the affected area probably overestimates the number of species that actually occur in the affected area. For many of the species identified as having potentially suitable habitat in the affected area, the nearest known occurrence is more than 20 mi (32 km) away from the SEZ.

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

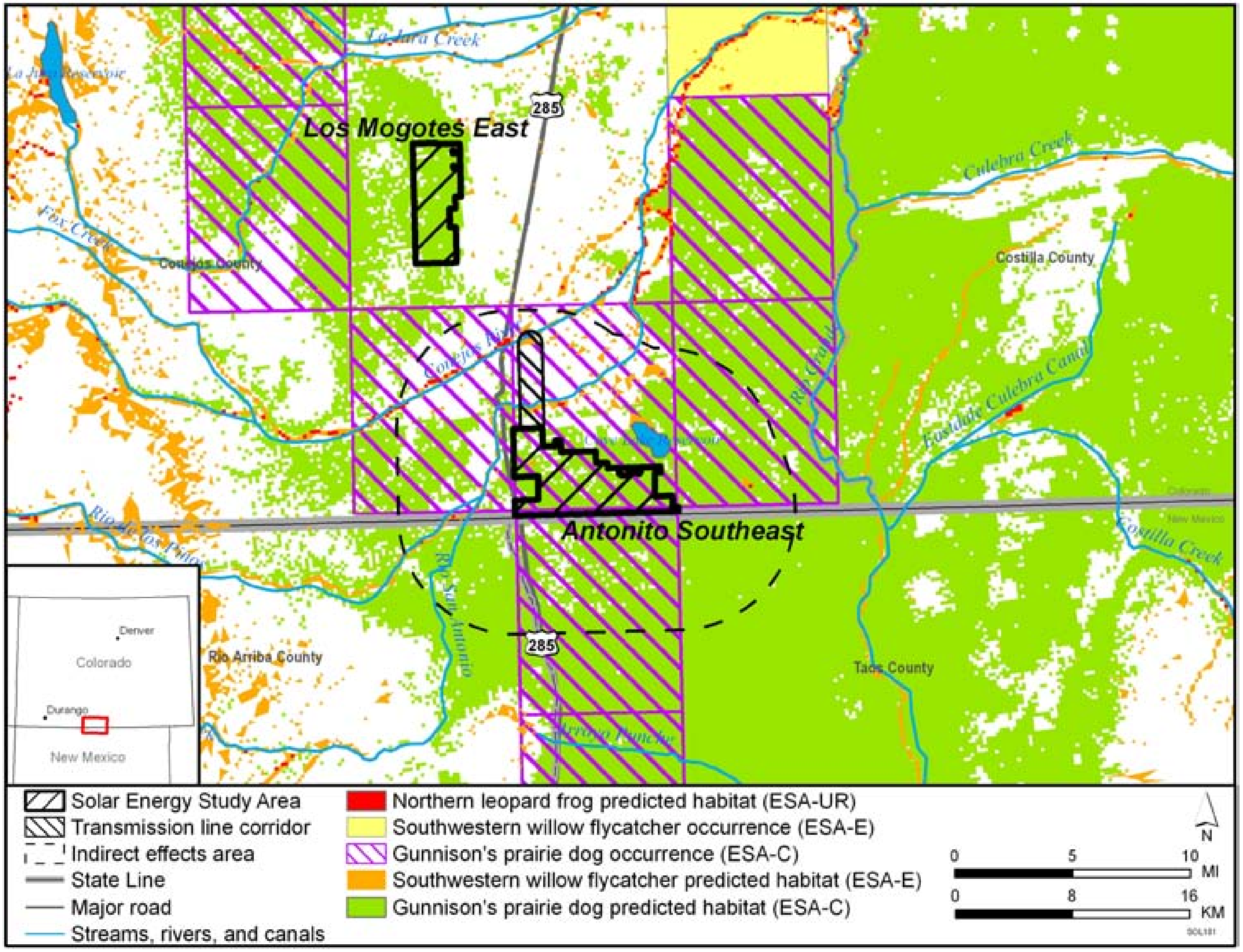

FIGURE 10.1.12.1-1 Locations of Species Listed as Endangered, Threatened, Candidates for Listing, or Species under Review for Listing under the ESA That May Occur in the Proposed Antonito Southeast SEZ Affected Area (Sources: CNHP 2009; NatureServe 2010; USGS 2007)

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

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

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TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds							
American peregrine falcon	*Falco peregrinus anatum*	BLM-S; FWS-SC; CO-SC; CO-S2; NM-S2	Year-round resident in the SEZ region. Open spaces associated with high, near vertical cliffs and bluffs above 200 ft in height overlooking rivers. Nearest occurrences are from the Rio Grande National Forest approximately 20 mi west of the SEZ. About 3,747,350 acres of potentially suitable habitat occurs within the analysis area.	128 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	80 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	31,808 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Bald eagle	*Haliaeetus leucocephalus*	CO-T; NM-T; CO-S1; NM-S1	Year-round resident in the SEZ region. Seldom seen far from water, especially larger rivers, lakes, and reservoirs. Occurs locally in semiarid shrubland habitats where there is an abundance of small mammal prey. Known to occur in riparian habitats along the Rio Grande as near as 7 mi east of the Antonito Southeast SEZ. About 96,000 acres of potentially suitable habitat occurs in the affected area.	8,492 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	10 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	85,832 acres of potentially suitable habitat (5.3% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Predisturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Barrow's goldeneye	*Bucephala islandica*	BLM-S; CO-S2; NM-S2	Winter resident in the SEZ region on larger lakes and rivers. Known to occur in the San Luis Valley. About 150,000 acres of potentially suitable habitat occurs in the affected area.	43 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	5 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,500 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of suitable riparian and aquatic habitats associated with the Rio San Antonio in the transmission corridor would further reduce impact.
Ferruginous hawk	*Buteo regalis*	BLM-S; CO-SC; NM-S2	Summer resident in the affected area, but year-round resident in the SEZ region. Grasslands, sagebrush and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands throughout the project area. Nests in tall trees or on rock outcrops along cliff faces. Known to occur approximately 10 mi east of the Antonito Southeast SEZ. About 28,000 acres of potentially suitable habitat occurs in the affected area.	43 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	70 acres of potentially suitable foraging and nesting habitat lost (<0.1% of available potentially suitable habitat)	25,708 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

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

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; CO-T; FWS-SC; NM-SC	Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Known to occur in Conejos County, Colorado. About 1,984,700 acres of potentially suitable habitat occurs in the SEZ region.	9,700 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	80 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	101,400 acres of potentially suitable habitat (5.1% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied burrows and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mammals							
Big free-tailed bat	*Nyctinomops macrotis*	BLM-S; CO-S1; FWS-SC	Roosts in rock crevices on cliff faces or in buildings. Forages primarily in coniferous forests and arid shrublands. Known to occur in Conejos County, Colorado. About 120,000 acres of potentially suitable habitat occurs in the affected area.	9,729 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	85 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	106,038 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Gunnison's prairie dog	***Cynomys gunnisoni***	ESA-C; NM-S2	Mountain valleys, plateaus, and open brush habitats in the project area at elevations between 1,000 and 12,000 ft. Known to occur in the SEZ affected area in Colorado and northern New Mexico. About 83,000 acres of potentially suitable habitat occurs in the affected area.	8,293 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	9 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	75,310 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of active colonies in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Mitigation should be developed in coordination with the USFWS and CDOW.
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	BLM-S; CO-SC; CO-S2; FWS-SC	Semiarid shrublands, pinyon-juniper woodlands, and montane forests below elevations of 9,500 ft. Roosts in caves, mines, rock crevices, under bridges, or within buildings. Known to occur in the San Luis Valley about 10 mi north of the Antonito Southeast SEZ. About 110,000 acres of potentially suitable habitat occurs in the affected area.	9,729 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	82 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	99,983 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

TABLE 10.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Spotted bat	*Euderma maculatum*	BLM-S; NM-T	Ponderosa pine forests, pinyon-juniper woodlands, and open semiarid shrublands. Roosts on exposed rocky cliff faces. Known to occur in the western-most counties of Colorado and in northern New Mexico. May occur in Conejos County, Colorado. About 9,600 acres of potentially suitable habitat occurs in the affected area.	0 acres	12 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	9,189 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.
Yuma myotis	*Myotis yumanensis yumanensis*	BLM-S; FWS-SC	Primarily associated with canyonlands and mesas at lower elevations in southwestern Colorado and northern New Mexico. Foraging may occur in relatively dry shrubland habitats. Roosts in rock crevices, buildings, and mines. The species is known to occur in Conejos County, Colorado. About 92,000 acres of potentially suitable habitat occurs in the affected area.	9,729 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	83,336 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

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

Footnotes continued on next page.

TABLE 10.1.12.1-1 (Cont.)

[b] For plant and invertebrate species, potentially suitable habitat was determined using SWReGAP land cover types. For fish species, potentially suitable habitat was determined from USFWS ECOS, USFWS Recovery Plans, and USFS Conservation Assessments. For reptile, bird, and mammal species, potentially suitable habitat was determined using SWReGAP habitat suitability models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[c] Maximum area of potential habitat that could be affected relative to availability within the analysis area. Habitat availability for each species within the analysis area was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. No new access roads are assumed to be needed due to the proximity of existing roads to the SEZ.

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

[e] For transmission line development, direct effects were estimated within a 4-mi (6.5-km), 250-ft (76-m) wide ROW from the SEZ to the nearest transmission line. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide transmission corridor.

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

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

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

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

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

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

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

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

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

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

10.1.12.1.2 Species That Are Candidates for Listing under the ESA

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

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

10.1.12.1.3 Species That Are under Review for Listing under the ESA

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

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

10.1.12.1.4 BLM-Designated Sensitive Species

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

Brandegee's Milkvetch

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

Fragile Rockbrake

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

Many-Stemmed Spider-flower

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

Ripley's Milkvetch

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

Rock-Loving Aletes

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

Great Basin Silverspot Butterfly

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

Rio Grande Chub

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

Milk Snake

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

American Peregrine Falcon

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

Barrow's Goldeneye

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

Ferruginous Hawk

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

Mountain Plover

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

Western Burrowing Owl

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

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident in the Antonito Southeast SEZ region where it forages in a variety of habitats including coniferous forests and desert shrublands. The species roosts in rock crevices or in buildings. The species is known to occur in the San Luis Valley of southern Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the big free-tailed bat occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects.

Pale Townsend's Big-Eared Bat

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

(16 km) north of the Antonito Southeast SEZ. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the pale Townsend's big-eared bat occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

Spotted Bat

The spotted bat is a year-round resident in the Antonito Southeast SEZ region where it occurs in desert shrublands, grasslands, and mixed coniferous forests. The species roosts in caves, rock crevices, and buildings. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable habitat for the spotted bat does not occur on the SEZ, but suitable foraging habitat does occur in the transmission corridor and in portion s of the area of indirect effects (Table 10.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

Yuma Myotis

The Yuma myotis is a year-round resident in the Antonito Southeast SEZ region where it occurs in canyonlands, mesas, and arid shrubland habitats. The species roosts in mines, rock crevices, and buildings. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the pale Yuma myotis occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

10.1.12.1.5 State-Listed Species

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

Rio Grande Sucker

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

Bald Eagle

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

10.1.12.1.6 Rare Species

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

10.1.12.2 Impacts

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

The assessment of impacts on special status species is based on available information on the presence of species in the affected area as presented in Section 10.1.12.1 following the analysis approach described in Appendix M. It is assumed that, prior to development, surveys would be conducted to determine the presence of special status species and their habitats in and near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA consultations, and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid, minimize, or mitigate impacts on special status species (see Section 10.1.12.3).

Solar energy development within the Antonito Southeast SEZ could affect a variety of habitats (see Section 10.1.10). These impacts on habitats could in turn affect special status species that are dependent on those habitats. Based on CNHP records, occurrences for the following six special status species intersect the Antonito Southeast SEZ affected area: halfmoon milkvetch, James' cat's-eye, Ripley's milkvetch, Rio Grande chub, mountain plover, and Gunnison's prairie dog. Suitable habitat for each of these species may occur in the affected area. Other special status species were identified that may occur on the SEZ or within the affected area based on the presence of potentially suitable habitat. As discussed in Section 10.1.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur there, and may therefore overestimate impacts on some special status species.

Potential direct and indirect impacts on special status species within the SEZ and in the area of indirect effect outside the SEZ are presented in Table 10.1.12.1-1. In addition, the overall potential magnitude of impacts on each species (assuming design features are in place) is presented along with any potential species-specific mitigation measures that could further reduce impacts.

Impacts on special status species could occur during all phases of development (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy project within the SEZ. Construction and operation activities could result in short- or long-term impacts on individuals and their habitats, especially if those activities were sited in areas where special status species are known to or could occur. As presented in Section 10.1.1.2, a 4-mi (6.5-km) long transmission line is assumed to be needed to serve solar facilities within this SEZ. No new access roads developments are assumed to be needed due to the proximity of U.S. Highway 285 adjacent to the western boundary of the SEZ.

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

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

10.1.12.2.1 Impacts on Species Listed under the ESA

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

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

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

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

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

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

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

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

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

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

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

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

10.1.12.2.4 Impacts on BLM-Designated Sensitive Species

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

Brandegee's Milkvetch

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

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

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

Fragile Rockbrake

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

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

Many-Stemmed Spider-flower

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

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

Ripley's Milkvetch

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

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

Rock-Loving Aletes

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

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

Great Basin Silverspot Butterfly

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

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

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

Rio Grande Chub

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

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

Milk Snake

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

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

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

American Peregrine Falcon

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

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

Barrow's Goldeneye

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

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

Ferruginous Hawk

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

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

Avoidance of direct impacts on all foraging habitat (shrublands) is not feasible because suitable foraging habitat (shrublands) is widespread in the area of direct effect and readily available in other portions of the affected area. However, avoiding or minimizing disturbance of all potential nesting habitat (woodlands) or occupied nests within the transmission line corridor is feasible, and could reduce impacts. If avoidance or minimization of disturbance to all suitable nesting habitat or occupied habitat is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Mountain Plover

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

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

Avoidance of all potentially suitable foraging and nesting habitats is not feasible to mitigate impacts on the mountain plover because potentially suitable shrubland and grassland habitats are widespread throughout the area of direct effect and readily available in other portions of the SEZ region. Direct impacts on the mountain plover could be reduced by avoiding or minimizing disturbance to occupied nests and suitable habitat in the area of direct effects. If avoidance or minimization of disturbance to all occupied habitat is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Western Burrowing Owl

The western burrowing owl is considered a summer breeding resident within the Antonito Southeast SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 9,700 acres (39 km^2) of potentially suitable habitat on the SEZ and 80 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents about 0.5% of potentially suitable habitat in the SEZ region. About 101,400 acres (410 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 5.1% of the potentially suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of this area could serve as foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting on the SEZ and in the area of indirect effects has not been determined.

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

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

Big Free-Tailed Bat

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

0.3% of potentially suitable habitat in the SEZ region. About 106,038 acres (429 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 3.8% of the available suitable habitat in the region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the big free-tailed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Pale Townsend's Big-Eared Bat

The pale Townsend's big-eared bat is a year-round resident within the Antonito Southeast SEZ region and is known to occur approximately 10 mi (16 km) north of the SEZ. According to the SWReGAP habitat suitability model, approximately 9,729 acres (39 km^2) of potentially suitable habitat on the SEZ and 82 acres (0.3 km^2) of potentially suitable foraging habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents about 0.4% of available suitable habitat in the SEZ region. About 99,983 acres (405 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 3.8% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the pale Townsend's big-eared bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Spotted Bat

The spotted bat is a year-round resident within the Antonito Southeast SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 12 acres (<0.1 km^2) of potentially suitable habitat within the assumed transmission line corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents <0.1% of available suitable habitat in the SEZ region. About 9,189 acres (37 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 0.6% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

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

Yuma Myotis

The Yuma myotis is a year-round resident within the Antonito Southeast SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 9,729 acres (39 km^2) of potentially suitable habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.1.12.1-1). This direct impact area represents about 0.4% of available suitable habitat in the SEZ region. About 83,336 acres (337 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 3.1% of the available suitable habitat in the SEZ region (Table 10.1.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects; approximately 5 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the Yuma myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Antonito Southeast SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents <1% of potentially suitable foraging habitat in the SEZ region. The implementation of design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

10.1.12.2.5 Impacts on State-Listed Species

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

Rio Grande Sucker

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

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

Bald Eagle

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

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

Avoidance of all potentially suitable habitats is not feasible to mitigate impacts on the bald eagle because potentially suitable shrubland habitats are widespread throughout the area of direct effects and readily available in other portions of the SEZ region. However, avoiding or minimizing disturbance to all potentially suitable nesting habitat (riparian woodlands) or occupied nests within the transmission line corridor is feasible, and could reduce impacts. If avoidance or minimization of disturbance to all occupied habitat is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

10.1.12.2.6 Impacts on Rare Species

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

10.1.12.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for effects on special status species. While some SEZ-specific design features are best established when project details are being considered, some design features can be identified at this time, including the following:

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

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

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

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

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

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

- Consultations with the USFWS and CDOW should be conducted to address the potential for impacts on the southwestern willow flycatcher, a species listed as endangered under the ESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements.

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

- Harassment or disturbance of federally listed species, candidates for federal listing, BLM-designated sensitive species, state-listed species, rare species, and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and CDOW.

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

10.1.13 Air Quality and Climate

10.1.13.1 Affected Environment

10.1.13.1.1 Climate

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

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

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

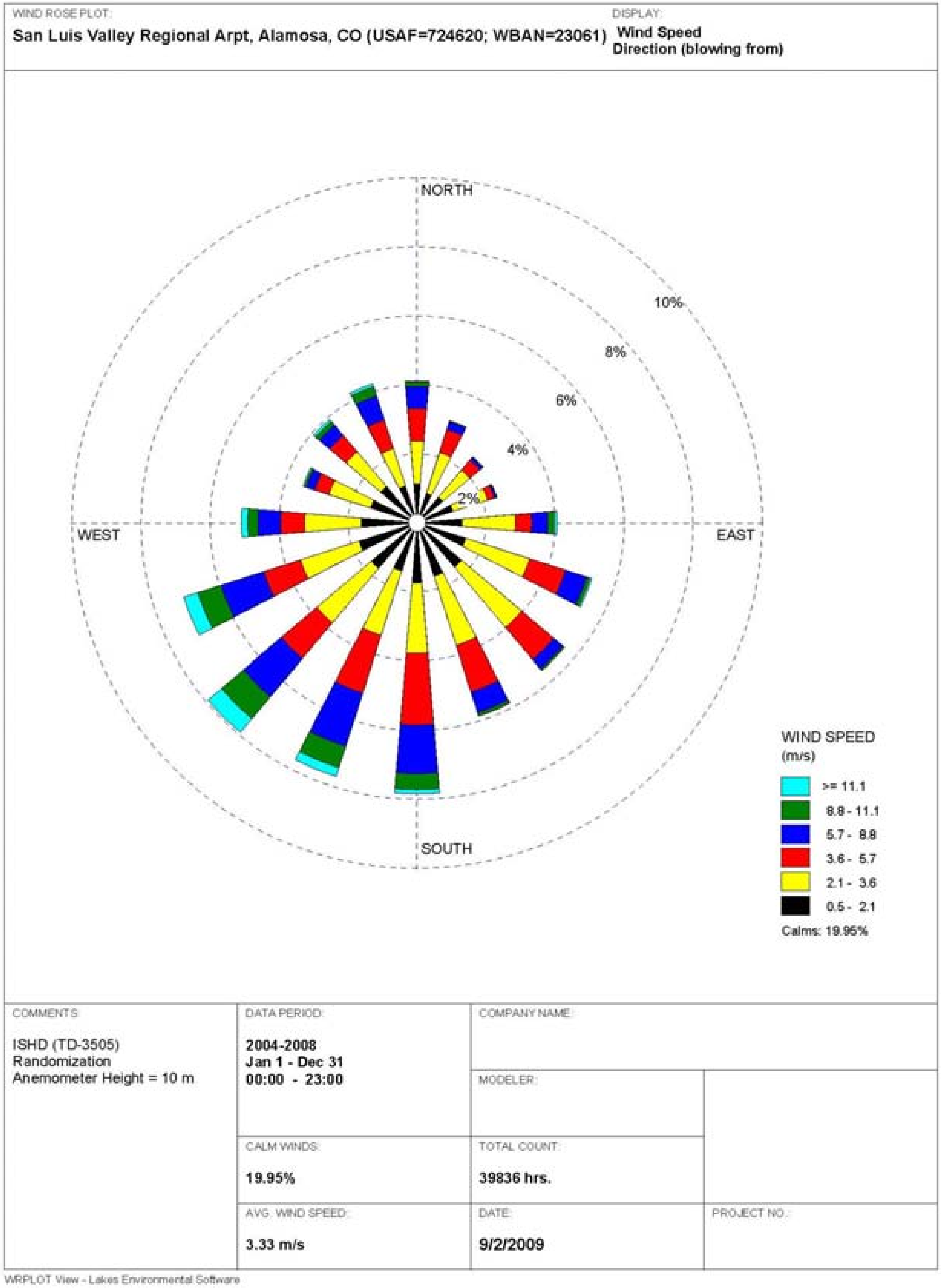

FIGURE 10.1.13.1-1 Wind Rose at 33-ft (10-m) Height at San Luis Valley Regional Airport, Alamosa, Colorado, 2004–2008 (Source: NCDC 2009b)

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

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

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

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

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

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

10.1.13.1.2 Existing Air Emissions

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

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

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

[a] Includes point, area, onroad and nonroad mobile, biogenic, and fire emissions.

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

Source: WRAP (2009).

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

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

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

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

10.1.13.1.3 Air Quality

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

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

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

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

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

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

Pollutant[a]	Averaging Time	NAAQS/ SAAQS[b]	Background Concentration Level	
			Concentration[c,d]	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
	8-hour	9 ppm	1 ppm (11%)	Ignacio on CR 517, 2005–2006
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,
	Annual	50 μg/m^3 [k]	13 μg/m^3 (26%)	West Site, 1991
$PM_{2.5}$	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; SO_2 = sulfur dioxide.

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

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

d Values in parentheses are background concentration levels as a percentage of NAAQS/SAAQS. Calculation of 1-hour SO_2, 1-hour NO_2, and rolling 3-month Pb to NAAQS was not made, because no measurement data based on new NAAQS are available.

e Effective August 23, 2010.

f NA = not applicable or not available.

Footnotes continued on next page.

TABLE 10.1.13.1-2 (Cont.)

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

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

[i] Effective April 12, 2010.

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

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

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

[m] Effective January 12, 2009.

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

The Prevention of Significant Deterioration (PSD) regulations (see 40 CFR 52.21), which are designed to limit the growth of air pollution in clean areas, apply to a major new or modification of an existing major source within an attainment or unclassified area (see Section 4.11.2.3). As a matter of policy, the EPA recommends that the permitting authority notify the Federal Land Managers when a proposed PSD source would locate within 100 km (62 mi) of a Class I area. There are several Class I areas around the Antonito Southeast SEZ, three of which are situated within 100 km (62 mi). The nearest Class I area is the Wheeler Peak WA in New Mexico (40 CFR 81.421), about 35 mi (57 km) southeast of the Antonito Southeast SEZ. This Class I area is not located downwind of prevailing winds at the Antonito Southeast SEZ (Figure 10.1.13.1-1). The other two Class I areas within this range are Great Sand Dunes WA and Weminuche WA in Colorado (40 CFR 81.406), which are located about 45 mi (73 km) north–northeast and 54 mi (87 km) northwest of the Antonito Southeast SEZ, respectively. The Great Sand Dunes WA is located downwind of prevailing winds at the Antonito Southeast SEZ, while the Weminuche WA is not.

10.1.13.2 Impacts

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

Air quality impacts shared by all solar technologies are discussed in detail in Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific to the Antonito Southeast SEZ are presented in the following sections. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 and through any additional mitigation applied. Section 10.1.13.3 identifies SEZ-specific design features of particular relevance to the Antonito Southeast SEZ.

10.1.13.2.1 Construction

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

Methods and Assumptions

Air quality modeling for PM_{10} and $PM_{2.5}$ emissions associated with construction activities was performed using the EPA-recommended AMS/EPA Regulatory Model (AERMOD) (EPA 2009c). Details for emissions estimation, the description of AERMOD, input data processing procedures, and modeling assumption are described in Section M.13 of Appendix M. Estimated air concentrations were compared with the applicable NAAQS/SAAQS levels at the site boundaries and nearby communities and with PSD increment levels at nearby Class I areas.[10] For the Antonito Southeast SEZ, the modeling was conducted based on the following assumptions and input:

- Uniformly distributed emissions over the 3,000 acres (12.1 km^2) in the northwest corner of the SEZ, close to the nearest town of Antonito;
- Surface hourly meteorological data from the San Luis Valley Regional Airport in Alamosa and upper air sounding data from Denver for the 2004 to 2008 period;
- A regularly spaced receptor grid over a modeling domain of 62 × 62 mi (100 km × 100 km) centered on the proposed SEZ; and

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

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

Results

The modeling results for both PM_{10} and $PM_{2.5}$ concentration increments and total concentrations (modeled plus background concentrations) that would result from construction-related fugitive emissions are summarized in Table 10.1.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled to occur at the site boundaries would be about 569 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. Total 24-hour PM_{10} concentrations of 596 μg/m^3 would also exceed the standard level, by about a factor of 4, at the SEZ boundary. However, high PM_{10} concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Predicted maximum 24-hour PM_{10} concentration increments would be about 230 μg/m^3 at the nearest residence, about 0.5 mi (0.8 km) north of the SEZ; about 100 μg/m^3 at Antonito; about 70 μg/m^3 at Conejos; about 60 μg/m^3 at San Antonio; and about 30 μg/m^3 at Manassa and Romeo. Annual average modeled and total PM_{10} concentration increments at the SEZ boundary would be about 106 μg/m^3 and 119 μg/m^3, respectively, which are higher than the standard level of 50 μg/m^3. Annual PM_{10} increments would be much lower for the mentioned locations, about 18 μg/m^3 at the nearest residence, about 3 to 4 μg/m^3 at Antonito and San Antonio, about 2 μg/m^3 at Conejos, and less

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

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

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

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

[c] A dash indicates not applicable.

Source: Chick (2009) for background concentration data.

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

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

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

Emissions from the engine exhaust from heavy equipment and vehicles could affect air-quality-related values (AQRVs) (e.g., visibility and acid deposition) at the nearby federal Class I areas. SO_x emissions from engine exhaust would be very low because required programmatic design features would require that ultra-low-sulfur fuel with a sulfur content of 15 ppm be used. NO_x emissions from engine exhaust would be primary contributors to potential impacts on AQRVs. Construction-related emissions are temporary in nature and thus would cause some unavoidable but short-term impacts.

It is assumed that a transmission line would need to be constructed to connect to the nearest existing line located about 4 mi (6 km) north of the Antonito Southeast SEZ. As discussed in Section 5.11.1.5, this activity would result in fugitive dust emissions from soil disturbance and engine exhaust emissions from heavy equipment and vehicles (commuter, visitor, support, and delivery vehicles), as at other construction sites. Because of the short distance to the regional grid, transmission line construction from the Antonito Southeast SEZ could be performed in a relatively short time (likely a few months). The construction site along the transmission line ROW would move continuously. Thus no particular area would be exposed to air emissions for a prolonged period, and potential air quality impacts on nearby residences along the transmission line ROW would be minor and temporary.

10.1.13.2.2 Operations

Emission sources associated with the operation of a solar facility would include auxiliary boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for the parabolic trough or power tower technology if wet cooling were implemented (drift comprises low-level PM emissions).

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

Estimates of potential air emissions displaced by the solar project development at the Antonito Southeast SEZ are presented in Table 10.1.13.2-2. Total power generation capacity ranging from 865 to 1,557 MW was estimated for the Antonito Southeast SEZ for various solar technologies (see Section 10.1.1.2). The estimated amount of emissions avoided for the solar technologies evaluated depends only on the megawatts of conventional fossil fuel–generated power displaced, because a composite emission factor per megawatt-hour of power by conventional technologies is assumed (EPA 2009d). If the Antonito Southeast SEZ were fully developed, it is expected that emissions avoided would be substantial. Development of solar power in the SEZ would result in avoided air emissions ranging from 3.2 to 5.7% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Colorado (EPA 2009d). Avoided emissions would be up to 1.4% of total emissions from electric power systems in the six-state study area. When compared with all source categories, power production from the same solar facilities would displace up to 3.1% of SO_2, 1.0% of NO_x, and 2.6% of CO_2 emissions in the state of Colorado (EPA 2009a; WRAP 2009). These emissions would be up to 0.8% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for more than 96% of the total electric power generation in Colorado. The contribution of coal combustion is about 72%, followed by that of natural gas combustion at about 24%. Thus, solar facilities to be built in the Antonito Southeast SEZ could displace relatively more fossil fuel emissions than those built in other states that rely less on fossil fuel-generated power.

As discussed in Section 5.11.1.5, the operation of associated transmission lines would generate some air pollutants from activities such as periodic site inspections and maintenance. However, these activities would occur infrequently, and the amount of emissions would be small. In addition, transmission lines could produce minute amounts of O_3 and its precursor NO_x associated with corona discharge (i.e., the breakdown of air near high-voltage conductors), which is most noticeable for higher-voltage lines during rain or very humid conditions. Since the Antonito Southeast SEZ is in an arid desert environment, these emissions would be small, and potential impacts on ambient air quality associated with transmission lines would be negligible, considering the infrequent occurrences and small amount of emissions from corona discharges.

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

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

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

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

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

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

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

[f] A dash indicates not estimated.

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

10.1.13.2.3 Decommissioning/Reclamation

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

10.1.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. Limiting dust generation during construction and operations at the Antonito Southeast SEZ (e.g., by increased watering frequency, or road paving or treatment) is a required design feature under BLM's Solar Energy Program. These extensive fugitive dust control measures would keep off-site PM levels (particularly at Wheeler Peak WA, New Mexico, and Great Sand Dunes WA) as low as possible during construction.

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10.1.14 Visual Resources

10.1.14.1 Affected Environment

10.1.14.1.1 Regional Setting

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

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

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

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

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

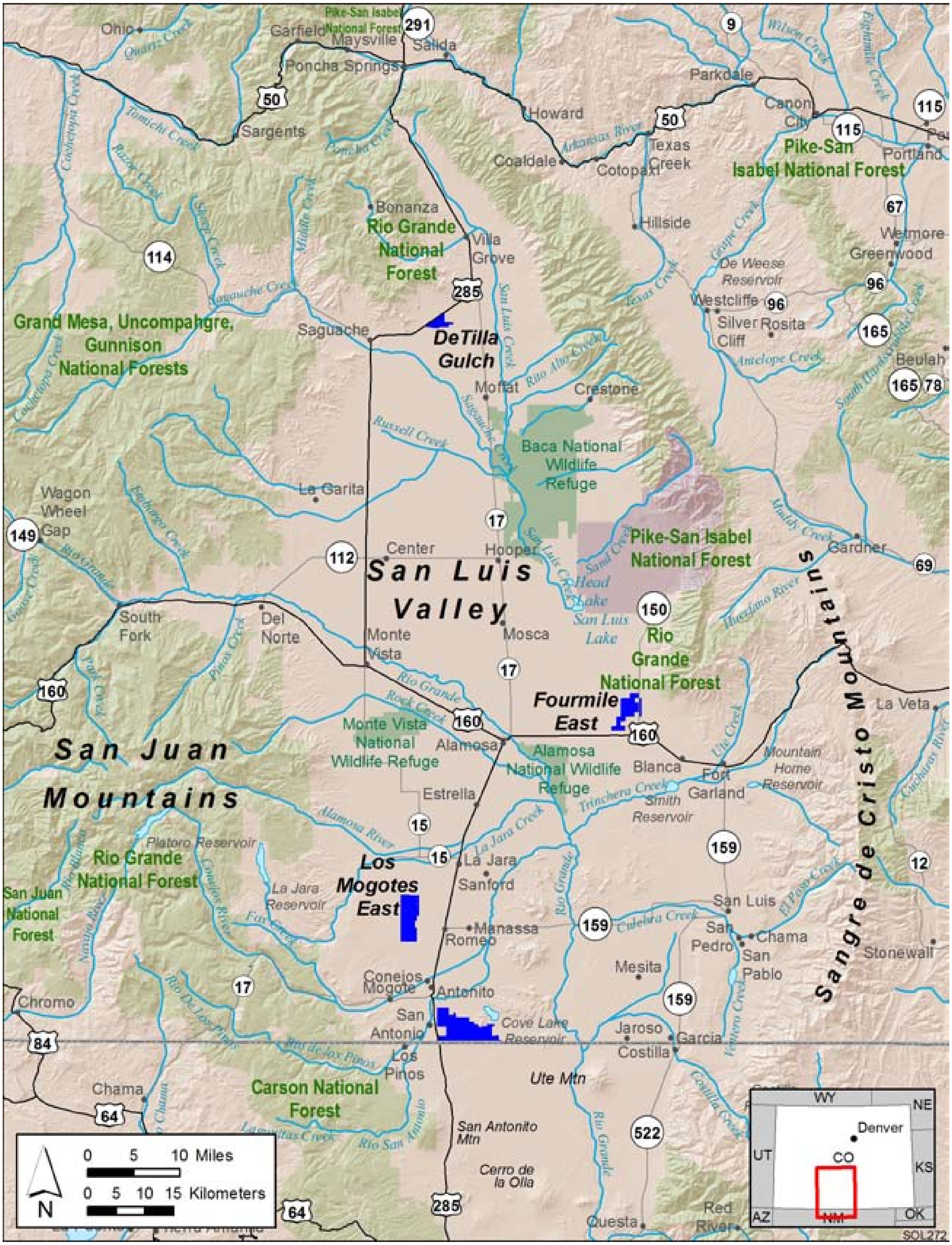

FIGURE 10.1.14.1-1 The San Luis Valley

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

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

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

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

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

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

10.1.14.1.2 Proposed Antonito Southeast SEZ

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

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

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

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

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

The BLM conducted a visual resource inventory (VRI) for the SEZ and surrounding lands in 2009 (BLM 2010). The VRI evaluates BLM-administered lands based on scenic quality; sensitivity level, in terms of public concern for preservation of scenic values in the evaluated lands; and distance from travel routes or key observation points (KOPs). Based on these three factors, BLM-administered lands are placed into one of four VRI Classes, which represent the relative value of the visual resources. Class I and II are the most valued; Class III represents a moderate value; and Class IV represents the least value. Class I is reserved for specially designated areas, such as national wildernesses and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape. Class II is the

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

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

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

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

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

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

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

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

10.1.14.2 Impacts

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

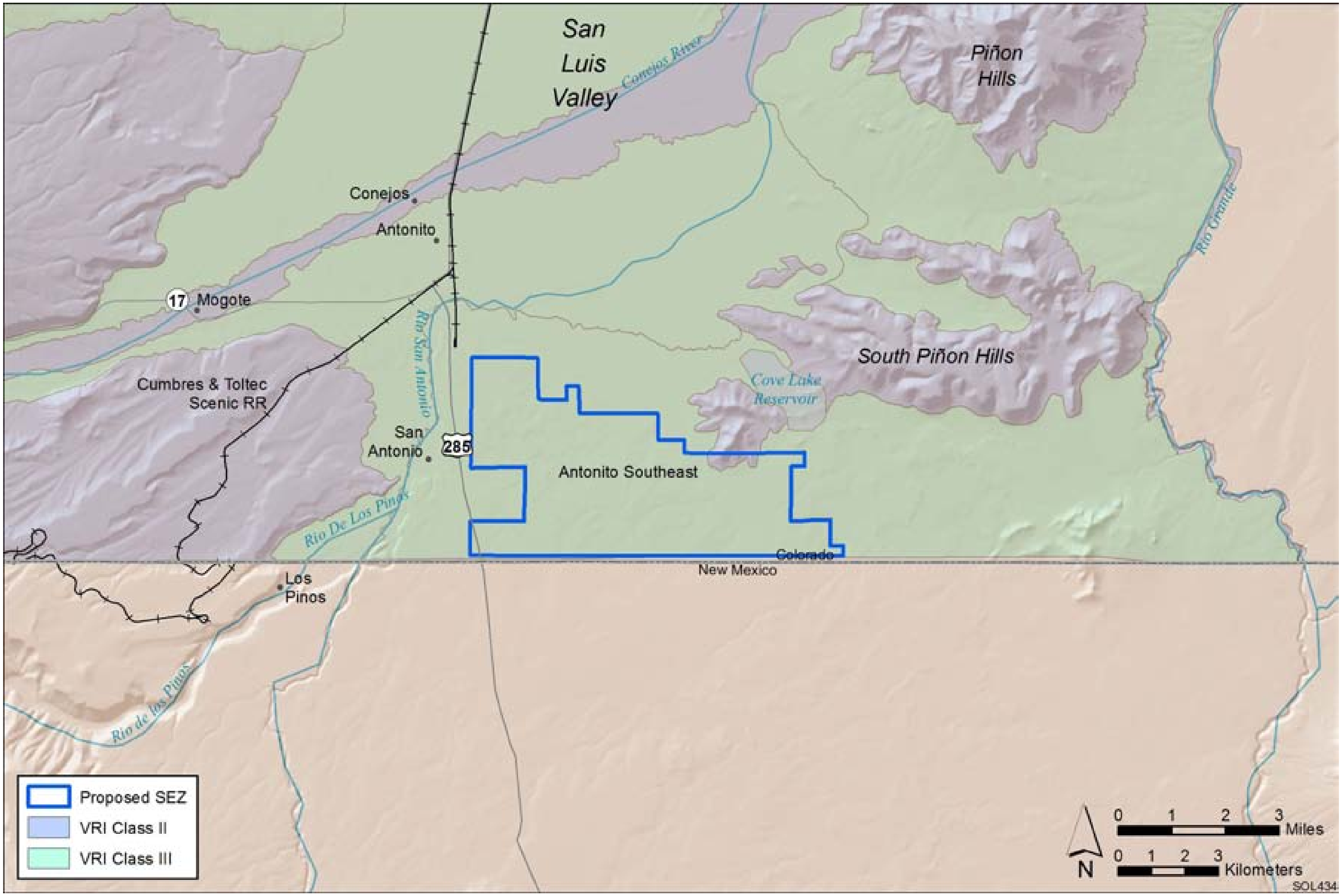

FIGURE 10.1.14.1-5 Visual Resource Inventory Values for the Proposed Antonito Southeast SEZ and Surrounding Lands

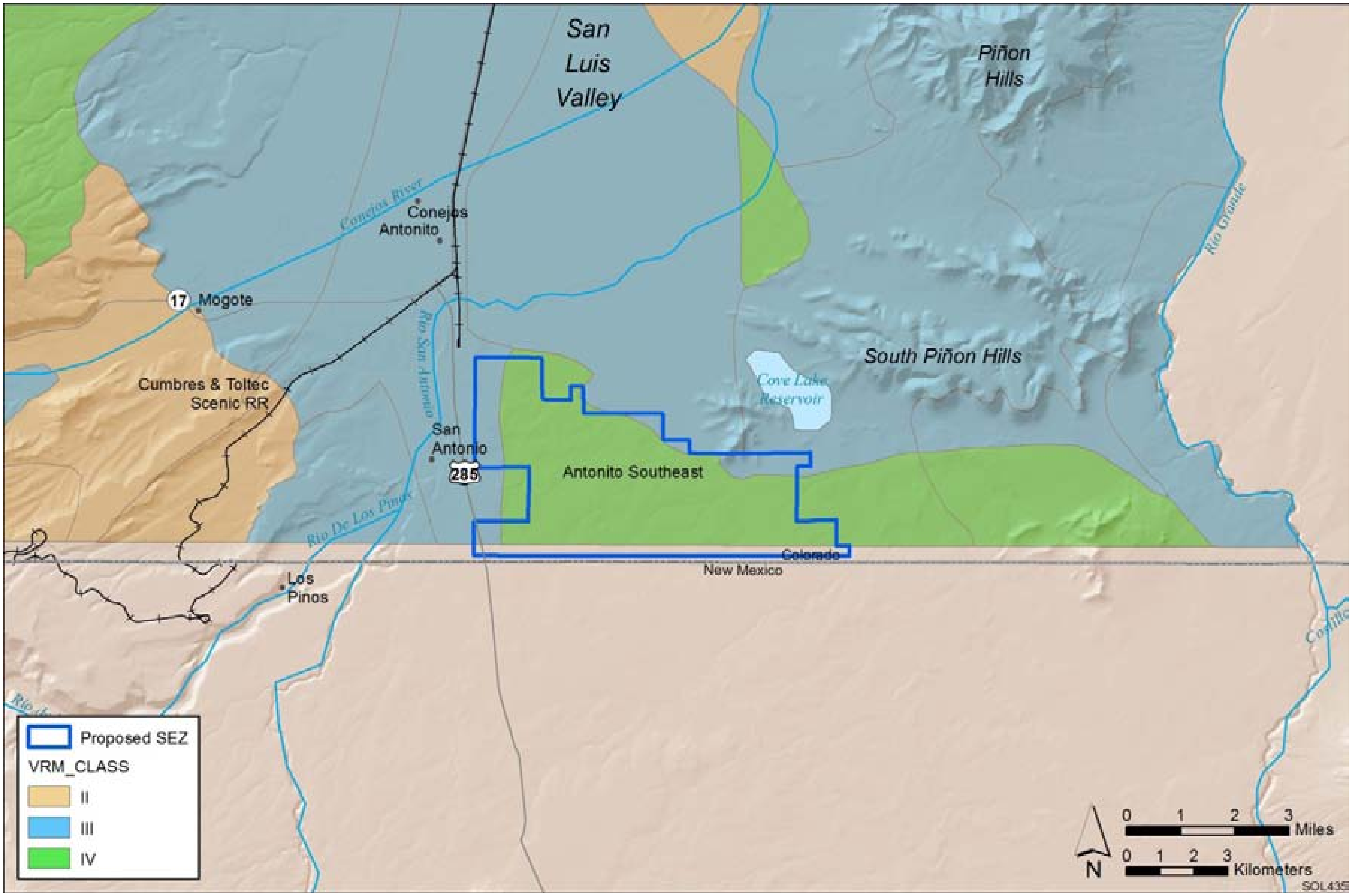

FIGURE 10.1.14.1-6 Visual Resource Management Classes for the Proposed Antonito Southeast SEZ and Surrounding Lands

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

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

10.1.14.2.1 Impacts on the Proposed Antonito Southeast SEZ

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

Common and technology-specific visual impacts from utility-scale solar energy development, as well as impacts associated with electric transmission lines, are discussed in Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and decommissioning, and some impacts could continue after project decommissioning. Visual impacts resulting from solar energy development in the SEZ would be in addition to impacts from solar energy and other projects that may occur on other public or private lands within the SEZ viewshed and are subject to cumulative effects. For discussion of cumulative impacts, see Section 10.1.22.4.13of this PEIS.

The changes described above would be expected to be consistent with BLM VRM objectives for VRM Class IV, as seen from nearby KOPs. As shown in Figure 10.1.14.1-6, more than 75% of the SEZ is currently designated as VRM Class IV. For the remainder of the site, depending on the type of facility built, project layout, visibility factors, and mitigations employed, impacts could exceed those consistent with objectives for VRM Class III. More information about impact determination using the BLM VRM program is available in Section 5.12 and in *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1 (BLM 1986b).

10.1.14.2.2 Impacts on Lands Surrounding the Proposed Antonito Southeast SEZ

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

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

Figure 10.1.14.2-1 shows the combined results of the viewshed analyses for all four solar technologies. The colored segments indicate areas with clear lines of sight to one or more areas within the SEZ and from which solar facilities within these areas of the SEZ would be expected to be visible, assuming the absence of screening vegetation or structures and adequate lighting and other atmospheric conditions. The light brown areas are locations from which PV and parabolic trough arrays located in the SEZ could be visible. Solar dishes and power blocks for

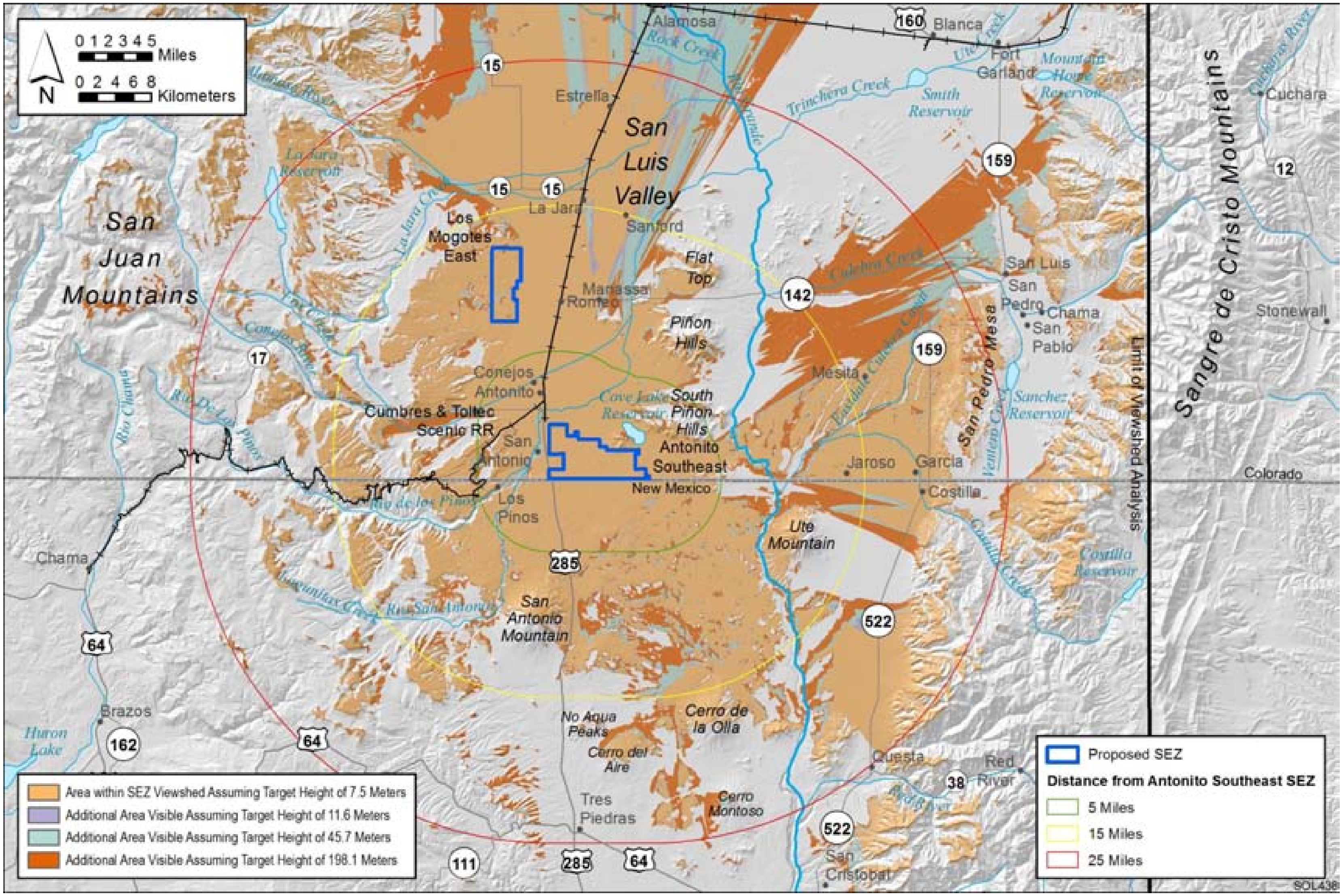

FIGURE 10.1.14.2-1 Viewshed Analyses for the Proposed Antonito Southeast SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

CSP technologies would be visible from the areas shaded in light brown and the additional areas shaded in light purple. Transmission towers and short solar power towers would be visible from the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power tower facilities located in the SEZ could be visible from areas shaded light brown, light purple, light blue, and at least the upper portions of power tower receivers could be visible from the additional areas shaded in medium brown.

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

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

Figure 10.1.14.2-2 shows the results of a GIS analysis that overlays selected federal, state, and BLM-designated sensitive visual resource areas onto the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds, in order to illustrate which of these sensitive visual resource areas could have views of solar facilities within the SEZ and therefore potentially would be subject to visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-specified foreground–middleground distance (5 mi [8 km]), background distance (15 mi [24 km]), and a 25-mi (40-km) distance zone are shown as well, in order to indicate the effect of distance from the SEZ on impact levels, which are highly dependent on distance.

The scenic resources included in the analysis were as follows:

- National Parks, National Monuments, National Recreation Areas, National Preserves, National Wildlife Refuges, National Reserves, National Conservation Areas, National Historic Sites;
- Congressionally authorized Wilderness Areas;
- Wilderness Study Areas;
- National Wild and Scenic Rivers;
- Congressionally authorized Wild and Scenic Study Rivers;
- National Scenic Trails and National Historic Trails;
- National Historic Landmarks and National Natural Landmarks;

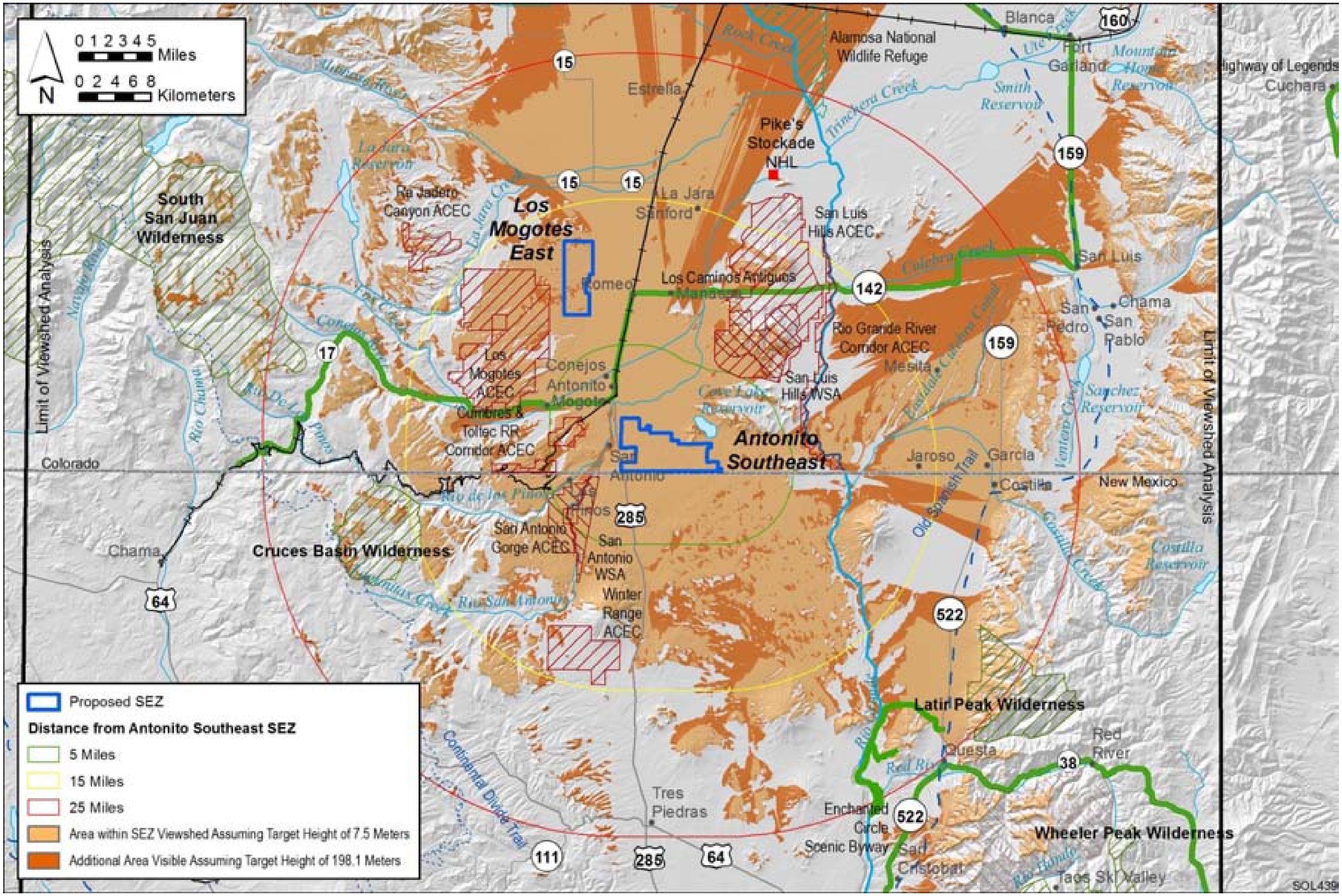

FIGURE 10.1.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds

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

- BLM-designated Special Recreation Management Areas; and

- ACECs designated because of outstanding scenic qualities.

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

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

National Wildlife Refuge

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

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

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

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

TABLE 10.1.14.2-1 (Cont.)

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

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

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

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

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

GOOGLE EARTH™ VISUALIZATIONS

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

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

Wilderness Areas

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

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

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

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

Wilderness Study Areas

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

  Figure 10.1.14.2-3 is a three-dimensional perspective visualization created with Google Earth depicting the SEZ (highlighted in orange) as it would be seen from a point in the northeast portion of the WSA, 2.6 mi (4.3 km) west–southwest of the southwest corner of the SEZ. The viewpoint is about 150 ft (46 m) higher in elevation than the nearest point in the SEZ. The visualization includes simplified wireframe models of a hypothetical solar power tower facility. The models were placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities. The receiver towers depicted in the visualization are properly scaled models of a 459-ft (140-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m)

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

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

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

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

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

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

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

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

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

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

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

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

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

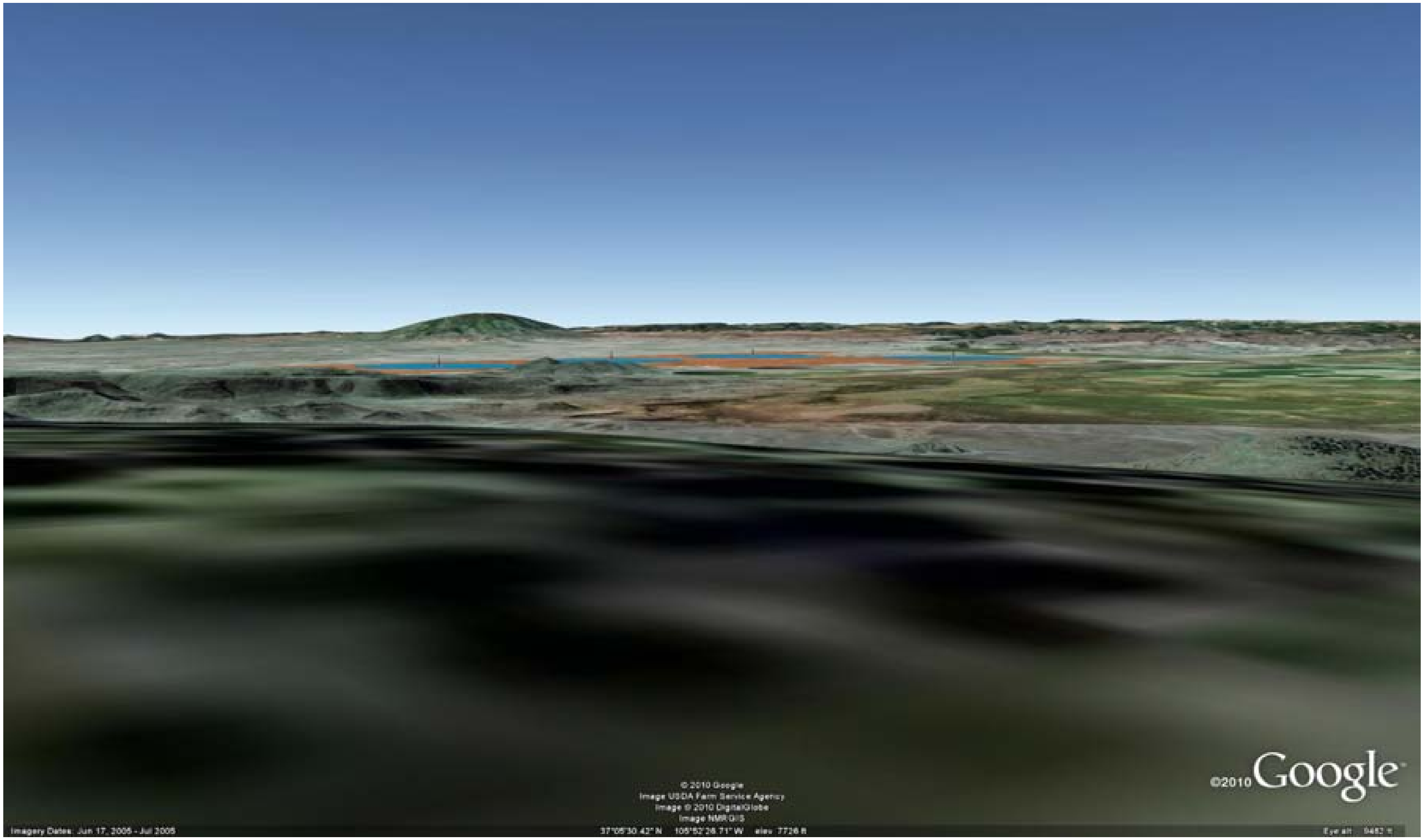

FIGURE 10.1.14.2-4 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Peak within the San Luis Hills WSA and the San Luis Hills ACEC

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

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

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

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

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

National Wild and Scenic River

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

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

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

National Historic Trail

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

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

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

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

National Scenic Trail

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

Scenic Highways/Byways

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

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

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

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

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

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

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

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

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

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

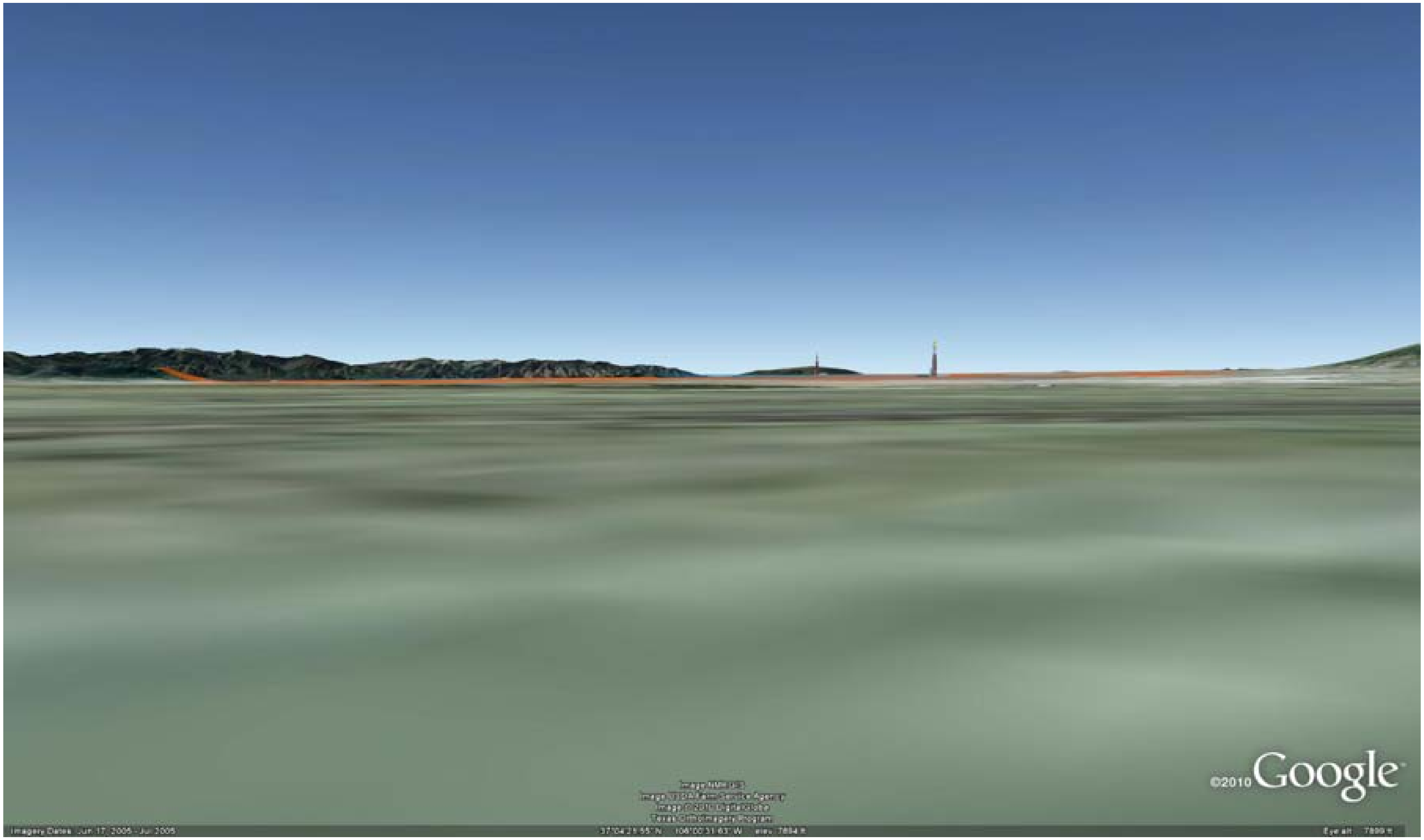

FIGURE 10.1.14.2-5 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Los Caminos Antiguos Scenic Byway in Antonito

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

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

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

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

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

Special Recreation Management Areas

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

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

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

ACECs Designated for Outstandingly Remarkable Scenic Values

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

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

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

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

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

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

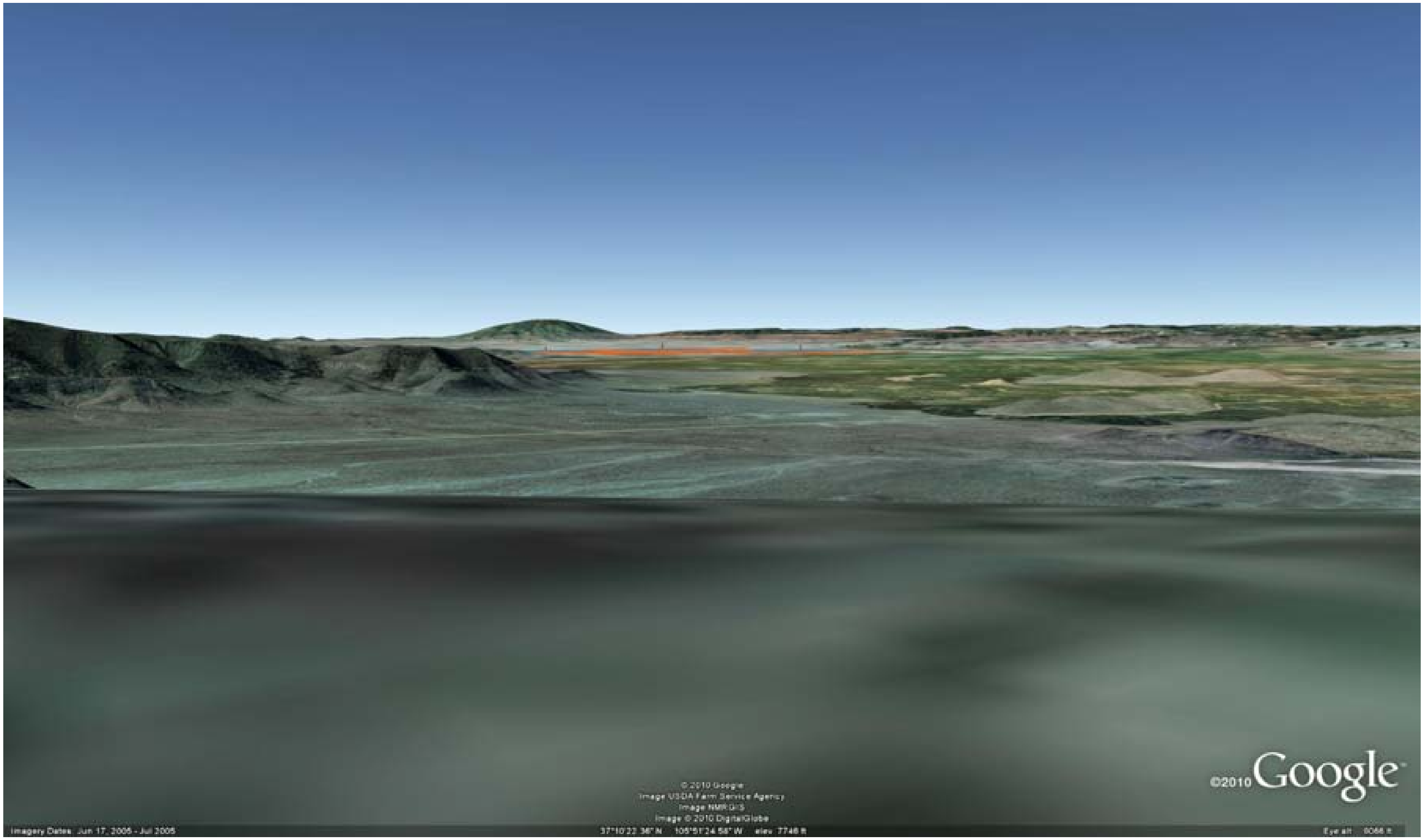

FIGURE 10.1.14.2-6 Google Earth Visualization of the Proposed Antonito Southeast East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Flat Top within the San Luis Hills ACEC

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

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

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

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

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

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

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

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

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

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

Impacts on Selected Other Lands and Resources

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

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

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

Regardless of visibility from Antonito and Conejos, residents, workers, and visitors to the area would likely experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads, particularly U.S. 285 and CO 17. Portions of both of these roads are included in the Los Caminos Antiguos Scenic Byway, a state- and BLM-designated scenic and historic byway within the viewshed of the SEZ in the immediate vicinity of Antonito (see Los Caminos Antiguos Scenic Byway impact analysis above).

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

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

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

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

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

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

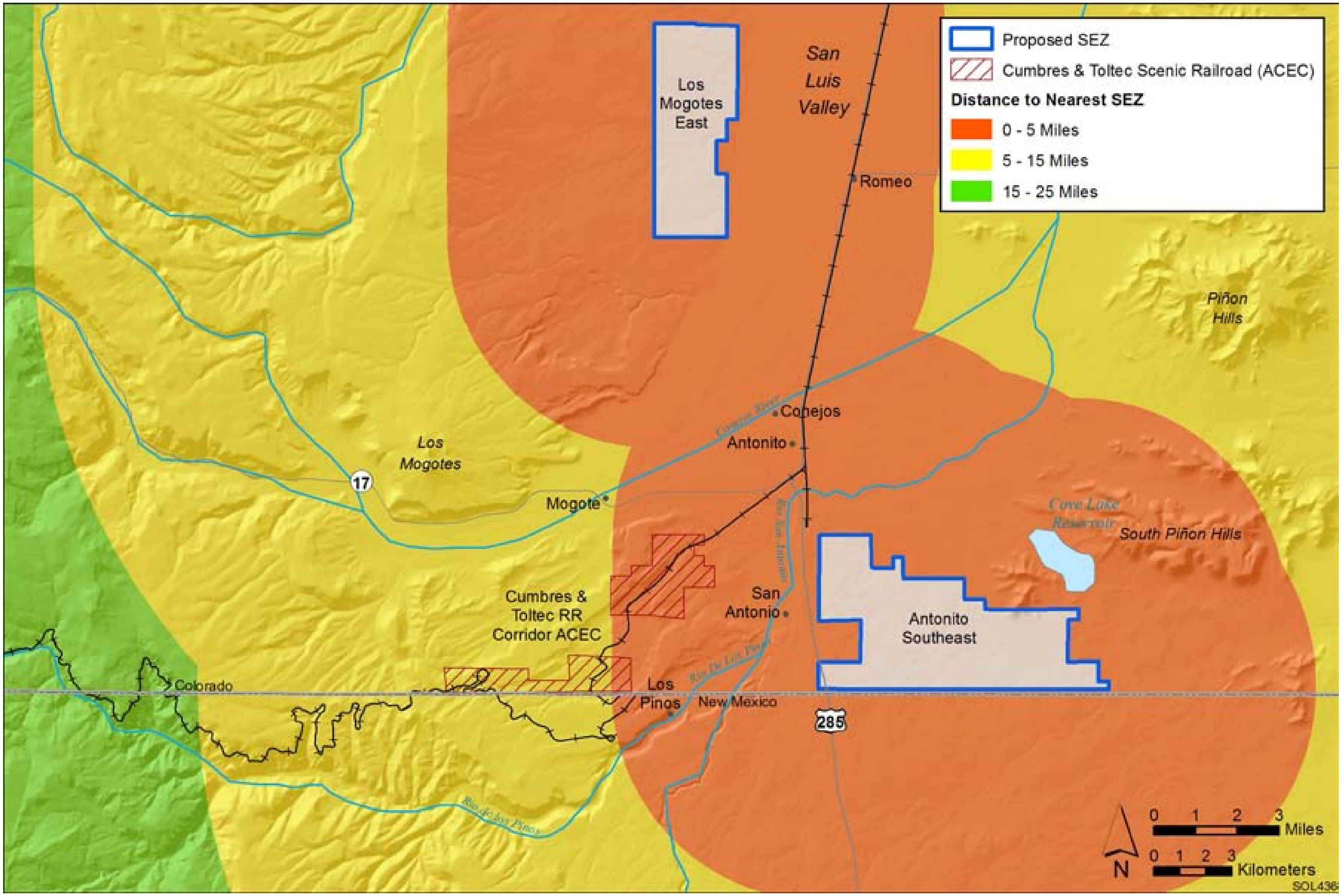

FIGURE 10.1.14.2-7 Cumbres & Toltec Scenic Railroad Corridor ACEC

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

Figures 10.1.14.2-8 and 10.1.14.2-9 are three-dimensional perspective visualizations created with Google Earth depicting views of the SEZ (highlighted in orange) as seen from points on the CTSR. The visualizations include four simplified wireframe models of a hypothetical solar power tower facility. The models omit some facility components and are not intended to simulate the actual appearance of the landscape or of proposed utility-scale solar energy projects. They do provide useful information about the apparent size, distance, and configuration of the SEZ and the apparent size of a typical solar power tower project and its relationship to the surrounding landscape, as seen from this potentially sensitive visual resource area. The receiver tower depicted in the visualizations is a properly scaled model of a 459-ft (139.9-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats. The SEZ area is depicted in orange, the heliostat fields in blue.

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

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

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

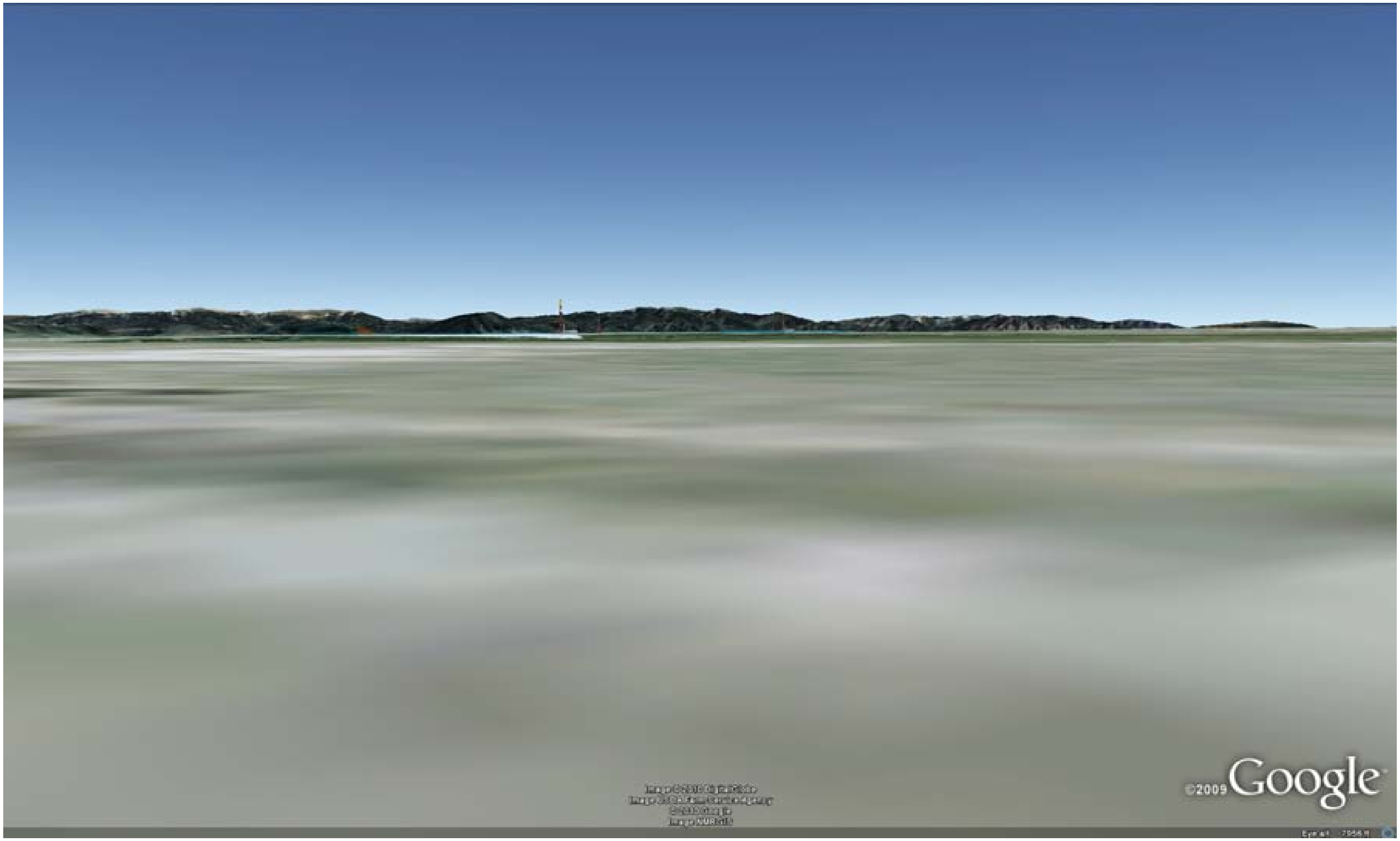

FIGURE 10.1.14.2-8 Google Earth Visualization of the Proposed Antonito Southeast SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the CTSR Approximately 2 mi (3 km) Southwest of the Depot at Antonito

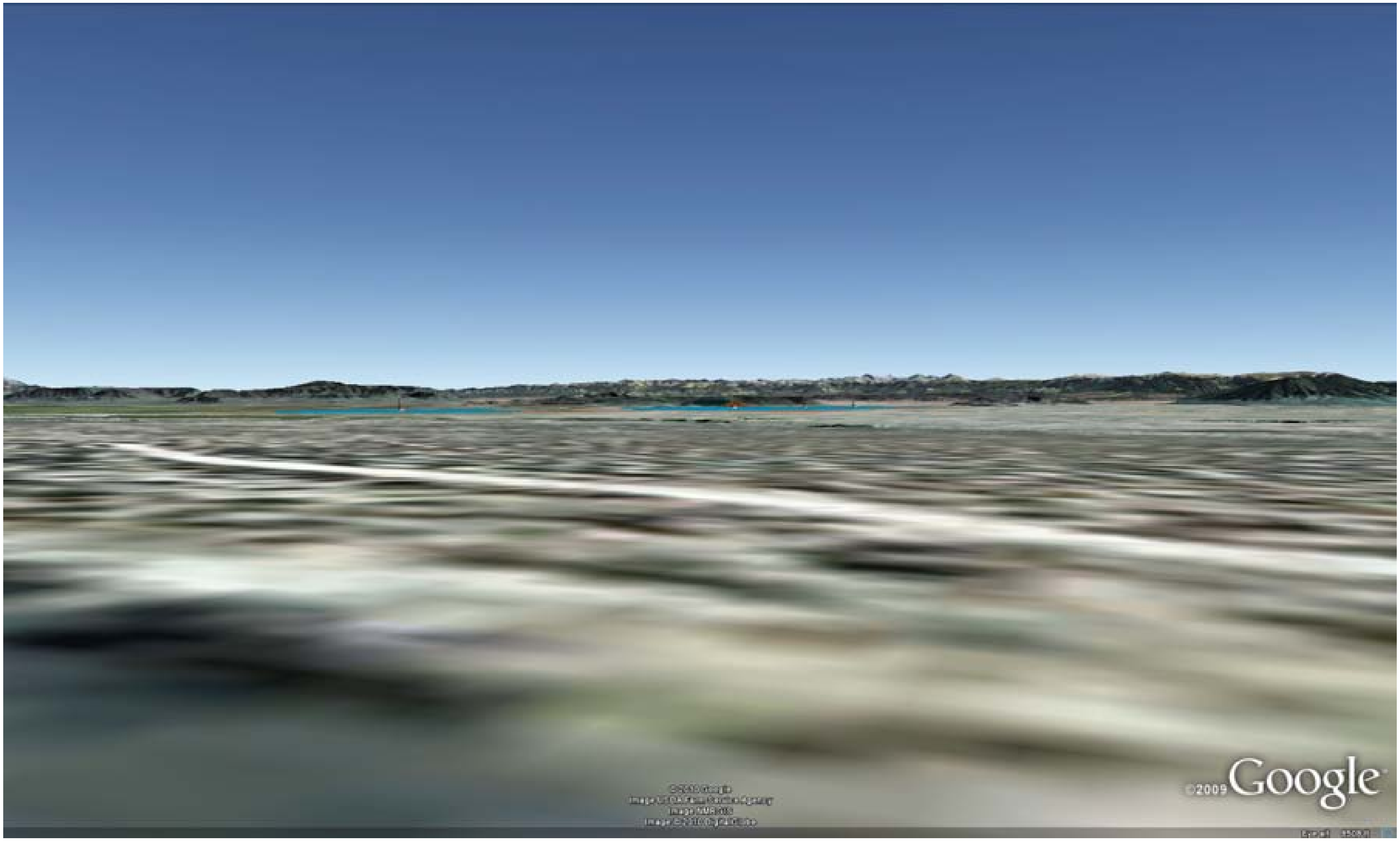

FIGURE 10.1.14.2-9 Google Earth Visualization of the Proposed Antonito Southeast SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the CTSR Approximately 8 mi (13 km) Southwest of the Depot at Antonito

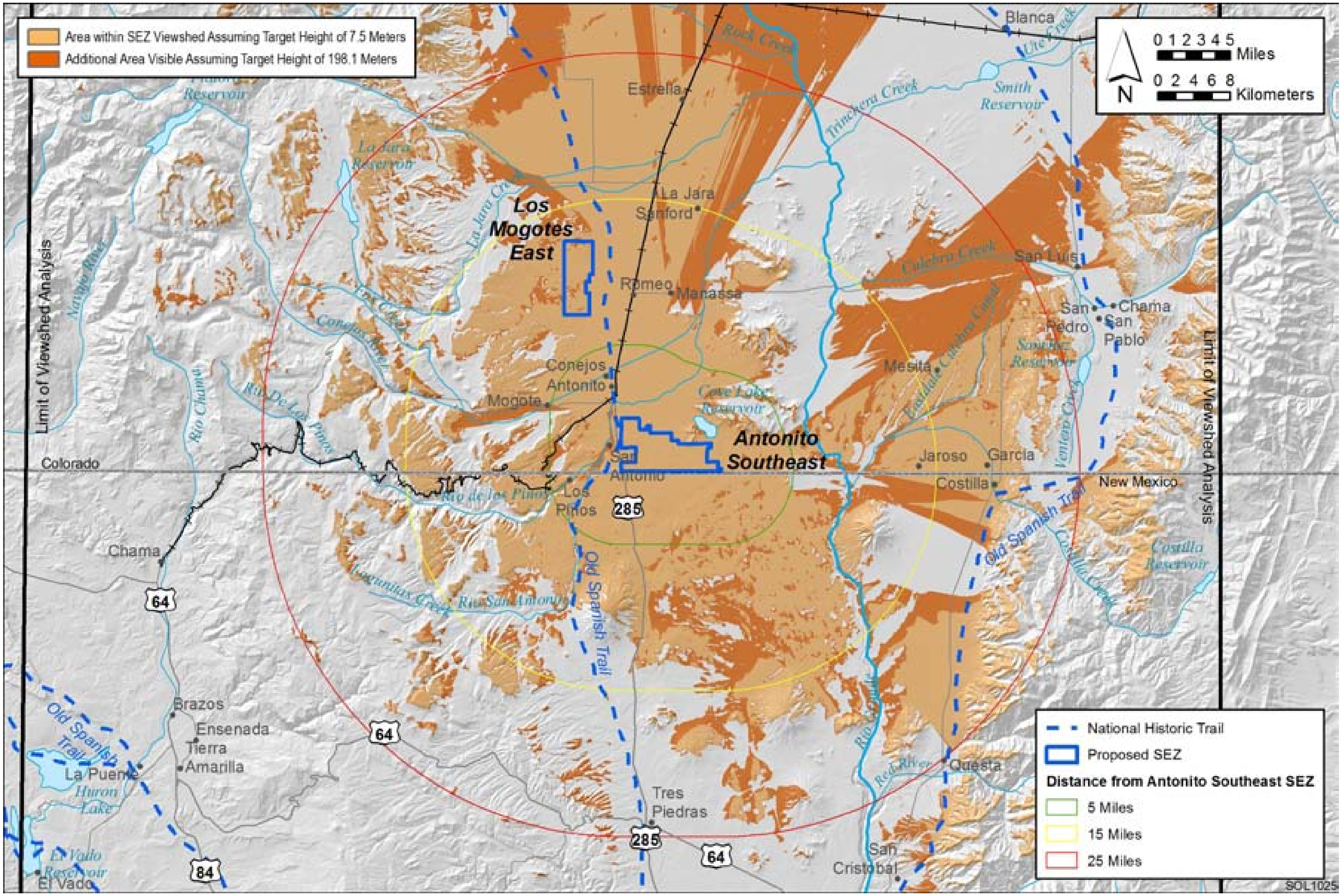

FIGURE 10.1.14.2-10 West Fork of the North Branch of the Old Spanish Trail in the Vicinity of the Proposed Antonito Southeast SEZ

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

10.1.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

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

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

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

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

TABLE 10.1.14.3-1 VRM Management Class Objectives

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

Source: BLM (1986b).

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

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

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

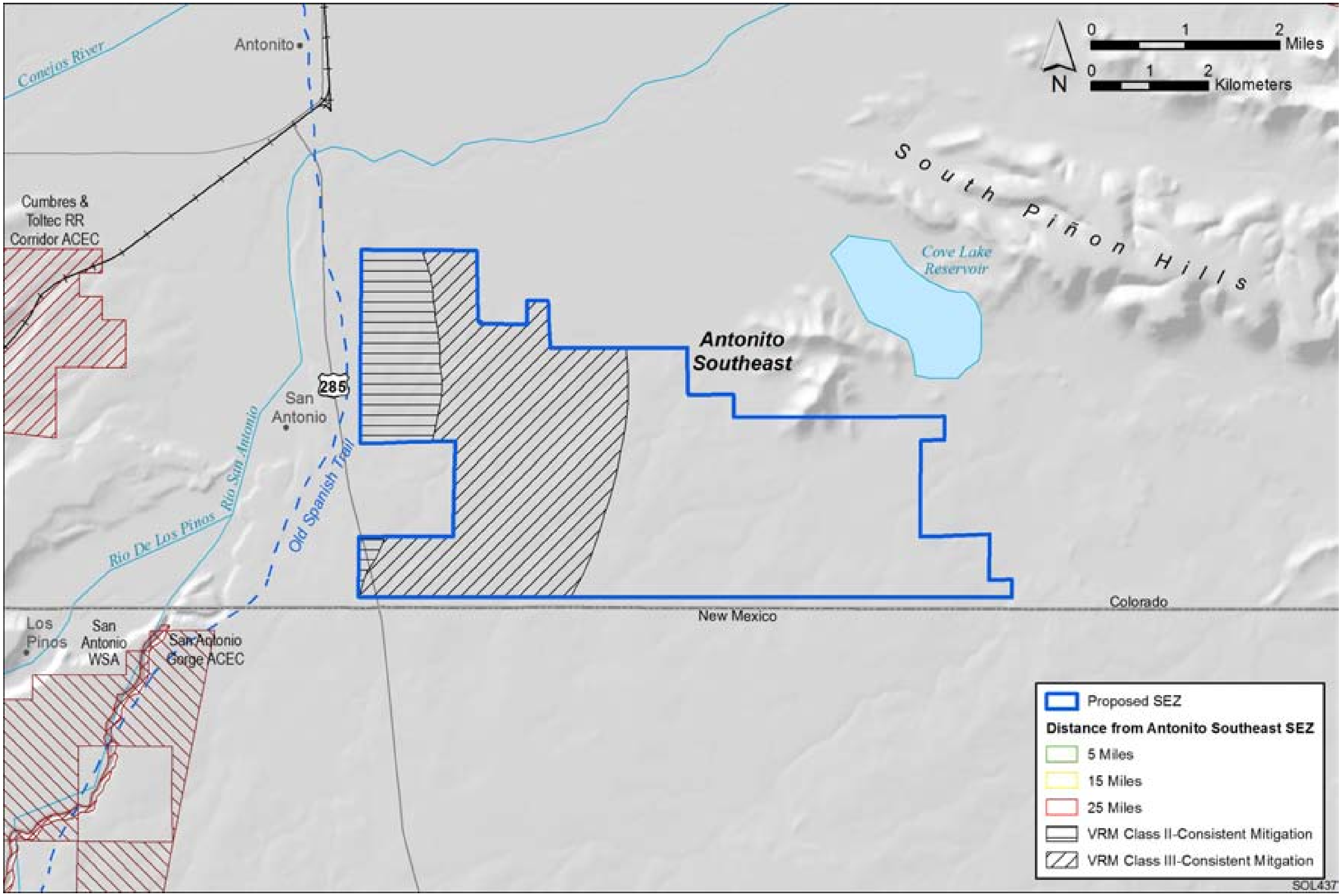

FIGURE 10.1.14.3-1 Areas within the Proposed Antonito Southeast SEZ Affected by SEZ-Specific Distance-Based Visual Impact Design Features

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

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

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

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10.1.15 Acoustic Environment

10.1.15.1 Affected Environment

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

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

10.1.15.2 Impacts

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

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

residences (within 0.5 mi [0.8 km] from the SEZ boundary) would be anticipated, albeit of short duration. During the operations phase, potential impacts on nearby residences would be anticipated, depending on the solar technologies employed. Noise impacts shared by all solar technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the proposed Antonito Southeast SEZ are presented in this section. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional SEZ-specific design features applied (see Section 10.1.15.3). This section primarily addresses potential noise impacts on humans, although potential impacts on wildlife at nearby sensitive areas are discussed, Additional discussion on potential noise impacts on wildlife is presented in Section 5.10.2.

10.1.15.2.1 Construction

The proposed Antonito Southeast SEZ has a relatively flat terrain; thus, minimal site preparation activities would be required, and associated noise levels would be lower than those during general construction (e.g., erecting building structures and installing equipment, piping, and electrical). Solar array construction would also generate noise, but it would be spread over a wide area.

For the parabolic trough and power tower technologies, the highest construction noise levels would occur at the power block area, where key components (e.g., steam turbine/generator) needed to generate electricity are located; a maximum of 95 dBA at a distance of 50 ft (15 m) is assumed, if impact equipment such as pile drivers or rock drills are not being used. Typically, the power block area is located in the center of the solar facility, at a distance of more than 0.5 mi (0.8 km) to the facility boundary. Noise levels from the construction of the solar array would be lower than 95 dBA. When geometric spreading and ground effects are considered, as explained in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of 1.2 mi (1.9 km) from the power block area. This noise level is typical of daytime mean rural background levels. In addition, mid- and high-frequency noise from construction activities is significantly attenuated by atmospheric absorption under the low-humidity conditions typical of an arid desert environment, and by temperature lapse conditions typical of daytime hours; thus noise attenuation to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi (1.9 km). If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur at about 1,200 ft (370 m) from the power block area, which would be well within the facility boundary. For construction activities occurring near the residences closest to the northwest SEZ boundary, estimated noise levels at these residences would be about 50 dBA, which is higher than a typical daytime mean rural background level of 40 dBA. In addition, estimated 47 dBA L_{dn}[12] at these residences falls below the EPA guideline of 55 dBA L_{dn} for residential areas.

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

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

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

It is assumed that most construction activities would occur during the day, when noise is better tolerated, than at night because of the masking effects of background noise. In addition, construction activities for a utility-scale facility are temporary in nature (typically a few years). Construction would cause some unavoidable but localized short-term impacts on neighboring communities, particularly for activities occurring near the northern or western proposed SEZ boundary, close to the nearby residences.

Construction activities could result in various degrees of ground vibration, depending on the equipment used and construction methods employed. All construction equipment causes ground vibration to some degree, but activities that typically generate the most severe vibrations are high-explosive detonations and impact pile driving. As is the case for noise, vibration would diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of perception for humans, which is around 65 VdB (Hanson et al. 2006). During the construction phase, no major construction equipment that can cause ground vibration would be used, and no residences or sensitive structures are located in close proximity. Therefore, no adverse vibration impacts are anticipated from construction activities, including from pile driving for dish engines.

It is assumed that a transmission line would need to be constructed to connect to the nearest existing line located about 4 mi (6 km) north of the Antonito Southeast SEZ. Because of the short distance to the regional grid, such construction could be performed in a relatively short time (likely a few months). Construction sites along a new transmission line ROW would move continuously, and thus, no particular area would be exposed to noise for a prolonged period. The potential noise impacts on nearby residences along the transmission line ROW would therefore be minor and temporary in nature.

10.1.15.2.2 Operations

Noise sources common to all or most types of solar technologies include equipment motion from solar tracking; maintenance and repair activities (e.g., washing mirrors or replacing broken mirrors) at the solar array area; commuter/visitor/support/delivery traffic within and around the solar facility; and control/administrative buildings, warehouses, and other auxiliary buildings/structures. Diesel-fired emergency power generators and fire water pump engines would be additional sources of noise, but their operations would be limited to several hours per month (for preventive maintenance testing).

With respect to the main solar energy technologies, noise-generating activities in the PV solar array area would be minimal, related mainly to solar tracking, if used. Dish engine technology, which employs collector and converter devices in a single unit, on the other hand, generally has the strongest noise sources.

For the parabolic trough and power tower technologies, most noise sources during operations would come from the power block area, including the turbine generator (typically in an enclosure), pumps, boilers, and dry- or wet-cooling systems. The power block is typically located in the center of the facility. On the basis of a 250-MW parabolic trough facility with a cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels around the power block would be more than 85 dBA, but about 51 dBA at the facility boundary, about 0.5 mi (0.8 km) from the power block area. For a facility located near the northwestern corner of the SEZ, the predicted noise level from the power block would be about 45 dBA at the nearest residences, located about 0.5 mi (0.8 km) from the facility boundary, which is higher than the typical daytime mean rural background level of 40 dBA. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only[13]), the EPA guideline level of 55 dBA (as L_{dn} for residential areas) would occur at about 1,370 ft (420 m) from the power block area and thus would not be exceeded outside of the proposed SEZ boundary. At the nearest residences, about 44 dBA L_{dn} would be estimated, which is well below the EPA guideline level of 55 dBA L_{dn} for residential areas. However, day-night average sound levels higher than those estimated above by using the simple noise modeling would be anticipated if TES were used during nighttime hours, as explained below and in Section 4.13.1.

On a calm, clear night typical of the proposed Antonito Southeast SEZ setting, the air temperature would likely increase with height (temperature inversion) because of strong radiative cooling. Such a temperature profile tends to focus noise downward toward the ground. There would be little, if any, shadow zone[14] within 1 or 2 mi (1.6 or 3 km) of the noise source in the presence of a strong temperature inversion (Beranek 1988). In particular, such conditions add to the effect of noise being more discernable during nighttime hours, when the background levels are the lowest. To estimate day-night average sound level (L_{dn}), 6-hour nighttime generation with TES is assumed after 12-hour daytime generation. For nighttime hours under temperature inversion, 10 dB is added to noise levels estimated from the uniform atmosphere

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

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

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

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

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

The solar dish engine is unique among concentrating solar power (CSP) technologies because it generates electricity directly and does not require a power block. A single, large, solar dish engine has relatively low noise levels, but a solar facility might employ tens of thousands of dish engines, which would cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar Two, LLC 2008). At the Antonito Southeast SEZ, assuming a dish engine facility of up to 865-MW capacity (covering 80% of the total area, or 7,783 acres [31.5 km^2]), up to 34,600 25-kW dish engines could be employed. Also, for a large dish engine facility, several hundred step-up transformers would be embedded in the dish engine solar field, along with a substation; the noise from these sources, however, would be masked by dish engine noise.

The composite noise level of a single dish engine would be about 88 dBA at a distance of 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA (typical of the mean rural daytime environment) within 320 ft (100 m). However, the combined noise level from tens of thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility, for example, about 49 dBA at 1.0 mi (1.6 km) and 45 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; both values are higher than the typical daytime mean rural background level of 40 dBA. However, these levels would occur at somewhat shorter distances than the aforementioned distances, considering noise attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate noise levels at the nearest residences, it was assumed that dish engines were placed all over the Antonito Southeast SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest residences about 0.5 mi (0.8 km) from the SEZ boundary would be about 50 dBA, which is higher than the typical daytime mean rural background level of 40 dBA.

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

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

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

During operations, no major ground-vibrating equipment would be used. In addition, no sensitive structures are located close enough to the Antonito Southeast SEZ to experience physical damage. Therefore, potential vibration impacts on surrounding communities and vibration-sensitive structures during operation of any solar facility would be minimal.

Transformer-generated humming noise and switchyard impulsive noises would be generated during the operation of solar facilities. These noise sources would be located near the power block area, typically near the center of a solar facility. Noise from these sources would generally be limited within the facility boundary and rarely be heard at nearby residences, assuming a 1-mi (1.6-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and another 0.5 mi [0.8 km] to the nearest residences). Accordingly, potential impacts of these noise sources on the nearest residences would be minimal.

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

10.1.15.2.3 Decommissioning/Reclamation

Decommissioning/reclamation requires many of the same procedures and equipment used in traditional construction. Decommissioning/reclamation would include dismantling of solar facilities and support facilities such as buildings/structures and mechanical/

electrical installations, disposal of debris, grading, and revegetation as needed. Activities for decommissioning would be similar to those used for construction but on a more limited scale. Potential noise impacts on surrounding communities would be correspondingly lower than those for construction activities. Decommissioning activities would be of short duration, and their potential impacts would be minor and temporary. The same mitigation measures adopted during the construction phase could also be implemented during the decommissioning phase.

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

10.1.15.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

- Noise levels from cooling systems equipped with TES should be managed so levels at nearest residences to the north and west of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.

- Dish engine facilities within the Antonito Southeast SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from nearby residences around the SEZ (i.e., the facilities should be located in the central or southeast area of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.

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10.1.16 Paleontological Resources

The San Luis Valley is an alluvium-filled basin in the Southern Rocky Mountain physiographic province. The San Luis Basin is an intermontane structural depression within the Rio Grande rift zone. The valley is flanked by the Sangre de Cristo Range to the east, the San Juan Mountains to the west, and the San Luis Hills to the southeast. (See Section 10.1.7 for a more detailed description of the geological setting of the San Luis Valley.)

Little surveying for paleontological resources has been conducted in the San Luis Valley. The potential for paleontological resources to occur in the larger San Luis Resource Area (SLRA) was assessed in 1983 by K. Don Lindsey, the curator of paleontology at the Denver Museum of Natural History, for BLM planning purposes. Although several geological formations in the SLRA have produced fossils elsewhere in the region, such fossils have not been found to be abundant in the SLRA; this finding could possibly be due to a lack of sufficient sampling. Most SLRA fossils have been Paleozoic marine invertebrates and Tertiary vertebrates consistent with the types of sedimentary rocks found in the area (Lindsey 1983; see Table 4.14-2 for the ages of geologic units).

The valley is filled with Quaternary stream deposits, gravels, and alluvial fans overlying volcanic debris and interbedded basalt flows of the Alamosa and Santa Fe Formations. Lindsey (1983) states that the total thickness of these deposits in the northern part of the valley is estimated 19,000 to 30,000 ft (5,971 to 9,144 m).

The western part of the valley is tertiary volcanic tuffs, flows, and breccias. These deposits are not expected to contain significant paleontological resources (Lindsey 1983), and they have been classified as PFYC Class 1. (Section 4.14 has a discussion of the potential fossil yield classification [PFYC] system.)

The Santa Fe Formation is the basal formation of the valley and dates back to between the Miocene and Pleistocene. In some parts of the valley, it can be 5,000 ft (1,524 m) thick. The only fossils recovered from this layer have been from deep wells, and they have been fragmentary and of little research value. Several Pliocene and Pleistocene vertebrates were found in a similar context in New Mexico (Lindsey 1983); thus, the potential for significant resources exists. The PFYC for this formation is Class 4/5 in New Mexico; however, in Colorado the BLM classifies these deposits as Class 3, indicating that the potential for the occurrence of significant fossil materials is currently unknown and needs to be investigated further.

The Alamosa Formation has yielded Pleistocene—Pliocene mammal species, such as *Equus scotti*, *Camelops*, and *Microtus*, as well as a number of herpetofauna, birds, fish, mollusks, ostracods, and bryozoans. Although there are only a few outcrops of the Alamosa Formation in the San Luis Valley, one such outcrop, which is about 40 ft (12 m) thick, is located at Hansen's Bluff in Alamosa County, southeast of the town of Alamosa (Lindsey 1983). This formation is classified as PFYC Class 4/5. A recent report by the U.S. Forest Service indicates that exposures of the Alamosa Formation may also occur in the San Luis Hills (Dyer 2009).

Quaternary deposits (alluvial fans, terrace gravels, and loess) overlie the Alamosa Formation extensively throughout the valley. Vertebrate fossils are possible but, when found, are typically fragmentary and of little use for determining age (Lindsey 1983). Several mammoth sites have been reported in the valley (Martorano et al. 1999). These sites have been of greater interest to archaeologists than paleontologists because of potential associations with Paleoindian artifacts (see Section 10.3.17.1). The bones found to date have been highly fragmented and badly deteriorated (Martorano et al. 1999). Although Lindsey classifies the fossils as Condition 3 (PFYC Class 1), they are categorized by the BLM as Class 4/5 because of the potential for significant resources in the underlying Alamosa Formation. Some Quaternary gravels are classified by the BLM as PFYC Class 3.

10.1.16.1 Affected Environment

The proposed Antonito Southeast SEZ is covered predominantly by Tertiary basalt flows and associated tuff, breccia, and conglomerate (classified as Tbb on geologic maps). Of the entire 9,598-acre (38.84-km^2) area of SEZ land, 9,594 acres (38.82 km^2) or 99.99% is composed of this volcanic deposit. The PFYC for Tbb is Class 1, which indicates that the occurrence of significant fossil materials is nonexistent or extremely rare. No paleontological resources are known in the SLRA from this type of surface geology. Less than 0.01% of the SEZ (specifically, 4 acres [0.016 km^2] or 0.00004% of the SEZ) is composed of unclassified Quaternary surface deposits overlying the Alamosa Formation (classified as QTsa on geologic maps). This small area is at the northern boundary of the SEZ. The PFYC for QTsa is Class 4/5 (on the basis of the PFYC map from the Colorado State Office; see Murphey and Daitch 2007), although no known paleontological resources from these deposits in the San Luis Valley have been recorded (Lindsey 1983). As stated in Section 10.1.16, the nearest identified exposures of the Alamosa Formation are located in the San Luis Hills. Most areas immediately adjacent to the Antonito Southeast SEZ are also Tbb deposits and are unlikely to contain significant fossils. The exception would be the areas immediately north and east of the 4-acre (0.016-km^2) parcel of Quaternary surface deposits, which is also composed of QTsa deposits and is PFYC Class 4/5.

10.1.16.2 Impacts

Few, if any, impacts on significant paleontological resources are likely to occur in the proposed Antonito Southeast SEZ. However, a more detailed look at the local geological deposits and their depth is needed to verify that the assignment of a PFYC of Class 1 is valid by determining whether the Alamosa Formation is exposed and whether paleontological resources are present at the surface. Also, the depth to the Alamosa Formation should be determined within the 4-acre (0.016-km^2) parcel to identify whether the application of mitigation measures might be necessary in that specific PFYC Class 4 or 5 area to avoid the potential for adverse effects.

Indirect impacts on paleontological resources, such as looting or vandalism, north of the SEZ in areas classified as PFYC Class 4 or 5 are unknown, but not likely if the Alamosa Formation is not exposed at the surface. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

No new roads are anticipated to be needed to access the Antonito Southeast SEZ, but approximately 4 mi (6 km) of transmission line is anticipated be needed to connect to the nearest existing line. Areas of both PFYC Class 1 and Class 4/5 could be affected. No impacts on paleontological resources are anticipated in areas of PFYC Class 1 deposits related to a new ROW. In areas of PFYC Class 4/5, the depth to the Alamosa Formation should be determined to identify whether the application of mitigation measures might be necessary in that area to avoid the potential for adverse effects (both direct and indirect) related to construction within the ROW. Possible impacts from solar energy development on paleontological resources that are encountered within the SEZ or along related ROWs, as well as general mitigation measures, are described in more detail in Section 5.14.

10.1.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. A SEZ-specific design feature is as follows:

- Avoidance of PFYC Class 4 or 5 areas is recommended for development within the Antonito Southeast SEZ (i.e., the 4-acre [0.016-km^2] parcel in the north part of the SEZ) and for transmission corridor placement. Where avoidance of Class 4 or 5 deposits is not possible in order to connect to existing transmission, a paleontological survey or monitoring may be required by the BLM.

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10.1.17 Cultural Resources

10.1.17.1 Affected Environment—San Luis Valley

The San Luis Valley is rich in cultural history with documented evidence of human occupation extending as far back as 11,000 years. The valley is at the headwaters of the Rio Grande and is flanked by the Sangre de Cristo Range to the east, the San Juan Mountains to the west, and the San Luis Hills to the southeast.

Various geographic features located in the valley or seen from the valley have cultural significance. Blanca Peak (also called Mount Blanca, Sierra Blanca, and White Shell Mountain) is the highest peak in the Sangre de Cristo Range at 14,345 ft (4,372 m). It is the fourth-highest peak in Colorado. It is thought to be a sacred mountain and could be the place the Navajo refer to as Sisnaajini, or the Sacred Mountain of the East, one of the four sacred mountains of the Navajo (Simmons 1999; BLM 2009c).[15] The Great Sand Dunes, located at the base of the Sangre de Cristo Mountains, are also considered sacred by a number of different Tribes. They are the highest inland sand dunes in the United States and have been designated a National Park and Preserve.[16] Languages of both the Ute and Jicarilla Apache Tribes have words referring to these dunes near where they historically camped and hunted (NPS 2009a). Water features in the valley, consisting of several streams, a shallow water table producing marshy areas and shallow ponds, and natural springs, played a significant role in human use of the area despite the low annual rainfall it receives (Simmons 1999). The water features supported abundant game and waterfowl and eventually irrigation practices to promote agriculture and settlement in the valley. The San Luis Lakes could also be the location of a mythical emergence place based on Upper Rio Grande Pueblo (Tewa) oral histories (Simmons 1999), such as that of the Santa Clara Pueblo in New Mexico; their creation story begins near sand dunes to the north. These and other topographic features of the valley, along with an elaborate trail system established prehistorically, and various natural resources, such as mineral resources (gold, turquoise), flora, and fauna, would be important factors for prehistoric and historic settlement in the valley.

10.1.17.1.1 Prehistory

The earliest peoples known to have used resources present in the San Luis Valley are from the Paleoindian Era, dating from between roughly 12,000 years before present (B.P.) to 7,500 years B.P. The archaeological data suggest that Paleoindian groups were mobile hunter-gatherers moving seasonally to exploit available natural resources. Although these groups initially hunted large animals (megafauna), such as mammoth and mastodon, they adapted to hunting bison and relatively smaller game animals and continued their reliance on wild plant foods as the larger megafauna became extinct. In Colorado, no evidence of sites earlier than

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[15] Wheeler Peak, Abiquin Peak, Pedernal Peak, and Pelado Peak have also been mentioned as possible alternative locations (TwinRocks 2009).

[16] The Great Sand Dunes were designated a National Monument in 1932 and a National Park and Preserve in 2000.

approximately 11,200 B.P. have been identified (Martorano et al. 1999). The San Luis Valley has the highest density of Paleoindian finds in Colorado. Distinctive Paleoindian projectile points from the Clovis, Folsom, and Plano periods have been found in the valley (Guthrie et al. 1984; Martorano et al. 1999). Sites dating to the Paleoindian Era are typically represented throughout the state by isolated surface finds of single projectile points. However, bison kill sites have been recorded in the San Luis Valley. Folsom points in association with ancient bison (*Bison antiquus*, *Bison taylori*) remains are present at some of the more significant sites in the valley, such as those recorded in the northeast portion of Alamosa County[17] (Guthrie et al. 1984; Martorano et al. 1999). In addition to bison, other animals of interest to Paleoindian hunters as well as later populations in the valley and surrounding mountains included elk, mountain sheep, and mule deer. It is postulated that proximity to Pleistocene water sources and animal migration routes were primary factors in site location for camps and activity areas during this time (Guthrie et al. 1984; Martorano et al. 1999).

About 7,500 years B.P., the Archaic Era takes hold, as evidenced by changing subsistence patterns and associated tool production. The projectile points found associated with Archaic peoples are stemmed or notched varieties, rather than the large, lanceolate points of the Paleoindian era, indicating a reliance on smaller game. Early Archaic (7,500 to 5,000 years B.P.) sites are present in the San Luis Valley. Many of these sites are located near the Rio Grande and contain characteristic tools made of local basalt (Guthrie et al. 1984). Continued use of the valley is documented by Middle Archaic (5,000 to 3,000 years B.P.) sites in Saguache County and in the northern portion of the valley. Late Archaic Period (3,000 to 1,500 years B.P.) sites have been recorded throughout the valley as indicated in results from a surface survey of the Blanca Wildlife Refuge (Dick 1975, as cited in Guthrie et al. 1984),[18] a 1980 Closed Basin survey of a conveyance channel in Alamosa and Saguache Counties (Button 1980), and, in Conejos County, a survey of the La Jara Reservoir area (west of the Los Mogotes SEZ) for the Baca Land Exchange (Wells 2008). It is unclear based on the archaeological evidence when the Archaic Period classification should end as the lifestyle appears to continue throughout the Late Prehistoric Period.

The period between A.D. 500 and 1300 has been referred to as the Formative Era, which in most cases includes the presence of agriculture and sedentary villages. In the San Luis Valley a more Archaic lifestyle of hunting and gathering probably continued during this time, also known as the Late Prehistoric Period. However, although sufficient evidence of agriculture and village life does not appear in San Luis Valley, some influences from Formative groups in the surrounding areas did occur. Several sites dating to this time period are known in the San Luis Valley. Evidence includes the presence of ceramics, corn, and smaller projectile point sizes suggesting use of the bow and arrow (Martorano et al. 1999). Specifically, Pueblo ceramics, Northern Rio Grande ceramics, and Woodland ceramics characterize sites from this period within the valley, as well as diagnostic corner-notched points. Two rockshelters recorded in the

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17 Linger, Zapata, and Stewart's Cattle Guard sites; Reddin site also in Saguache County (Guthrie et al. 1984; Martorano et al. 1999).

18 A more recent context developed for the Rio Grande Basin in Colorado, Martorano et al. (1999), does not discuss the Early, Middle, or Late stages of the Archaic period for reasons of insufficient dated components and a lack of associated artifact assemblages as so far found in the basin.

region contained remnants of corn (Guthrie et al. 1984). The majority of known sites in the region dating to this period have been recorded near the San Luis Lakes and Great Sand Dunes in Alamosa and Saguache counties. Fewer sites have been identified in Conejos County; those that have been found are located along drainages or the bases of the San Juan Mountains or the Sangre de Cristo Range (Martorano et al. 1999).

10.1.17.1.2 Ethnohistory

Inhabitants of the valley during a transitional time between the Late Prehistoric Period and the beginning of Spanish contact (A.D. 1300 to 1600) would primarily include the Utes, nomadic bands of hunters and gatherers traveling in small groups foraging for food. Similar to the Formative or Late Prehistoric period, diagnostic artifacts include corner-notched points and some ceramics. Seasonal hunting was likely the predominant use of the valley, rather than year-round residency. The Apache[19] also claimed portions of the valley as their territory. Once the Ute and Apache started interacting with the Spanish, they obtained horses to help them hunt buffalo, trade goods, and fight (see below for a more detailed discussion of the Ute and Jicarilla Apache). Other Native American groups that likely visited the area during this time are the Navajo, Kiowa, Comanche, Arapaho, Pueblo people (mostly northern Pueblo groups) (BLM 2009c), and Cheyenne (Martorano 1999). Artifacts indicative of this period in the Rio Grande Basin include Euro-American trade goods, such as guns, metal projectile points and knives, and metal cooking pots; projectile points for use with a bow and arrow; glass artifacts, such as flaked glass and beads; wickiups; and brown ware ceramics. Other features of archaeological interest include culturally peeled trees and rock art depicting horses (Martorano et al. 1999).

Native American human skeletal remains have been found in the San Luis Valley, including several burial sites in Saguache and Alamosa Counties (Martorano et al. 1999).

Ute

Speakers of a dialect of Southern Numic, the Ute ranged from Utah's Oquirrh Mountains in the west to the Front Range in Colorado in the east (Callaway et al. 1986). Those who ranged primarily in Colorado are often classified as eastern Ute. Prior to their enforced settlement on reservations, the Ute led a mobile lifestyle. Groups centered on nuclear families followed a seasonal round, hunting and gathering in the various habitats that their range provided them as resources became available throughout the year. Family groups would join one another or hunt and gather separately depending on the abundance of the resource sought. They were loosely organized into regional groups or bands, whose composition continually fluctuated. These groups tended to prefer the upper basins of river drainages, which provided access to a wider range or resources. The Capote band was resident in the San Luis Valley as early as the eighteenth century, while their eastern neighbors, the Moache, are likely to have exploited the resources of the valley as well (Baker et al. 2007). In general, hunting grounds were open to all

[19] The Jicarilla Apache are most commonly associated with the San Luis Valley.

Ute groups, although etiquette demanded that local groups be consulted before hunting or gathering in their territory. Typical Ute dwellings were conical wickiups constructed of wooden poles. Camps also included brush structures and ramadas (Callaway et al. 1986); however, wickiups recorded in the San Luis Valley are scarce, suggesting an early change there to the tepee (Baker et al. 2007).

Beyond hunting and gathering, the Ute had trading and raiding relationships with neighboring tribes, including the Pueblos to the south, whom they supplied with buckskin. With the arrival of the Spanish in New Mexico, this relationship was easily extended to them. Located at the southern extent of the Ute range, the Capote would have been among the first Utes to encounter Spanish colonists and explorers. By 1765 when Juan Rivera made the first recorded exploration into the Ute heartland, the Ute were already engaged in down-the-line trade for Spanish goods, both from New Mexico and via Plains tribes from Mexico itself. Between their mobile lifestyle and trading expeditions, a network of foot trails extended throughout Ute territory and beyond (Baker et al. 2007).

The arrival of the Spanish in the early to mid-sixteenth century marked the beginning of an important change in Ute lifestyle. The Ute were anxious to obtain Spanish metal goods and were introduced to the horse. Until the introduction of the horse, dogs were the only beasts of burden known to the Ute. That which was not packed on dogs was carried, and travel was on foot. The incorporation of the horse was neither immediate nor universal, since many parts of Ute territory lacked forage. The Capote, however, being close to the Spanish, likely adopted the horse earlier and to a greater extent than many other bands along with a veneer of Plains horse culture. Horses allowed the Ute to range farther and to gather in larger numbers for short periods. Larger groups fostered the spread of new diseases introduced by the Spanish. The Ute were participants in the slave trade with the Spanish colonies, both as slaves and as slavers. The horse gave them an advantage over neighboring tribes and was one of the objects of the trade. Utes were among the *genizaros*, Native American captives forcibly taught a sedentary lifestyle by the Spanish (Baker et al. 2007).

Mexican independence in 1821 brought an increased Hispanic presence including traders and settlers in San Luis Valley. The Utes profited from the increased trade. Shortly thereafter, Euro-American trappers entered Ute territory from the north and east. The desire for furs increased the pressure on the wildlife that upon which the Ute depended. With the Treaty of Hidalgo in 1848 ending the Mexican War, Ute territory passed into the hands of the United States. The discovery of gold in eastern Colorado attracted settlers from the organized states. Immigration increased after the end of the Civil War. The disbanding of the huge armies of the north and south sent many veterans westward. Throughout the latter half of the nineteenth century, Euro-Americans in Colorado clamored for the removal of the Utes (Baker et al. 2007).

A Ute reservation was established in northeastern Utah in 1861, and much of western Colorado was included in a second reservation in 1868. There were significant reductions in the Colorado reservation in 1874 and 1880, when most Utes were required to move to reservations in northeastern Utah. The last remnants of the Colorado reservation are the Southern Ute and Ute Mountain Ute reservations in southwestern Colorado. The descendants of the Moache and

Capote Bands are located on the Southern Ute Reservation (Callaway et al. 1986; Simmons 2000).

Jicarilla Apache

The Jicarilla Apache group is one of six Southern Athapaskan or Apachean groups who arrived in the Southwest sometime between A.D. 1300 and 1500 (Tiller 1983). Primarily hunters and gatherers, their traditional range included northeastern New Mexico as far south as modern Mora and as far north as the Arkansas River in Colorado. While their hunting activities extended well into the plains east of the Rockies, their home ranges and base camps were in the mountains of northern New Mexico (Opler 1936). Their loosely organized matrilineal groups may be divided into two bands: the Olleros, or potters, ranged west of the Rio Grande and the Llanos, or plainsmen, to the east. The hunting and gathering range of each group included parts the San Luis Valley (Tiller 1983). Poised between the plains and pueblo cultures, they were influenced by each, while retaining an Apachean cultural foundation with mythology and ritual similar to that of the Navajo. The Ollero groups, the only groups to produce pottery, were more likely to include agriculture in their substance base and lived in flat-roofed rancherias, whereas the Llano groups relied less on horticulture and adopted the horse, tepee, and travois while on the plains and domed brush-covered structures when in the mountains. Like other Apaches, they traditionally saw the natural world as suffused with supernatural power. Natural features and phenomena are seen as expressions of that power. Individuals could receive power from animals, natural phenomena, or celestial bodies. Prominent physical features could be places of power and supernatural instruction (Opler 1936; Tiller 1983).

The Spanish entered New Mexico soon after the Jicarilla. While their relations with the Jicarilla were not always peaceful, by the seventeenth and eighteenth century, pressure from the Comanches, who obtained firearms from the French, caused the Spanish and Jicarilla to join forces in common defense. Once Mexico gained its independence, the new government encouraged settlement on its northern frontier and issued land grants in northern New Mexico without regard to Jicarilla presence or territory. With the acquisition of New Mexico and Colorado by the United States as a result of the war with Mexico, Mexican land grants were respected, but Jicarilla territorial claims ignored. Increasing American settlement encroached upon the traditional Jicarilla lifeway, resulting in raiding by the Apaches and retaliation by the United States Cavalry, which established Fort Massachusetts in the San Luis Valley. An initial attempt in 1873 to establish a reservation for the Jicarilla near the headwaters of the San Juan River was unsuccessful, as was an 1883 attempt to settle the Jicarilla with the Mescalero Apache. In 1887 a reservation was established somewhat east of their traditional range straddling the continental divide in the mountains of northern New Mexico. Little of this land was suitable for agriculture, and most agricultural lands and water rights that existed had already been taken by homesteaders. Initial attempts at raising sheep were enhanced by the addition of lower elevation lands in 1907 for winter pasturing. Raising sheep aided tribal finances, and the Jicarilla were able to organize in 1937 under the Indian Reorganization Act. In the 1950s, revenues from gas and oil resources on tribal lands began to supplement revenue from livestock. Increasingly the Jicarilla population congregated at Dulce, New Mexico, the center of tribal government, and emphasis shifted from stock raising to wage labor. By the 1960s, reliance on traditional gathering activities was limited. Identification with the former bands was diminished, replaced by identification with the tribe as a whole (Tiller 1983).

10.1.17.1.3 History

In 1598, Don Juan de Oñate took possession of New Mexico, including the San Luis Valley, for King Phillip II of Spain. The process by which the Spanish expanded across the frontier was through the issuance of land grants by the Spanish government. The San Luis Valley was initially administered by Spaniards in New Mexico but was designated *La Tierra de los Indios* (i.e., Indian Lands), so it was not initially authorized for Spanish settlement. Nevertheless, exploration, hunting, prospecting, and trading were being conducted in the valley. Interactions between the Utes and the Spaniards/New Mexicans varied in outcome: friendly encounters resulted in trade of horses, food, and material goods and access to Indian trails; less-than-friendly encounters, in raids, thefts, and enslavements. Various raids and attacks were also occurring during this time among the various Native American tribes.

Lieutenant Zebulon Pike can probably be credited as the first American explorer of the valley. He traversed the area in 1807 in search of the Red River, the perceived boundary between the United States and Spanish territories. He and his men built a fort along the Conejos River (mistaking it for the Red River) and raised a U.S. flag on land that he later found to be within Spanish territory (as he was escorted by Spanish soldiers to Spain's capital city, Santa Fe) (Bean 2001). Pike's Stockade, the first official fort in the region, is a National Historic Landmark, in addition to being listed in the *National Register of Historic Places* (NRHP) and is located several miles northeast of the Antonito Southeast and Los Mogotes East SEZs.

Numerous trading forts emerged to support the fur-trapping industry in the 1830s and 1840s. Utes were given guns and whiskey in exchange for livestock they had stolen from the New Mexicans; resistance to settlement continued. Three land grants were approved by the Mexican government[20] for the San Luis Valley between 1821 and 1845. Numerous attempts at settlement between 1840 and 1850 failed, and resistance from Ute Indians forced settlers out of the area on several occasions. In 1846 the Mexican-American War broke out, and no attempts at settlement in the region were made. At the close of the war, the land was purchased by the United States, and the New Mexicans became American citizens under the 1848 Treaty of Guadalupe Hidalgo. The first official non-Indian permanent settlement in Colorado, San Luis de la Culebra, was not established until 1851. San Luis is considered the oldest continually occupied town in Colorado and is located in the southeast corner of the San Luis Valley. Hispanic farmers and ranchers continued settling in the region throughout the 1850s, establishing a rich cultural heritage in the region that continues today. Several traditions have endured in the San Luis Valley, related to the Hispanic culture, specifically art, language, architecture, and farming techniques. The use of *acequias*, an historic communal irrigation system of canals, and the use of *la vega*, a communal grazing area, are still maintained today (BLM 2009c).

[20] Mexico won its independence from Spain in 1821.

The U.S. military established Fort Massachusetts in 1852 to help the new settlements survive. This fort was poorly located at the foot of Mt. Lindsey and was not in use for very long (BLM 2009e). A second fort, Fort Garland, was built further to the south and served the area for 25 years in support of westward expansion. A notable resident was Kit Carson, who served as commander of the fort near the end of his career. Carson was instrumental in working with Ute Chief Ouray to ensure nonviolent settlement in the area. Men from Fort Garland also served in the only Civil War battle to take place in the West, at Glorietta Pass, to drive back Texas confederates. Buffalo Soldiers, African-American soldiers named as such by the Cheyenne, also served at Fort Garland between 1876 and 1879 (BLM 2009e).

In 1861, the area became part of the Colorado Territory, and Colorado achieved statehood in 1876. The ethnic and religious diversity of the valley continued to expand. Anglo settlers moved in under the Homestead Act of 1862. After 1870 Mormons also began settling in the valley. Cattle ranching on large tracts of land became the trend in the 1880s. Railroads established during the same decade brought waves of immigrants to the West. The next wave of settlement was in the 1920s with the arrival of Japanese-American tenant farmers in the valley (BLM 2009e).

Trails and Rails

Trails used by the early inhabitants of the valley did not go unnoticed by later visitors. It is likely that some trails started as migration routes used by large animals, including natural travel corridors along streams (Martorano et al. 1999). Not surprisingly, early hunters used the paths to track game for food and hides. Later, the same paths became conduits for trade. One trail system used throughout the history of the San Luis Valley, known as the Old Spanish Trail, was part of a much larger system of trails extending across several western states. Additional local paths through the area were also utilized for a long time by prehistoric peoples, Native Americans, explorers, trappers, military scouts, miners, and settlers. Two forks of the North Branch of the Old Spanish Trail are present in the San Luis Valley. The East Fork straddles the base of the Sangre de Cristo Mountains before cutting west across the valley to head through a pass west of Saguache. The West Fork follows the base of the San Juan Mountains from New Mexico through Antonito and north to Saguache. The wetlands in the valley restricted movement through the interior. By the time of European exploration, many of the paths were well-established and continued to be used. The Old Spanish Trail was likely used by Don Diego de Vargas in 1694, Juan Batista de Anza in 1779, Lieutenant Zebulon Pike in 1807, fur trapper Jacob Fowler in 1822, trapper Kit Carson throughout the 1830s and 1840s, several government expeditions between 1849 and1853 (by John C. Fremont and Captain John Gunnison), and sheep herders in the 1850s to get sheep to the California Gold Rush camps. By the 1870s many of the trails had turned into well-worn wagon roads (Old Spanish Trail Association 2007). The East Fork, which runs near the proposed Fourmile East and DeTilla Gulch SEZs, was congressionally designated in 2002 as part of the National Historic Trail system under the National Trail System Act. The West Fork, whose path is near the proposed Antonito Southeast and Los Mogotes East SEZs, is not currently part of the National Historic Trail system but is undergoing evaluation for possible inclusion.

During the late nineteenth century, the Denver & Rio Grande Railroad (D&RG) heavily affected the cultural landscape of the valley. It was established in the 1870s when General William Jackson Palmer decided to try narrow-gauge tracks in the West to maneuver through the Rocky Mountains and steep passes in the Colorado Territory. His idea was very successful and spurred tremendous expansion and economic growth. Railroad towns, like Alamosa and Antonito, emerged in the San Luis Valley with a whole host of businesses to support them (restaurants, saloons, gambling establishments, bordellos, and so on). Mining, ranching, and agricultural markets expanded because of the new accessibility. The San Juan extension of the D&RG became known as the Cumbres & Toltec Scenic Railroad and is important for aiding in the establishment of the major Colorado towns of Durango and Silverton. The line, which runs to Chama, New Mexico, was taken out of regular passenger service in 1951. The Cumbres & Toltec Scenic Railroad is listed in the NRHP and is a tourist attraction for the area. Portions of the line near Antonito have also been designated as an ACEC to be managed by the BLM to protect its historical and scenic values. Another spur of the D&RG in the San Luis Valley was the D&RG Western line at Antonito, which became known as the Chili Line. The Chili Line was taken out of service and was dismantled in the 1940s (*Time* 1941).

National Register of Historic Places

Within Alamosa, Conejos, and Saguache Counties, where the four proposed SEZs are located, 29 properties are listed in the NRHP (14 in Alamosa County, 9 in Conejos County, and 6 in Saguache County). The majority of these properties are related to town (churches, courthouses, schools, stores, banks) and railroad (railcars, depots, tracks) development. Other property types include bridges, homesteads/ranches, forts, and archaeological sites. The Superintendent's Residence for the Great Sand Dunes National Park is also listed. Pike's Stockade is a National Historic Landmark, and the NRHP-listed Cumbres & Toltec Scenic Railroad is currently being nominated for National Historic Landmark status.

Of additional note related to historic properties in the San Luis Valley, the Los Caminos Antiguos Scenic and Historic Byway was established by the Colorado Scenic and Historic Byways Commission to provide visitors a glimpse of exceptional scenic, historic, cultural, recreational, and natural features present within the valley. Also related to the cultural heritage of the region, the Sangre de Cristo NHA was created in 2009. The heritage area encompasses Alamosa, Conejos, and Costilla Counties; management implications of the heritage area are not yet clear (Section 10.1.3).

10.1.17.1.4 Traditional Cultural Properties—Landscape

Traditional cultural properties of significance to the Ute, Apache, Navajo, Kiowa, Arapaho, Comanche, Cheyenne, and Pueblo ancestral groups could be present in the valley. Government-to-government consultation is ongoing with these Native American Tribes, so that their concerns, including any potential impacts on traditional cultural properties, can be adequately addressed (see also Section 10.1.18 on Native American Concerns and Chapter 14 and Appendix K for a summary of government-to-government consultations for this PEIS).

Identification of traditional cultural properties may be considered sensitive and therefore may not be fully described or disclosed in this PEIS.

Potential types of traditional cultural properties for the Navajo, Ute, and Tewa Clans of the Upper Rio Grande Pueblos are identified by Spero and Martorano (1999). The Navajo may consider natural features (such as mountains, canyons, springs, and areas containing significant plant species, clay sources, or minerals) and archaeological sites, such as battlefields, quarries, hunting traps, and other site types containing rock art, various types of cairns or stone caches, and certain artifacts, as culturally significant places. Blanca Peak has been identified as an important mountain of the Navajo, and protection of gathering rights for plants, soil, and spring water for ceremonies is an important concern (Spero and Martorano 1999). There are also reports of Jicarilla Apache traveling to Blanca Peak up until the 1930s (Martorano 1999). The Southern Ute have previously identified Great Sand Dunes National Monument and the Baca Land Grant, near Crestone, as culturally significant areas. In addition, stone circles, stone structures and alignments, wickiups, platform burials and other burial sites, quarries, caves, cairns, rock art, rockshelters, and battle or massacre sites are all types of sites and features that could be of cultural significance to the Southern Ute. The Pueblo people have previously identified the San Luis Valley as a place of emergence for the Tewa peoples.[21] Various researchers have suggested different locations within the valley as that emergence place, such as the Dry Lakes area and Great Sand Dunes National Monument. The Taos Pueblo also have an emergence myth that suggests a location near Blanca Peak (Spero and Martorano 1999).

Hispanic cultural tradition, which is strong in the San Luis Valley, began with the initial settlement of the area in the mid-1800s. The town of Antonito is one of the local settlements noteworthy for its strong Hispanic cultural heritage. The cultural tradition is evident in the art, architecture, and farming methods that continue to endure in the valley. Settlement in the San Luis Valley was based on ranching and farming economies, and the open agricultural expanses and communal irrigation systems, *acequias*, characterize the landscape today. *Acequias*, gravity-fed irrigation systems, are maintained by communal organizations and are dependent upon the cooperation of all of those who live along the canal for the care of the resource. The historic settlement patterns that were shaped by the geographical features and encounters with Native Americans remain visible on the landscape, and the historic methods of working the land are still employed and continue to be passed on through the generations (BLM 2009c).

10.1.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources

The proposed Antonito Southeast SEZ is the southernmost solar energy zone in Colorado, extending to the New Mexico state line. It is the only SEZ in Colorado with an existing surface water body, Alta Lake. No portions of the SEZ have been surveyed for cultural resources, and consequently no archaeological sites have been recorded within the SEZ (Colorado SHPO 2009). Eighty site points have been recorded within 5 mi (8 km) of the SEZ, including prehistoric and historic sites, features, structures, and isolated finds. Among those, several small sites were recorded in 1980 northwest of the SEZ, such as cairns, historic trash

[21] San Ildefonso, San Juan, Santa Clara, Nambe, and Tesuque Pueblos.

scatters, and a stone circle; a prehistoric open lithic site was recommended field eligible (Colorado SHPO 2009).

No properties currently listed in the NRHP for Conejos County are located within the SEZ; however, five properties are located nearby in the town of Antonito within 5 mi (8 km) of the SEZ. The Denver & Rio Grande Railroad San Juan Extension (also known as the Cumbres & Toltec Scenic Railroad) is one of the five properties listed in the NRHP and is located relatively close to the west side of the SEZ (within 22 mi [33 km] at the nearest point). Portions of the railroad are managed as an ACEC by the BLM; the SEZ comes within 33 mi (55 km) of the boundary of the ACEC at its nearest point.

No traditional cultural properties within the SEZ have been identified during government-to-government consultations, nor have concerns been raised to date for traditional cultural properties or sacred areas located in the vicinity of the SEZ, such as Blanca Peak (see also Section 10.1.18).

The proposed SEZ has the potential to contain significant cultural resources. The potential for finding significant Paleoindian sites exists throughout the entire valley. An isolated, corner-notched projectile point was found on the surface of a terrace overlooking Alta Lake during a preliminary site visit to the SEZ. Isolated (single) basalt flakes were also noted on the surface in at least two different locations within the SEZ; additional artifacts are likely to be encountered in the area. An earthen berm present within the SEZ could be related to the Taos Valley Canal. Taos Valley Canal 1, dating to approximately 1883, is indicated on maps at the Colorado State Engineer’s Office as going through the proposed SEZ (Brown 2010). Site records from the Colorado SHPO indicate a recorded site named “Taos Valley Canal 2” is located nearby approximately 1 mi (1.6 km) to the east, outside of the SEZ boundary (Colorado SHPO 2009). The berm, which alternatively could be associated with the former Alta Lake Reservoir, as well as other man-made features within the SEZ, should be investigated by using both traditional field methods and historical documentation and maps. An old stagecoach route also may be present through or near the SEZ. The route is documented on a USGS historic trail map of the Trinidad quadrangle (Scott 2001) and should be investigated further. An additional trail, either an animal migration trail or prehistoric trail with trail markers and possible hunting blinds along it, has also been identified within the proposed SEZ and requires further investigation (Brown 2010). Other themes of potential archaeological interest in the Antonito Southeast SEZ area would include early Hispanic New Mexican settlement in the valley and rural agricultural and settlement practices (based on research questions posed in Church et al. 2007).

On the western edge of the SEZ, historic trash scatters are present that appear to be associated with the Chili Line rail bed; they should be investigated further. The Chili Line, also officially known as the Santa Fe Branch of the D&RG Western Railroad, was a narrow-gauge rail line that ran from Santa Fe, New Mexico, to Antonito, Colo. It was part of the more well-known D&RG founded by General William Jackson Palmer in 1870. The Chili Line was named after its main source of freight, red chili peppers, which were grown by the farmers along the line. Its last run was in September 1941 because use of the line had been dwindling since the Great Depression and the railroad was no longer profitable (Brief History undated; *Time* 1941).

The West Fork of the North Branch of the Old Spanish Trail proceeds close to the western boundary of the SEZ.[22] A survey of the West Fork is needed to verify the location of the trail and identify associated sites and features. Identification of evidence for use of the West Fork during the period of 1829 to 1848 would support local recommendations by the Old Spanish Trail Association to include the West Fork as part of the congressionally designated Old Spanish National Historic Trail. Until additional research has been completed, the West Fork is being managed as a significant cultural resource in order to maintain the historic and visual integrity of the corridor (Haas 2010).

10.1.17.2 Impacts

Direct impacts on significant cultural resources could occur in the proposed Antonito Southeast SEZ; however, as stated in Section 10.1.17.1, further investigation is needed in a number of areas. A cultural resource survey of the entire area of potential effect (APE) of a proposed project (including the construction footprint, staging areas, areas of anticipated erosion, access routes, and ROWs for transmission, water, and communication lines) would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any recorded sites meet the criteria for eligibility for listing in the NRHP. Depending on the integrity of various features within the proposed SEZ, several could be determined eligible, such as the Taos Valley Canal and the stagecoach route. Section 5.15 discusses the types of impacts that could occur on any significant cultural resources found to be present within the proposed SEZ. Possible impacts from solar energy development on cultural resources that are encountered within the SEZ or along related ROWs, as well as general mitigation measures, are described in more detail in Section 5.15. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

Indirect impacts on cultural resources resulting from erosion outside of the SEZ boundary (including along ROWs) are unlikely assuming programmatic design features to reduce water runoff and sedimentation are implemented (as described in Section A.2.2). One eligible open lithic site[23] is located very near (within 0.5 mi [0.8 km]) to a reasonable location for a new transmission line to connect potential solar facilities within the SEZ to an existing 69-kV line. This site could be directly affected during construction, depending on the location of the ROW. Indirect impacts are possible from unauthorized surface collection depending on the proximity of the ROW to the site. No new road corridors have been assessed for the proposed SEZ, assuming existing roads would be used and no new areas of potential cultural significance would be opened to increased access. Impacts on cultural resources related to the creation of a new corridor would be evaluated at the project-specific level if new road construction were to occur.

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[22] The West Fork is located within 0.13 mi (0.2 km) of the SEZ at its closest point on the basis of preliminary maps; the mapped location of the trail is considered approximate.

[23] Site location information from Colorado SHPO (2009).

Although the West Fork of the North Branch of the Old Spanish Trail has not received congressionally designated National Historic Trail status, the potential effect of solar energy development on the nearby trail should be further evaluated. The historic Cumbres & Toltec Scenic Railroad is located near the proposed SEZ. The Cumbres & Toltec Scenic Railway Corridor ACEC was designated by the BLM to protect historical and scenic values associated with the railroad. As stated in Section 10.1.14.2, preliminary viewshed analyses indicate that the visual integrity of the railway corridor could be adversely affected by solar energy development within the Antonito Southeast SEZ, especially by solar power towers, cooling towers, steam plumes, transmission lines, or any other tall structures. The depot in Antonito, certain portions of the line not sufficiently screened by intervening topography, and the Cumbres & Toltec Scenic Railway Corridor ACEC are elements of the historic property that could be affected. However, the general area is not pristine, and some industrial development is present (e.g., the perlite facility adjacent to SEZ, an existing transmission line within 4 mi [6 km] to the north). Previous surface disturbances within the SEZ also include the existing highway (U.S. 285), a former irrigation reservoir (Alta Lake Reservoir), unpaved roads into the SEZ, the former railroad, and the artificial berm. Visual impacts on historic properties should be evaluated within that context to determine whether sufficient integrity of the setting can be maintained (if setting is an important element of the property's cultural significance).

10.1.17.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to mitigate adverse effects on significant cultural resources, such as avoidance of significant sites and features, are provided in Appendix A, Section A.2.2.

Ongoing consultation with the Colorado State Historic Preservation Office (SHPO) and the appropriate Native American governments would be conducted during the development of the Antonito Southeast SEZ. It is likely that adverse effects on significant resources in the valley could be mitigated to some degree through such efforts, although not enough to eliminate the effects unless a significant resource is avoided entirely. SEZ-specific design features could include the following:

- Development of a PA may be needed among the BLM, DOE, Colorado SHPO, and the Advisory Council on Historic Preservation (ACHP) to consistently address impacts on significant cultural resources within the San Luis Valley. Should a PA be developed to incorporate mitigation measures for resolving adverse effects on the Old Spanish National Historic Trail or the West Fork of the North Branch of the Old Spanish Trail, the Trail Administration for the Old Spanish Trail (BLM-NMSO and National Park Service (NPS) Intermountain Trails Office, Santa Fe) also should be included in the development of that PA.

- Additional coordination with the Cumbres & Toltec Scenic Railroad Commission is recommended to address possible mitigation measures for reducing visual impacts on the railroad.[24]

[24] Additional parties, such as the NPS and the ACHP, may need to be consulted if the railroad achieves National Historic Landmark status.

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10.1.18 Native American Concerns

10.1.18.1 Affected Environment

For a discussion of issues of possible Native American concern, several sections in this PEIS should be consulted. General topics of concern are addressed in Section 4.16. Specifically for the proposed Antonito Southeast SEZ, Section 10.1.17 discusses archaeological sites, structures, landscapes, trails, and traditional cultural properties; Section 10.1.9.1.3 discusses water rights and water use; Section 10.1.10 discusses plant species; 10.1.11 discusses wildlife species, including wildlife migration patterns; Sections 10.1.19 and 10.1.20 discuss socioeconomics and environmental justice, respectively; and issues of human health and safety are discussed in Section 5.21.

The valley was predominantly used by Tribes historically for hunting and trading rather than long-term settlement. The nearest Tribal land claim (judicially established as traditional tribal territory) to the proposed Antonito Southeast SEZ is for the Jicarilla Apache. Their land claim is located east and southeast of the Antonito Southeast SEZ, mostly in New Mexico but also up into southeastern Colorado. The Taos Pueblo has a judicially established land claim to the south of the SEZ in New Mexico.

Consultation for the Colorado SEZs has been initiated by the BLM with the Tribes[25] shown in Table 10.1.18.1-1. Details on government-to-government consultation efforts are presented in Chapter 14 and Appendix K.

10.1.18.1.1 Plant Resources

Native Americans continue to make use of a wide range of indigenous plants for food, medicine, construction materials, and the like. Although the proposed SEZs in the San Luis Valley are sparsely vegetated, some species traditionally used by Native Americans are possible. The vegetation present at the proposed Antonito Southeast SEZ is described in Section 10.1.10. In general, the vegetation consists of low shrubs. The vegetation cover types present are all part of the Inter-mountain Basin series. Semi-Desert Shrub Steppe dominates, but there are substantial areas of Semi-Desert Grassland, some Greasewood Flat, small areas of Mixed Salt Desert Scrub, and patches of Big Sagebrush Shrubland (USGS 2005b). As shown in Table 10.1.18.1-2, there are likely to be some plants in the SEZs that have been traditionally used by Native Americans for food and medicine (Fowler 1986; Callaway et al. 1986; Castetter 1935). However, project-specific analyses will be needed to determine their presence at any proposed development site. The importance of any stand to Native Americans must be determined in consultation with the affected Tribes.

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[25] Plains Tribes that may have used the valley ranged widely and may have been settled a great distance from the valley in Oklahoma and South Dakota.

TABLE 10.1.18.1-1 Federally Recognized Tribes with Traditional Ties to the Proposed SEZs in San Luis Valley

Tribe	Location	State
Cheyenne and Arapaho Tribes of Oklahoma	Concho	Oklahoma
Comanche Nation	Lawton	Oklahoma
Eastern Shoshone	Fort Washakie	Wyoming
Fort Sill Apache Tribe of Oklahoma	Apache	Oklahoma
Hopi	Kykotsmovi	Arizona
Jicarilla Apache Nation	Dulce	New Mexico
Kiowa Tribe of Oklahoma	Carnegie	Oklahoma
Navajo Nation	Window Rock	Arizona
Northern Arapaho	Fort Washakie	Wyoming
Northern Cheyenne	Lame Deer	Montana
Ohkay Owingeh	San Juan Pueblo	New Mexico
Pueblo of Nambe	Santa Fe	New Mexico
Pueblo of Santa Ana	Santa Ana Pueblo	New Mexico
Pueblo of Santo Domingo	Santo Domingo Pueblo	New Mexico
San Ildefonso Pueblo	Santa Fe	New Mexico
Santa Clara Pueblo	Espanola	New Mexico
Southern Ute	Ignacio	Colorado
Taos Pueblo	Taos	New Mexico
Tesuque Pueblo	Santa Fe	New Mexico
Ute Mountain Ute	Towaoc	Colorado
Ute Tribe of the Uinta and Ouray Reservation	Fort Duchesne	Utah
White Mesa Ute	Blanding	Utah

TABLE 10.1.18.1-2 Plant Species Important to Native Americans Observed or Likely To Be Present in the San Luis Valley

Common Name	Scientific Name	Status
Food		
Basin wildrye	*Leymus cinerus*	Possible
Dropseed	*Sporobolus airoides*	Possible
Galleta	*Pleuraphis jamesii*	Possible
Indian ricegrass	*Achnatherum hymenoides*	Possible
Rabbitbrush	*Chrysothamnus greenei*	Possible
Sagebrush	*Artemisia* spp.	Possible
Saltbush	*Atriplex* spp.	Possible
Wheatgrass	*Elymus lanceolatus*	Possible
Wolfberry	*Lycium andersonii*	Possible
Medicine		
Mormon tea	*Ephedra* spp.	Possible
Saltbush	*Atriplex* spp.	Possible

Sources: Field visit; USGS (2005b); Fowler (1986); Callaway et al. (1986); Castetter (1935).

10.1.18.1.2 Other Resources

Water is an essential prerequisite for life in the arid areas of the Southwest. As a result, it is a keystone of many desert cultures' religions. Springs are of particular importance. Tribes are also sensitive about the use of scarce local water supplies for the benefit of distant communities and recommend that determination of adequate water supplies be a primary consideration as to whether a site is suitable for the development of a utility-scale solar energy facility (Moose 2009).

The habitat found on the four proposed San Luis Valley SEZs is similar. The wildlife likely to be found there is similar as well. Wildlife likely to be found in the proposed Antonito Southeast SEZ is described in Section 10.1.11. Species traditionally hunted by local Native Americans whose range includes the proposed San Luis Valley SEZ are listed in Table 10.1.18.1-3. Most of these are common small animals and birds. Traditionally important large game animals include mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*) (Callaway et al. 1986). Pronghorn and mule deer are possible on the San Luis Valley floor. There is habitat for elk and bighorn sheep in the surrounding mountains.

TABLE 10.1.18.1-3 Animal Species Used by Native Americans as Food Whose Range Includes the Proposed San Luis Valley SEZs

Common Name	Scientific Name	Status
Mammals		
Badger	*Taxidea taxus*	All year
Chipmunks	*Tamias* spp	All year
Mountain cottontail	*Silvilagus nattallii*	All year
Coyote	*Canis latrans*	All year
Ground squirrels	*Spermophilus* spp.	All year
Jack rabbits	*Lepus* spp.	All year
Kangaroo rat	*Dipodomys ordii*	All year
Mountain lion	*Puma concolor*	All year
Mule deer	*Odocoileus hemionus*	All year
Pocket mouse	*Perognathus flavus*.	All year
Porcupine	*Erethizon dorsatum*	All year
Prairie dog	*Cynimys gunnisoni*	All year
Pronghorn	*Antilocapra americana*	All year
Red Fox	*Vulpes vulpes*	All year
Ringtail	*Bassariseus astutus*	All year
Striped skunk	*Mephilis mephilis*	All year
Wood rats	*Neotoma* spp.	All year
Birds		
Great horned owl	*Bubo virginianus*	All year
Northern mockingbird	*Mimus polyglottos*	All year

Sources: Field visit; USGS (2005b); Callaway et al. (1986); Fowler (1986).

10.1.18.2 Impacts

To date, no comments have been received from the Tribes referencing the proposed Antonito Southeast SEZ specifically. The Navajo Nation has responded that “the proposed undertaking/project area will not impact any Navajo traditional cultural properties,” with the caveat that the Nation be notified of any inadvertent discoveries that might take place related to the undertaking (Joe 2008; Joe 2009). No direct impacts from disturbance during project development would occur on areas previously indicated as culturally significant (San Luis Lakes, the Great Sand Dunes, Blanca Peak). For example, gathering rights on Blanca Peak will not be affected by development in the Antonito Southeast SEZ; however, it is possible that there will be Native American concerns about potential visual effects and the effects of noise from solar energy development in the SEZ on Blanca Peak (see Section 10.1.17) or on the valley as a whole as consultation continues and additional analyses are undertaken. If 80% of the proposed SEZ were developed, it is likely that some plants traditionally important to Native Americans will be destroyed and that habitat of traditionally important animals will be lost. Given that similar plants and habitat would remain in the valley, project-level consultation with affected Tribes will be necessary to determine the importance of the traditional resources.

Groundwater withdrawals in the valley are tightly regulated, and the use of programmatic design features described in Appendix A, Section A.2.2, would ensure that minimal impacts on surface waters and springs would occur.

10.1.18.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to mitigate impacts of potential concern to Native Americans, such as avoidance of sacred sites, water sources, and tribally important plant and animal species, are provided in Appendix A, Section A.2.2.

The need for and nature of SEZ-specific design features regarding potential issues of concern would be determined during government-to-government consultation with affected Tribes listed in Table 10.1.18.1-1.

10.1.19 Socioeconomics

10.1.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the region of influence (ROI) surrounding the proposed Antonito Southeast SEZ. The ROI is a six-county area comprising Alamosa, Conejos, Costilla, and Rio Grande Counties in Colorado and Rio Arriba and Taos Counties in New Mexico. It encompasses the area in which workers are expected to spend most of their salaries and in which a portion of site purchases and nonpayroll expenditures from the construction, operation, and decommissioning phases of the proposed SEZ facility are expected to take place.

10.1.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 55,187 (Table 10.1.19.1-1). Over the period 1999 to 2008, annual average employment growth rates were higher in Taos County (3.7%) and Rio Grande County (2.4%) than elsewhere in the ROI. Employment in Conejos County declined over this period. At 1.5%, the growth rate in the ROI as a whole was similar to the average state rates for Colorado (1.5%) and New Mexico (1.5%).

In 2006, the service sector provided the highest percentage of employment in the ROI at 47.7%, followed by agriculture (18.6%) and wholesale and retail trade (18.0%) (Table 10.1.19.1-2). Smaller employment shares were held by construction (7.0%) and finance,

TABLE 10.1.19.1-1 ROI Employment for the Proposed Antonito Southeast SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Alamosa County, Colorado	7,885	7,935	0.1
Conejos County, Colorado	3,498	3,402	–0.3
Costilla County, Colorado	1,234	1,268	0.3
Rio Grande County, Colorado	4,784	6,040	2.4
Rio Arriba County, New Mexico	18,426	19,886	0.8
Taos County, New Mexico	11,612	16,656	3.7
ROI	47,439	55,187	1.5
Colorado	2,269,668	2,596,309	1.5
New Mexico	793,052	919,466	1.5

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

TABLE 10.1.19.1-2 ROI Employment for the Proposed Antonito Southeast SEZ by Sector, 2006[a]

	Alamosa County, Colorado		Conejos County, Colorado		Costilla County, Colorado		Rio Grande County, Colorado	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,470	22.4	488	42.8	484	77.0	1,763	41.9
Mining	10	0.2	10	0.9	0	0.0	0	0.0
Construction	324	4.9	39	3.4	14	2.2	179	4.3
Manufacturing	93	1.4	60	5.3	10	1.6	79	1.9
Transportation and public utilities	201	3.1	100	8.8	10	1.6	70	1.7
Wholesale and retail trade	1,300	19.8	159	14.0	90	14.3	769	18.3
Finance, insurance, and real estate	434	6.6	41	3.6	10	1.6	197	4.7
Services	2,752	41.9	299	26.3	114	18.1	1,172	27.9
Other	9	0.1	0	0.0	10	1.6	10	0.2
Total	6,575		1,139		631		4,207	

	Rio Arriba County, New Mexico		Taos County, New Mexico		RIO	
	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,281	14.1	353	3.6	5,841	18.6
Mining	107	1.2	758	0.8	205	0.7
Construction	621	6.8	1,038	10.6	2,215	7.0
Manufacturing	176	1.9	133	1.4	551	1.8
Transportation and public utilities	225	2.5	199	2.0	805	2.6
Wholesale and retail trade	1,724	18.9	1,637	16.7	5,679	18.0
Finance, insurance, and real estate	290	3.2	495	5.0	1,467	4.7
Services	4,803	52.8	5,874	59.8	15,014	47.7
Other	10	0.1	10	0.1	49	0.2
Total	9,100		9,825		31,477	

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

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

insurance, and real estate (4.7%). Within the ROI, the distribution of employment across sectors was similar to that of the ROI as a whole; the percentage of employment in agriculture was lower in Rio Arriba County (14.1%) and in Taos County (3.6%) than in the ROI as a whole. Employment in agriculture was more significant in the four Colorado counties than in the ROI as a whole; more than 75% of total employment in this sector was in Costilla County and more than 40% in Rio Grande and Conejos Counties. Employment in services was much less significant than in the ROI as a whole.

10.1.19.1.2 ROI Unemployment

Unemployment rates have varied across the six counties in the ROI. Over the period 1999 to 2008, the average rate in Costilla County was 9.2%, with a relatively high rate of 6.9% in Taos and Conejos Counties; rates exceeded 5% in all counties except Alamosa over this period (Table 10.1.19.1-3). Rates have fallen over the period; in 1999, Taos and Conejos Counties experienced rates higher than 11%. The average rate in the ROI over this period was 6.1%, higher than the average rate for Colorado (4.5%) and New Mexico (5.0%). Unemployment rates for the first five months of 2009 contrast with rates for 2008 as a whole; in Costilla County, the unemployment rate increased to 11.1%, while rates reached 9.9% and 8.1% in Conejos County and Rio Grande County, respectively. The average rates for the ROI (7.0%), for Colorado (7.5%), and for New Mexico (5.6%) were also higher during this period than the corresponding average rates for 2008.

10.1.19.1.3 ROI Urban Population

The population of the ROI in 2008 was 29% urban; the largest city, Alamosa, had an estimated population of 8,746; other cities in the ROI include Espanola, New Mexico (7,076), Taos, New Mexico (5,546) and Monte Vista, Colorado (4,015) (Table 10.1.19.1-4). In addition, there are ten smaller cities in the ROI with 2008 populations of less than 1,500.

Population growth rates in the ROI have varied over the period 2000 to 2008 (Table 10.1.19.1-4). Taos, New Mexico, grew at an annual rate of 2.1% during this period, with higher-than-average growth also experienced in Chama, New Mexico (1.4%) and Alamosa, Colorado (1.2%). The remaining cities experienced lower growth rates from 2000 to 2008, with majority of these cities experiencing negative growth rates during this period.

10.1.19.1.4 ROI Urban Income

Median household incomes vary across cities in the ROI. No data are available for cities in the ROI for 2006 to 2008. In 1999, only Taos Ski Village, New Mexico ($87,175) had median

TABLE 10.1.19.1-3 ROI Unemployment Rates (%) for the Proposed Antonito Southeast SEZ

Location	1999–2008	2008	2009[a]
Alamosa County	5.0	5.3	7.6
Conejos County	6.9	7.5	9.9
Costilla County	9.2	7.6	11.1
Rio Grande County	5.6	5.8	8.1
Rio Arriba County	5.9	5.1	6.1
Taos County	6.9	5.2	6.5
ROI	6.1	5.5	7.0
Colorado	4.5	4.2	7.5
New Mexico	5.0	4.9	5.6

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

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

TABLE 10.1.19.1-4 ROI Urban Population and Income for the Proposed Antonito Southeast SEZ

	Population			Median Household Income ($ 2008)		
City	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 (%)[a]
Alamosa, Colorado	7,960	8,746	1.2	32,771	NA	NA
Espanola, New Mexico	7,105	7,076	–0.1	34,948	NA	NA
Taos, New Mexico	4,700	5,546	2.1	32,208	NA	NA
Monte Vista, Colorado	4,529	4,015	–1.5	36,556	NA	NA
Chama, New Mexico	1,199	1,344	1.4	39,286	NA	NA
Manassa, Colorado	1,042	936	–1.3	29,731	NA	NA
La Jara, Colorado	877	784	–1.4	31,115	NA	NA
Antonito, Colorado	873	776	–1.5	24,727	NA	NA
Sanford, Colorado	817	733	–1.3	32,993	NA	NA
San Luis, Colorado	739	641	–1.8	18,299	NA	NA
Blanca, Colorado	391	343	–1.6	29,452	NA	NA
Romeo, Colorado	375	340	–1.2	24,857	NA	NA
Hooper, Colorado	123	125	0.2	41,154	NA	NA
Taos Ski Village, New Mexico	56	58	0.4	87,175	NA	NA

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

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

incomes that were higher than the average for Colorado ($56,574) and New Mexico ($43,202) (Table 10.1.19.1-4).

10.1.19.1.5 ROI Population

Table 10.1.19.1-5 presents recent and projected populations in the ROI and states as a whole. Population in the ROI stood at 116,511 in 2008, having grown at an average annual rate of 0.7% since 2000. Growth rates for the ROI were lower than those for New Mexico (1.7%) and Colorado (1.9%) over the same period.

Three of the six counties in the ROI have experienced minor growth in population since 2000; the remainder experienced loss of population. Population in Taos County, New Mexico, grew at an annual rate of 1.2% from 2000 to 2008, while Alamosa County, Colorado, and Rio Arriba County, New Mexico, populations grew by 0.7% over the same period. The remaining counties saw declines in population of less than 1.0%. The ROI population is expected to increase to 132,554 by 2021 and to 134,655 by 2023.

10.1.19.1.6 ROI Income

Personal income in the ROI stood at $3.0 billion in 2007 and has grown at an annual average rate of 2.2% over the period 1998 to 2007 (Table 10.1.19.1-6). ROI personal income per

TABLE 10.1.19.1-5 ROI Population for the Proposed Antonito Southeast SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Alamosa County, Colorado	14,966	15,783	0.7	20,210	20,943
Conejos County, Colorado	8,400	8,232	−0.3	9,322	9,453
Costilla County, Colorado	3,663	3,465	−0.7	3,898	3,945
Rio Grande County, Colorado	12,413	12,279	−0.1	14,465	14,776
Rio Arriba County, New Mexico	41,190	43,653	0.7	46,300	46,487
Taos County, New Mexico	29,979	33,100	1.2	38,359	39,051
ROI	110,611	116,511	0.7	132,554	134,655
Colorado	4,301,261	5,010,395	1.9	6,398,532	6,613,747
New Mexico	1,819,046	2,085,115	1.7	2,573,667	2,640,712

Sources: U.S. Bureau of the Census (2009e,f); State Demography Office (2009); University of New Mexico (2009).

TABLE 10.1.19.1-6 ROI Personal Income for the Proposed Antonito Southeast SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Alamosa County, Colorado			
Total income[a]	0.4	0.4	1.1
Per-capita income	26,089	27,238	0.4
Conejos County, Colorado			
Total income[a]	0.2	0.2	0.9
Per-capita income	18,795	20,161	0.7
Costilla County, Colorado			
Total income[a]	0.1	0.1	0.9
Per-capita income	20,755	23,273	1.2
Rio Grande County, Colorado			
Total income[a]	0.3	0.4	0.5
Per-capita income	27,435	27,814	0.1
Rio Arriba County, New Mexico			
Total income[a]	0.8	1.0	2.4
Per-capita income	19,865	23,321	1.6
Taos County, New Mexico			
Total income[a]	0.7	0.9	3.6
Per-capita income	23,005	28,763	2.3
ROI			
Total income[a]	2.4	3.0	2.2
Per-capita income	22,360	25,637	1.4
Colorado			
Total income[a]	118.5	199.5	2.8
Per capita income	37,878	41,955	1.0
New Mexico			
Total income[a]	48.8	62.4	2.5
Per-capita income	27,182	30,497	1.2

[a] Unless indicated otherwise, values are reported in $ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

capita also rose over the same period at a rate of 1.4%, increasing from $22,360 to $25,637. Per-capita incomes were higher in Taos ($28,763), Rio Grande ($27,814), and Alamosa ($27,238) Counties in 2007 than elsewhere in the ROI. Personal income and per-capita income growth rates have been higher in Rio Arriba and Taos Counties than in New Mexico as a whole; in 2007 per-capita personal income, however, was higher in New Mexico ($30,497) than in both New Mexico counties. In the Colorado counties, per-capita income growth rates in Costilla County were higher than the state rate, but per-capita incomes were significantly lower in these counties than in Colorado as a whole ($41,955).

Median household income over the period 2006 to 2008 varied from $25,146 in Costilla County to $41,387 in Rio Arriba County (U.S. Bureau of the Census 2009d).

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10.1.19.1.7 ROI Housing

In 2007, more than 57,300 housing units were located in the six ROI counties; more than 6% of these were located in Rio Arriba and Taos Counties (Table 10.1.19.1-7). Owner-occupied units compose approximately 75% of the occupied units in the six counties, with rental housing making up 25% of the total. Vacancy rates in 2007 were significantly higher in Taos County (32.4%) and Costilla County (31.7%) than elsewhere in the ROI, although a significant portion of vacant housing in Taos County were units used for seasonal or recreational purposes. With an overall vacancy rate of 25.6% in the ROI, there were 14,691 vacant housing units in the ROI in 2007, of which 2,844 are estimated to be rental units that would be available to construction workers. There were 5,837 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

Housing stock in the ROI as a whole grew at an annual rate of 1.0% over the period 2000 to 2007, with 3,729 new units added to the existing housing stock in the ROI (Table 10.1.19.1-7).

The median value of owner-occupied housing in 2008 varied from $58,980 in Costilla County to $233,000 in Taos County (U.S. Bureau of the Census 2009g).

10.1.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 10.1.19.1-8. There are five Tribal governments located in the ROI, and there are members of other Tribal groups located in the ROI but whose Tribal governments are located in adjacent counties or states.

10.1.19.1.9 ROI Community and Social Services

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

TABLE 10.1.19.1-7 ROI Housing Characteristics for the Proposed Antonito Southeast SEZ

Parameter	2000	2007[a]
Alamosa County, Colorado		
Owner-occupied	3,498	3,713
Rental	1,969	2,090
Vacant units	621	659
Seasonal and recreational use	75	NA[b]
Total units	6,088	6,463
Conejos County, Colorado		
Owner-occupied	2,347	2,590
Rental	633	699
Vacant units	906	1,000
Seasonal and recreational use	544	NA
Total units	3,886	4,289
Costilla County, Colorado		
Owner-occupied	1,175	1,230
Rental	328	343
Vacant units	699	732
Seasonal and recreational use	447	NA
Total units	2,202	2,305
Rio Grande County, Colorado		
Owner-occupied	3,323	3,676
Rental	1,378	1,524
Vacant units	1,302	1,440
Seasonal and recreational use	761	NA
Total units	6,003	1,641
Rio Arriba County, New Mexico		
Owner-occupied	12,281	11,164
Rental	2,763	2,831
Vacant units	2,972	4,731
Seasonal and recreational use	1,042	NA
Total units	18,016	18,726
Taos County, New Mexico		
Owner occupied	9,570	9,166
Rental	3,105	3,609
Vacant units	4,729	6,129
Seasonal and recreational use	2,968	NA
Total units	17,404	18,904

TABLE 10.1.19.1-7 (Cont.)

Parameter	2000	2007[a]
ROI Total		
Owner-occupied	32,194	31,540
Rental	10,176	11,097
Vacant units	11,229	14,691
Seasonal and recreational use	5,837	NA
Total units	53,599	57,328

[a] 2007 data for number of owner-occupied, rental, and vacant units for Colorado counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

[b] NA = data not available.

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

TABLE 10.1.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Antonito Southeast SEZ

Governments	
City	
Alamosa, Colorado	Manassa, Colorado
Antonito, Colorado	Monte Vista, Colorado
Blanca, Colorado	Romeo, Colorado
Chama, New Mexico	San Luis, Colorado
Espanola, New Mexico	Sanford, Colorado
Hooper, Colorado	Taos, New Mexico
La Jara, Colorado	Taos Ski Village, New Mexico
County	
Alamosa County, Colorado	Rio Grande County, Colorado
Conejos County, Colorado	Rio Arriba County, New Mexico
Costilla County, Colorado	Taos County, New Mexico
Tribal	
Jicarilla Apache Nation, New Mexico	Pueblo of Santa Clara, New Mexico
Pueblo of Picuris, New Mexico	Pueblo of Taos, New Mexico
Pueblo of San Juan, New Mexico	

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

Schools

In 2007, the six-county ROI had a total of 92 public and private elementary, middle, and high schools (NCES 2009). Table 10.1.19.1-9 provides summary statistics for enrollment and educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Costilla County schools (11.1) is slightly lower than for schools in the remaining five counties, while the level of service is slightly higher in Conejos County (15.4); in Taos County, there are fewer teachers per 1,000 population (8.8).

Health Care

While Taos County has a much larger number of physicians (98), the number of physicians per 1,000 population is also higher there than in the majority of the remaining counties in the ROI and significantly higher than in Costilla County (0.8) (Table 10.1.19.1-10). The smaller number of health care professionals in Conejos and Costilla Counties may mean that residents of these counties have poorer access to health care; a substantial number of county residents might also travel to other counties in the ROI for their medical care.

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI (Table 10.1.19.1-11). Conejos County has 7 officers and would provide law enforcement services to the SEZ; there are 69 officers in the remainder of the ROI counties. Currently, there is only one professional firefighter in the ROI, with the majority of firefighting services provided

TABLE 10.1.19.1-9 ROI School District Data for the Proposed Antonito Southeast SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Alamosa County, Colorado	2,483	166	14.9	10.5
Conejos County, Colorado	1,830	129	14.2	15.4
Costilla County, Colorado	535	48	11.1	13.6
Rio Grande County, Colorado	2,272	170	13.4	13.5
Rio Arriba County, New Mexico	6,550	447	14.7	10.3
Taos County, New Mexico	4,315	287	15.1	8.8
ROI	17,985	1,246	14.4	10.7

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

Source: NCES (2009).

TABLE 10.1.19.1-10 Physicians in the Proposed Antonito Southeast SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Alamosa County, Colorado	41	2.6
Conejos County, Colorado	8	1.0
Costilla County, Colorado	3	0.8
Rio Grande County, Colorado	13	1.0
Rio Arriba County, New Mexico	47	1.1
Taos County, New Mexico	98	3.0
ROI	210	1.8

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

Source: AMA (2009).

TABLE 10.1.19.1-11 Public Safety Employment in the Proposed Antonito Southeast SEZ ROI

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service
Alamosa County	21	1.3	0	0.0
Conejos County	7	0.8	0	0.0
Costilla County	5	1.4	0	0.0
Rio Grande County	8	0.6	0	0.0
Rio Arriba County	18	0.4	1	0.0
Taos County	17	0.5	0	0.0
ROI	76	0.7	1	0.0

[a] 2007 data.

[b] Number per 1,000 population.

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

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

by volunteers (Table 10.1.19.1-9). Levels of service of police protection in Costilla County (1.4) and Alamosa County (1.3) are higher than those for the counties in the remainder of the ROI and lower than those in Rio Arriba County (0.4).

10.1.19.1.10 ROI Social Structures and Social Change

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

Various energy development studies have suggested that once the annual growth in population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase, and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Tables 10.1.19.1-12 and 10.1.19.1-13 present data for a number of indicators of social change, including violent crime and property crime rates, alcoholism and illicit drug use, and mental health and divorce, that might be used to indicate social change.

The level of crime varies somewhat across the ROI, with slightly higher rates of violent crime in Rio Arriba County (5.1 per 1,000 population) and Alamosa County (4.1) and lower rates elsewhere in the ROI (Table 10.1.19.1-12). Property-related crime rates are much higher in Alamosa County (30.2) than in the remainder of the ROI; overall crime rates in Alamosa County were almost double the rate for the ROI as a whole. No crime rates were reported for Conejos County and Costilla County.

Other measures of social change—alcoholism, illicit drug use, and mental health—are not available at the county level and thus are presented for the Substance Abuse and Mental Health Services Administration (SAMHSA) regions in which the ROI is located. There is some variation across the ROI, with slightly higher rates in the Colorado portion of the ROI than in the New Mexico counties (Table 10.1.19.1-13). Divorce rates are also slightly higher in Colorado as a whole than in New Mexico.

10.1.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for a range of activities, including hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These activities are discussed in Section 10.1.5.

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

TABLE 10.1.19.1-12 County and ROI Crime Rates for the Proposed Antonito Southeast SEZ[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
Location	Offenses	Rate	Offenses	Rate	Offenses	Rate
Alamosa County, Colorado	65	4.1	477	30.2	542	34.3
Conejos County, Colorado	NA[d]	NA	NA	NA	NA	NA
Costilla County, Colorado	NA	NA	NA	NA	NA	NA
Rio Grande County, Colorado	26	2.1	139	11.3	165	13.4
Rio Arriba County, New Mexico	224	5.1	669	15.3	893	20.5
Taos County, New Mexico	58	1.8	448	13.5	506	15.3
ROI	368	3.2	1,696	14.6	2,064	17.7

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

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

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

[d] NA = not available.

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

TABLE 10.1.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Antonito Southeast SEZ ROI

Geographic Area	Alcoholism[a]	Illicit Drug Use[a]	Mental Health[b]	Divorce[c]
Colorado Region 4 (includes Alamosa, Conejos, Costilla, and Rio Grande Counties)	9.7	3.1	10.2	–[d]
New Mexico Region 2 (includes Rio Arriba and Taos Counties	9.3	2.6	9.8	–
Colorado				4.4
New Mexico				4.3

[a] Data for alcoholism and drug use represent percentage of the population over 12 years of age with dependence or abuse of alcohol or illicit drugs. Data are averages for 2004 to 2006.

[b] Data for mental health represent percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

[c] Divorce rates are the number of divorces per 1,000 population. Data are for 2004.

[d] A dash indicates not applicable.

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

Another method is to estimate the economic impact of the various recreational activities supported by natural resources on public land in the vicinity of the proposed solar facilities by identifying sectors in the economy in which expenditures on recreational activities occur. Not all activities in these sectors are directly related to recreation on state and federal lands, with some activity occurring on private land (e.g., dude ranches, golf courses, bowling alleys, and movie theaters). Expenditures associated with recreational activities form an important part of the economy of the ROI. In 2007, 5,577 people were employed in the ROI in the various sectors identified as recreation, constituting 10.0% of total ROI employment (Table 10.1.19.1-14). Recreation spending also produced almost $104.3 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

10.1.19.2 Impacts

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

10.1.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of expenditures of wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as

TABLE 10.1.19.1-14 Recreation Sector Activity in the Proposed Antonito Southeast SEZ ROI, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	336	8.1
Automotive rental	18	0.6
Eating and drinking places	3,479	55.7
Hotels and lodging places	882	19.4
Museums and historic sites	55	4.9
Recreational vehicle parks and campsites	187	3.7
Scenic tours	154	5.7
Sporting goods retailers	486	6.2
Total ROI	5,577	104.3

Source: MIG, Inc. (2010).

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

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits). While it is clear that some land in the ROI would no longer be accessible for recreation, the majority of popular recreational locations would be precluded from solar development. It is also possible that solar facilities in the ROI would be visible from popular recreation locations, and that construction workers residing temporarily in the ROI would occupy accommodations otherwise used for recreational visits, thus reducing visitation and consequently affecting the economy of the ROI.

Social Change

Although an extensive literature in sociology documents the most significant components of social change in energy boomtowns, the nature and magnitude of the social impact of energy developments in small rural communities is still unclear (see Section 5.17). While some degree of social disruption is likely to accompany large-scale in-migration during the boom phase, there is insufficient evidence to predict the extent to which specific communities are likely to be affected, which population groups within each community are likely to be most affected, and the extent to which social disruption is likely to persist beyond the end of the boom period (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it has been suggested that social disruption is likely to occur once an arbitrary population growth rate associated with solar energy development projects has been reached; an annual rate of 5 to 10% growth in population is assumed to result in a breakdown in social structures, with a consequent increase in alcoholism, depression, suicide, social conflict, divorce, delinquency, and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

In overall terms, the in-migration of workers and their families into the ROI would represent an increase of 1.4 % in ROI population during construction of the trough technology and smaller increases for the power tower, dish engine and photovoltaic technologies, and during the operation of each technology. While it is possible that some construction and operations workers will choose to locate in communities closer to the SEZ, the lack of available housing in smaller rural communities in the ROI to accommodate all in-migrating workers and families, and an insufficient range of housing choices to suit all solar occupations, many workers are likely to commute to the SEZ from larger communities elsewhere in the ROI, reducing the potential impact of solar developments on social change. Regardless of the pace of population growth associated with the commercial development of solar resources and the likely residential location of in-migrating workers and families in communities some distance from the SEZ itself, the number of new residents from outside the region of influence is likely to lead to some demographic and social change in small rural communities in the ROI. Communities hosting solar developments are likely to be required to adapt to a different quality of life, with a transition away from a more traditional lifestyle involving ranching and taking place in small, isolated, close-knit, homogenous communities with a strong orientation toward personal and family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing dependence on formal social relationships within the community.

Livestock Grazing Impacts

Cattle ranching and farming supported 847 jobs and $5.0 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed SEZ could result in a decline in the amount of land available for livestock grazing, resulting in the loss of a total (direct plus indirect) of 7 jobs and $0.1 million in income in the ROI. There would also be a decline in grazing fees payable to the BLM and to the USFS by individual permittees based on the number of AUMs required to support livestock on public land. Assuming the 2008 fee of $1.35 per AUM, grazing fee losses would amount to $575 annually on land dedicated to solar development in the SEZ.

Transmission Line Impacts

The impacts of transmission line construction could include the addition of 18 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 10.1.19.2-1). Construction activities in the peak year would constitute less than 0.1% of total ROI employment. A transmission line would also produce $0.7 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, less than $0.1 million.

Given the likelihood of local worker availability in the required occupational categories, construction of a transmission line would mean that some in-migration of workers and their families from outside the ROI would be required, with 21 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 11 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 0.1% of the vacant rental units expected to be available in the ROI.

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

TABLE 10.1.19.2-1 Proposed Antonito Southeast SEZ ROI Socioeconomic Impacts of Transmission Line Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	8	<1
Total	18	<1
Income[b]		
Total	0.7	<0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	21	<1
Vacant housing[c] (no.)	11	<1
Local community service employment		
Teachers (no.)	<1	<1
Physicians (no.)	<1	<1
Public safety (no.)	<1	<1

a Construction impacts assume 4 mi [6 km] of transmission line is required to connect SEZ solar facilities to the grid. Construction impacts were assessed for a single representative year, 2021.

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

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

Total operations employment impacts on the ROI (including direct and indirect impacts) of a transmission line would be less than 1 job (Table 10.1.19.2-1) and would also produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, less than $0.1 million. Operation of a transmission line would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no new community service employment would be required in order to meet existing levels of service in the ROI.

10.1.19.2.2 Technology-Specific Impacts

The economic impacts of solar energy development in the proposed SEZ were measured in terms of employment, income, state tax revenues (sales and income), BLM acreage rental and capacity payments, population in-migration, housing, and community service employment (education, health, and public safety). More information on the data and methods used in the analysis can be found in Appendix M.

The assessment of the impact of the construction and operation of each technology was based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of possible impacts, solar facility size was estimated on the basis of the land requirements of various solar technologies, assuming that 9 acres/MW (0.04 km^2/MW) would be required for power tower, dish engine, and PV technologies and 5 acres/MW (0.02 km^2/MW) for solar trough technologies. Impacts of multiple facilities employing a given technology at each SEZ were assumed to be the same as impacts for a single facility with the same total capacity. Construction impacts were assessed for a representative peak year of construction, assumed to be 2021 for each technology. Construction impacts assumed that a maximum of one project could be constructed within a given year, with a corresponding maximum land disturbance of up to 3,000 acres (12 km^2). For operations impacts, a representative first year of operations was assumed to be 2023 for each technology. The years of construction and operations were selected as representative of the entire 20-year study period because they are the approximate midpoint; construction and operations could begin earlier.

Solar Trough

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of solar trough technologies would be 2,885 jobs (Table 10.1.19.2-2). Construction activities in 2021would constitute 4.6% of total ROI employment. A solar development would also produce $153.7 million in income. Direct sales taxes would be $0.1 million in 2021; direct income taxes, $5.9 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 1,827 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 914 rental units expected to be occupied in the ROI. This occupancy rate would represent 28.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would also affect community service employment (education, health, and public safety). An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 21 new teachers, 3 physicians, and 1 public safety employee (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 1.4% of total ROI employment expected in these occupations.

TABLE 10.1.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with Trough Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	1,641	339
Total	2,885	530
Income[b]		
Total	153.7	16.7
Direct state taxes[b]		
Sales	0.1	0.1
Income	5.9	0.5
BLM payments[b]		
Rental	NA[d]	0.6
Capacity[c]	NA	10.2
In-migrants (no.)	1,827	216
Vacant housing[e] (no.)	914	194
Local community service employment		
Teachers (no.)	21	2
Physicians (no.)	3	0
Public safety (no.)	1	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 600 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 1,557 MW.

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

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

[d] NA = not available.

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

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using solar trough technologies would be 530 jobs (Table 10.1.19.2-2). Such a solar development would also produce $16.7 million in income. Direct sales taxes would be $0.1 million; direct income taxes, $0.5 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $10.2 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 216 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 194 owner-occupied units expected to be occupied in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (health, education, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the provision of these services in the ROI. Accordingly, two new teachers would be required in the ROI in 2021.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technologies would be 1,149 jobs (Table 10.1.19.2-3). Construction activities would constitute 1.8% of total ROI employment. Such a solar development would also produce $61.2 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $2.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 728 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 364 rental units expected to be occupied in the ROI. This occupancy rate would represent 11.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, eight new teachers, one physician, and one public safety employee (career firefighters and

TABLE 10.1.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with Power Tower Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	654	175
Total	1,149	247
Income[b]		
Total	61.2	7.6
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	2.4	0.3
BLM payments[b]		
Rental	NA[d]	0.6
Capacity[c]	NA	5.7
In-migrants (no.)	728	112
Vacant housing[c] (no.)	364	100
Local community service employment		
Teachers (no.)	8	1
Physicians (no.)	1	0
Public safety (no.)	1	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 33 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 865 MW.

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

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

[d] NA = not available.

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

uniformed police officers) would be required in the ROI in 2021. These increases would represent 0.5% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using power tower technologies would be 247 jobs (Table 10.1.19.2-3). Such a solar development would also produce $7.6 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.3 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $5.7 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 112 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 100 owner-occupied units expected to be required in the ROI.

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

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of dish engine technologies would be 467 jobs (Table 10.1.19.2-4). Construction activities would constitute 0.7% of total ROI employment. Such a solar development would also produce $24.9 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $1.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 296 persons in-migrating into the ROI. Although in migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 148 rental units expected to be occupied in the ROI. This occupancy rate would represent 4.6% of the vacant rental units expected to be available in the ROI.

TABLE 10.1.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with Dish Engine Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	266	170
Total	467	240
Income[b]		
Total	24.9	7.4
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	1.0	0.3
BLM payments[b]		
Rental	NA[c]	0.6
Capacity[d]	NA	5.7
In-migrants (no.)	296	108
Vacant housing[e] (no.)	148	98
Local community service employment		
Teachers (no.)	3	1
Physicians (no.)	1	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 865 MW.

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

[c] NA = not available.

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

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

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

Operations. Total operations employment impacts on the ROI (including direct and indirect impacts) of a build-out using dish engine technologies would be 240 jobs (Table 10.1.19.2-4). Such a solar development would also produce $7.4 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.3 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $5.7 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a dish engine solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 108 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 98 owner-occupied units expected to be required in the ROI.

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

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) in 2021 from use of PV technologies would be 218 jobs (Table 10.1.19.2-5). Construction activities in 2021would constitute 0.3 % of total ROI employment. Such a solar development would also produce $11.6 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $0.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 138 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large,

TABLE 10.1.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Antonito Southeast SEZ with PV Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	124	17
Total	218	24
Income[b]		
Total	11.6	0.7
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	0.4	<0.1
BLM payments[b]		
Rental	NA[c]	0.6
Capacity[d]	NA	4.5
In-migrants (no.)	138	11
Vacant housing[e] (no.)	69	10
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 865 MW.

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

[c] NA = not available.

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

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

with 69 rental units expected to be occupied in the ROI. This occupancy rate would represent 2.1% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, two new teachers would be required in the ROI. This increase would represent 0.1% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts on the ROI (including direct and indirect impacts) of a build-out using PV technologies would be 24 jobs (Table 10.1.19.2-5). Such a solar development would also produce $0.7 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.6 million, and solar generating capacity payments would total at least $4.5 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 11 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 10 owner-occupied units expected to be required in the ROI.

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

10.1.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

10.1.20 Environmental Justice

10.1.20.1 Affected Environment

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

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the Council on Environmental Quality's (CEQ's) *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description of the geographic distribution of low-income and minority populations in the affected area is undertaken; (2) an assessment is conducted to determine whether construction and operation would produce impacts that are high and adverse; and (3) if impacts are high and adverse, a determination is made as to whether these impacts disproportionately affect minority and low-income populations.

Construction and operation of solar energy projects in the proposed SEZ could affect environmental justice if any adverse health and environmental impacts resulting from either phase of development are significantly high and if these impacts would disproportionately affect minority and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations. In the event impacts are significant, disproportionality would be determined by comparing the proximity of any high and adverse impacts with the location of low-income and minority populations.

The analysis of environmental justice issues associated with the development of solar facilities considered impacts within the SEZ and an associated 50-mi (80-km) radius around the boundary of the SEZ. A description of the geographic distribution of minority and low-income groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau of the Census 2009k,l). The following definitions were used to define minority and low-income population groups:

- **Minority.** Persons are included in the minority category if they identify themselves as belonging to any of the following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

  Beginning with the 2000 Census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origin. In addition, persons who classify themselves as being of multiple racial origins may choose up to six racial groups as the basis of

their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or "Other Race" (U.S. Bureau of the Census 2009k).

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

This PEIS applies both criteria in using the Census Bureau data for census block groups, wherein consideration is given to the minority population that is both greater than 50% and 20 percentage points higher than in the state (the reference geographic unit).

- **Low-Income.** Individuals who fall below the poverty line. The poverty line takes into account family size and age of individuals in the family. In 1999, for example, the poverty line for a family of five with three children younger than 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (U.S. Bureau of the Census 2009l).

The data in Table 10.1.20.1-1 show the minority and low-income composition of total population located in the proposed SEZ based on 2000 Census data and CEQ guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number also includes individuals also identifying themselves as being part of one or more of the population groups listed in the table.

A large number of minority and low-income individuals are located in the 50-mi (80-km) area around the boundary of the SEZ. Within the 50-mi (80-km) radius in Colorado, 48% of the population is classified as minority, while 19.0% is classified as low-income. Although the number of minority individuals does not exceed 50% of the total population in the area, the number of minority individuals exceeds the state average by 20 percentage points or more, meaning that there is a minority population in the Colorado portion of the SEZ area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the Colorado portion of the SEZ.

Within the 50-mi (80-km) radius in New Mexico, 65.1% of the population is classified as minority, while 18.8% is classified as low-income. Although the number of minority individuals does not exceed the state average by 20 percentage points or more, the number of minority individuals exceeds 50% of the total population in the area, meaning that there are minority populations in the New Mexico portion of the 50-mi (80-km) area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average

TABLE 10.1.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Antonito Southeast SEZ

Parameter	Colorado	New Mexico
Total population	49,258	41,558
White, non-Hispanic	25,603	14,514
Hispanic or Latino	22,130	24,259
Non-Hispanic or Latino minorities	1,525	2,785
One race	955	2,228
Black or African American	162	101
American Indian or Alaskan Native	486	1,855
Asian	212	128
Native Hawaiian or Other Pacific Islander	18	10
Some other race	77	134
Two or more races	570	557
Total minority	23,655	27,044
Low-income	9,362	7,797
Percent minority	48.0	65.1
State percent minority	25.5	55.3
Percent low-income	19.0	18.8
State percent low-income	9.3	18.4

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

by 20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the New Mexico portion of the SEZ.

Figures 10.1.20.1-1 and 10.1.20.1-2 show the locations of the minority and low-income population groups within the 50-mi (80-km) radius around the boundary of the SEZ.

In the Colorado portion of the 50-mi (80-km) radius, more than 50% of the population in all but one of the block groups in Conejos County consists of minority population groups, together with all the block groups in adjacent Costilla County. Block groups in the cities of Alamosa (Alamosa County), Monte Vista, and Del Norte (both in Rio Grande County) are also more than 50% minority. In the New Mexico portion of the radius, Rio Arriba County has three block groups in which the minority population is more than 20 percentage points higher than the state average and one block group that is more than 50% minority. Tao County has six block groups with more than 50% minority, and five block groups in the vicinity of the City of Taos (Taos County) have minority populations that are 20 percentage points higher than the state average.

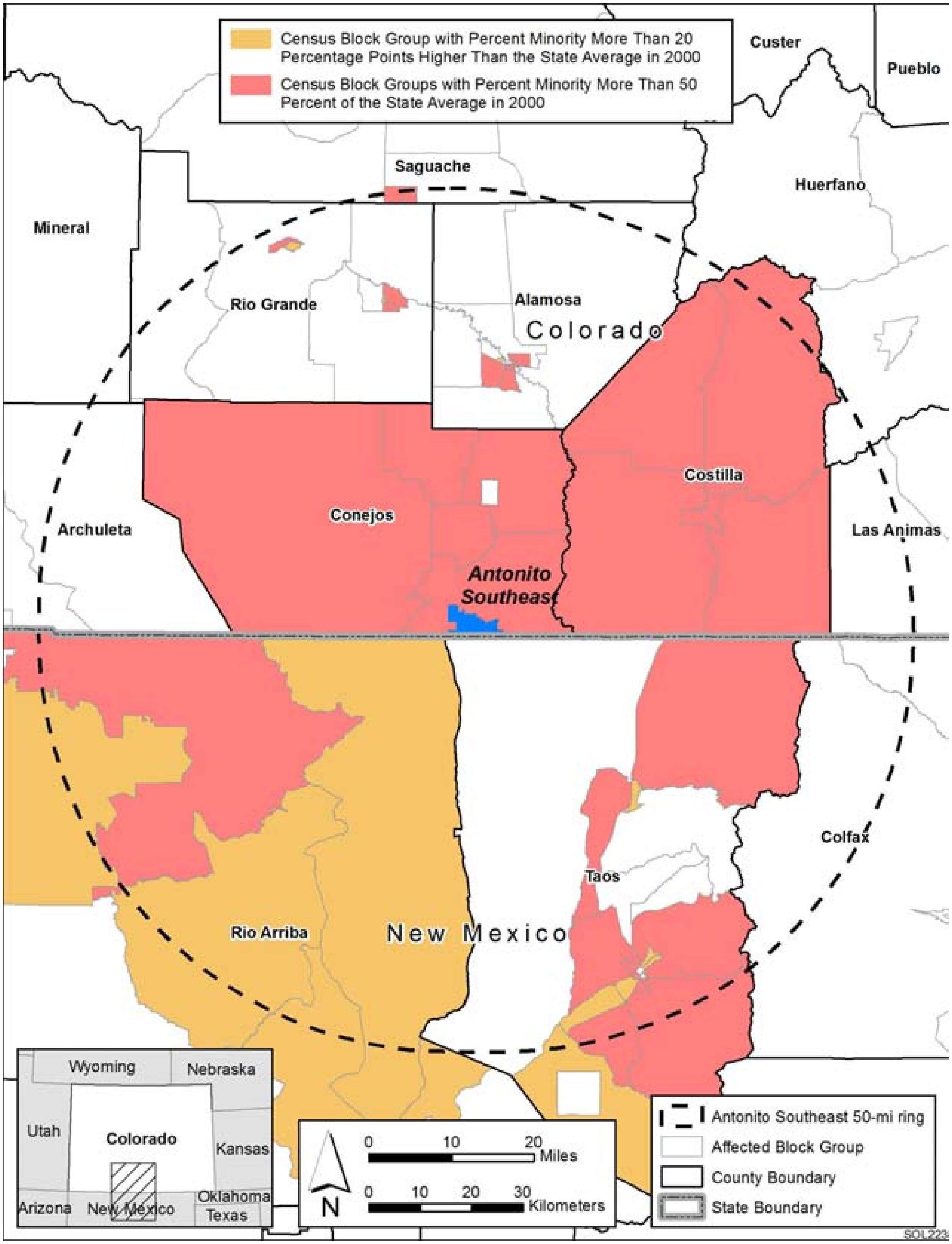

FIGURE 10.1.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Antonito Southeast SEZ

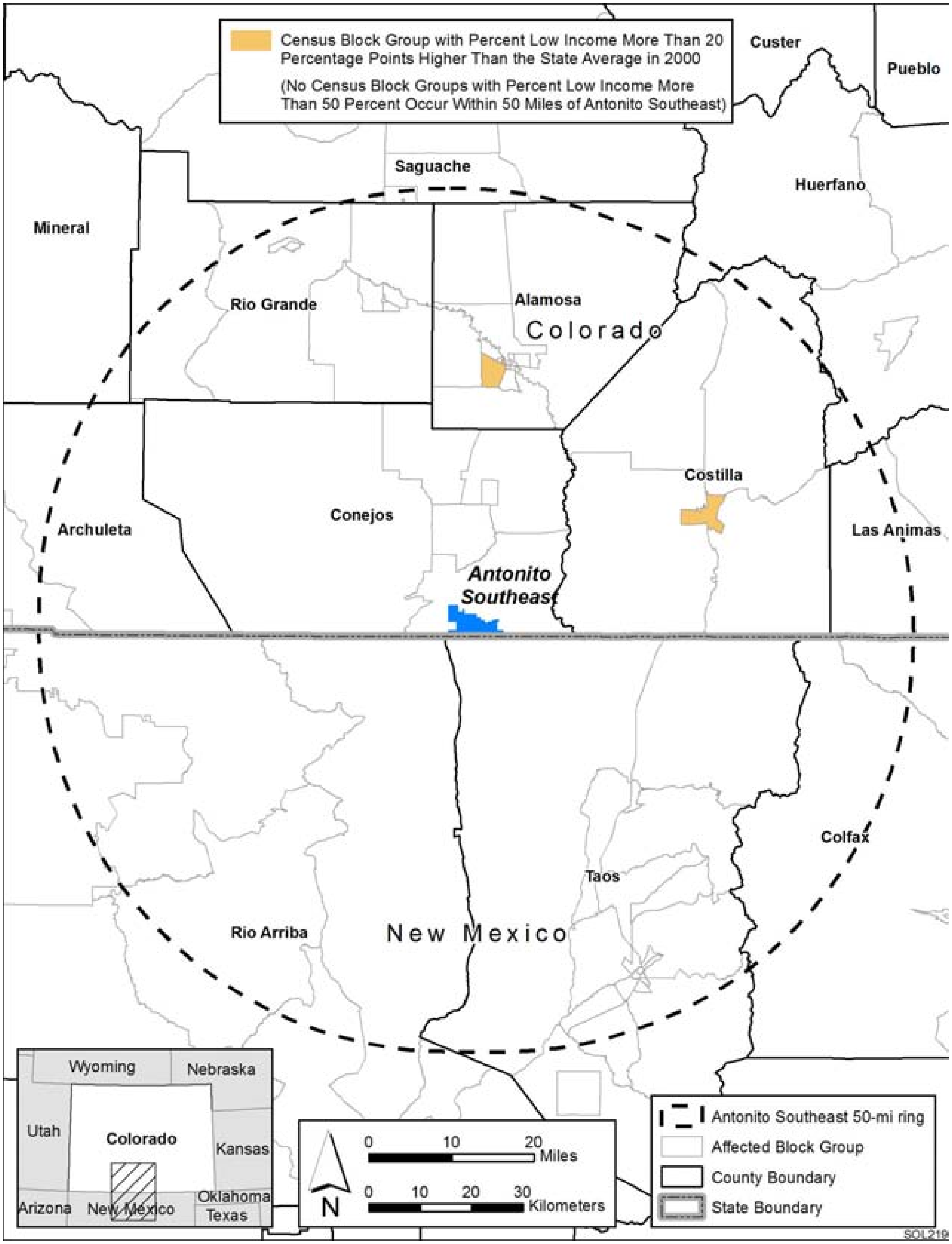

FIGURE 10.1.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Antonito Southeast SEZ

Low-income populations in the 50-mi (80-km) radius are limited to two block groups in the Colorado portion in the cities of San Luis (Costilla County) and Alamosa, both of which have low-income population shares that are more than 20 percentage points higher than the state average.

10.1.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy developments are described in detail in Section 5.18. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2, which address the underlying environmental impacts contributing to the concerns. The potentially relevant environmental impacts associated with solar development within the proposed SEZ include noise and dust during the construction of solar facilities; noise and electromagnetic field (EMF) effects associated with solar project operations; the visual impacts of solar generation and auxiliary facilities, including transmission lines; access to land used for economic, cultural, or religious purposes; and effects on property values as areas of concern that might potentially affect minority and low-income populations.

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar facilities involving each of the four technologies. Although impacts are likely to be small, there are minority populations defined by CEQ guidelines (Section 10.1.20.1) within both the Colorado and New Mexico portions of the 50-mi (80-km) radius around the boundary of the SEZ, meaning that any adverse impacts of solar projects could disproportionately affect minority populations. Because there are also low-income populations within the 50-mi (80-km) radius, according to CEQ guidelines, there would also be impacts on low-income populations.

10.1.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

10.1.21 Transportation

The proposed Antonito Southeast SEZ is accessible by road and rail networks. One U.S. highway and one regional railroad serve the area. A small regional airport is located 34 mi (55 km) north of the SEZ. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

10.1.21.1 Affected Environment

U.S. 285, a two-lane highway, passes along the western border of the proposed Antonito Southeast SEZ, as shown in Figure 10.1.21.1-1. The small town of Antonito is located to the northwest of the SEZ along U.S. 285 on its way to Alamosa, which is 34 mi (55 km) to the north. Santa Fe, New Mexico, can be reached traveling south on U.S. 285 to U.S. 84 for a total distance of 110 mi (177 km). A number of local roads cross the SEZ. Annual average traffic volumes for the major roads for 2008 are provided in Table 10.1.21.1-1. Several road/trail segments are located within the SEZ and have been identified as Open Motorized Road and Mechanized Use Trail. There is an area identified as Open to OHV use that is located outside of the SEZ but near the northwest corner of the area (see Section 10.1.5.1).

The SLRG Railroad serves the area (SLRG 2009). This regional railroad has rail stops in the towns of Antonito and Conejos several miles to the northeast of the SEZ. A freight dock and warehouse are also available in Antonito. The SLRG Railroad runs to the northeast from Antonito for a distance of approximately 100 mi (161 km), where it connects to the Union Pacific (UP) Railroad in Walsenburg.

The nearest public airport is San Luis Valley Regional Airport located 34 mi (55 km) north of the SEZ in Alamosa along U.S. 285. The airport has two runways, one of which is restricted to light aircraft. One regional airline provides daily scheduled service to Denver. No commercial cargo shipped to or from the airport has been reported by the Bureau of Transportation Statistics (BTS), and about 7,800 passengers departed from or arrived at the airport in 2008 (BTS 2008).

10.1.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. U.S. 285 provides a regional traffic corridor that could experience moderate impacts for single projects that may have up to 1,000 daily workers with an additional 2,000 vehicle trips per day (maximum), an increase nearly twice the current annual average daily traffic (AADT) value for this route, as shown in Table 10.1.21.1-1. In addition, local road improvements would be necessary in any portion of the SEZ that might be developed so as not to overwhelm the local roads near any site access point(s).

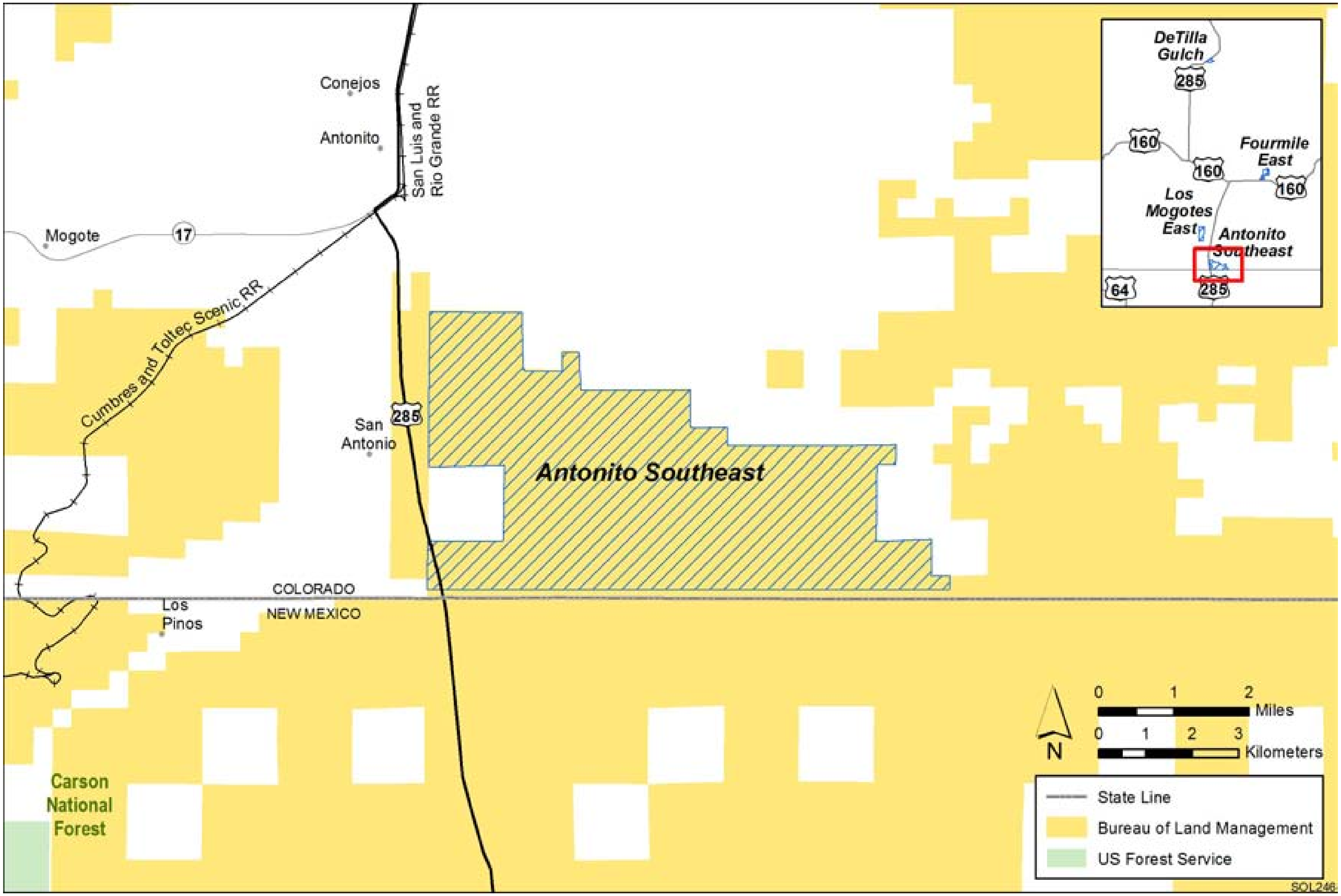

FIGURE 10.1.21.1-1 Local Transportation Network Serving the Proposed Antonito Southeast SEZ

TABLE 10.1.21.1-1 Annual Average Daily Traffic on Major Roads near the Proposed Antonito Southeast SEZ, 2008

Road	General Direction	Location	AADT (Vehicles)
U.S. 285	North–south	New Mexico–Colorado border	1,300
		Junction with CO RD 12, just south of Antonito	1,500
		Between Antonito and Romeo; junction with CO RD 18 (CR J)	3,900
CO 17	East–west	Junction with CO RD 13; west of Antonito and junction with U.S. 285	1,500

Source: CDOT (undated).

10.1.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the Antonito Southeast SEZ. The programmatic design features described in Appendix A, Section A.2.2, including local road improvements, multiple site access locations, staggered work schedules, and ride sharing, would all provide some relief to traffic congestion on local roads leading to the site. Depending on the location of solar facilities within the SEZ, more specific access locations and local road improvements could be implemented.

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10.1.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Antonito Southeast SEZ in the southern part of the San Luis Valley, Colorado. The CEQ guidelines for implementing NEPA define cumulative impacts as environmental impacts resulting from the incremental effects of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to what agency (federal or nonfederal), organization, or person undertakes them. The time frame of this cumulative impacts assessment could appropriately include activities that would occur up to 20 years in the future (the general time frame for PEIS analyses), but little or no information is available for projects that could occur further than 5 to 10 years in the future.

The proposed Antonito Southeast SEZ is located on and is surrounded on the east by relatively flat BLM-administered land in Conejos County, Colorado. On the north and west, it is bounded by private land, while the southern boundary of the area abuts BLM-administered public lands in New Mexico. The private lands to the north are extensively developed for irrigated agriculture. There are two state-owned sections of land near the area, one to the west and one to the east. The area is rural in nature, and most of the land within the SEZ and to the east, south, and west is grazed (BLM and USFS 2010a). The Conejos River, which flows to the northeast toward the Rio Grande, runs north of the SEZ. The Rio Grande is to the east. U.S. 285 is located immediately to the west of the SEZ. The area is located within the boundaries of the Sangre de Cristo NHA. The designated Los Caminos Antiguos Scenic Byway passes by the northwest corner of the area. There are no active oil and gas leases in or near the SEZ. The nearest active mining (lode) claims on BLM land are located about 6 mi (10 km) to the northeast near the South Piñon Hills at the Conejos–Costilla County boundary. There are many other closed lode claims in this area. The SEZ is within a DoD airspace consultation area (BLM and USFS 2010a).

The geographic extent of the cumulative impacts analysis for potentially affected resources near the proposed Antonito Southeast SEZ is identified in Section 10.1.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 10.1.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 10.1.22.3. Cumulative impacts for each resource area are discussed in Section 10.1.22.4.

10.1.22.1 Geographic Extent of the Cumulative Impacts Analysis

Table 10.1.22.1-1 presents the geographic extent of the cumulative impacts analysis for potentially affected resources near the Antonito Southeast SEZ. These geographic areas define the boundaries encompassing potentially affected resources. Their extent varies on the basis of the nature of the resource being evaluated and the distance at which an impact may occur (thus, for example, the evaluation of air quality may have a greater regional extent of impact than visual resources). Lands around the SEZ are privately owned, administered by the USFS, or

TABLE 10.1.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Antonito Southeast SEZ

Resource Area	Geographic Extent
Lands and Realty	Southern San Luis Valley
Specially Designated Areas and Lands with Wilderness Characteristics	Southern San Luis Valley
Rangeland Resources	Southern San Luis Valley
Recreation	Southern San Luis Valley
Military and Civilian Aviation	Southern San Luis Valley
Soil Resources	Areas within and adjacent to the Antonito Southeast SEZ
Minerals	Southern San Luis Valley
Water Resources	
Surface Water	Conejos River, Rio San Antonio, and Rio Grande
Groundwater	Rio Grande Basin within the San Luis Valley (unconfined and confined aquifers)
Vegetation, Wildlife and Aquatic Biota, Special Status Species	Known or potential occurrences within a 50-mi (80-km) radius of the Antonito Southeast SEZ, including Alamosa, Conejos, Costilla, Rio Grande, and Saguache Counties, Colorado; Rio Arriba and Taos Counties, New Mexico.
Air Quality and Climate	San Luis Valley and beyond
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Antonito Southeast SEZ
Acoustic Environment (noise)	Areas adjacent to the Antonito Southeast SEZ
Paleontological Resources	Areas within and adjacent to the Antonito Southeast SEZ
Cultural Resources	Areas within and adjacent to the Antonito Southeast SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Antonito Southeast SEZ for other properties, such as historic trails and traditional cultural properties.
Native American Concerns	San Luis Valley; viewshed within a 25-mi (40-km) radius of the Antonito Southeast SEZ
Socioeconomics	Conejos County
Environmental Justice	Conejos County
Transportation	U.S. 285

administered by the BLM. The BLM administers approximately 11% of the lands within a 50-mi (80-km) radius of the SEZ.

10.1.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions

The future actions described below are those that are "reasonably foreseeable;" that is, they have already occurred, are ongoing, are funded for future implementation, or are included in firm near-term plans. Types of proposals with firm near-term plans are as follows:

- Proposals for which NEPA documents are in preparation or finalized;
- Proposals in a detailed design phase;
- Proposals listed in formal Notices of Intent (NOIs) published in the *Federal Register* or state publications;
- Proposals for which enabling legislation has been passed; and
- Proposals that have been submitted to federal, state, or county regulators to begin a permitting process.

Projects in the bidding or research phase or that have been put on hold (e.g., the Iowa Pacific Holding Railway Hub) were not included in the cumulative impacts analysis.

The reasonably foreseeable future actions described below are grouped into two categories: (1) actions that relate to energy production and distribution, including potential solar energy projects under the proposed action (Section 10.1.22.2.1); and (2) other ongoing and reasonably foreseeable actions, including those related to mining and mineral processing, grazing management, transportation, recreation, water management, and conservation (Section 10.1.22.2.2). Together, these actions have the potential to affect human and environmental receptors within the geographic range of potential impacts over the next 20 years.

10.1.22.2.1 Energy Production and Distribution

Reasonably foreseeable future actions related to energy development and distribution within the San Luis Valley are identified in Table 10.1.22.2-1 and are described in the following sections. Figure 10.1.22.2-1 shows the approximate locations of the key projects.

Renewable Energy Development

In 2007, the State of Colorado increased its Renewable Portfolio Standard by requiring that large investor-owned utilities produce 20% of their energy from renewable resources by 2020; of this total, 4% must come from solar-electric technologies. Municipal utilities and

TABLE 10.1.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Antonito Southeast SEZ and in the San Luis Valley

Description	Status	Resources Affected	Primary Impact Location
Renewable Energy Development			
Renewable Portfolio Standards	Ongoing	Land use	State of Colorado
San Luis Valley GDA (Solar) Designation	Ongoing	Land use	San Luis Valley
Xcel Energy/SunEdison Project; 8.2 MW, PV	Ongoing	Land use, ecological resources, visual	San Luis Valley GDA
Alamosa Solar Energy Project; 30 MW, PV	Under way	Land use, ecological resources, visual	San Luis Valley GDA
Greater Sandhill Solar Project; 17 MW, PV	Under way	Land use, ecological resources, visual	San Luis Valley GDA
San Luis Valley Solar Project; Tessera Solar, 200 MW, dish engine	Proposed	Land use, ecological resources, visual, cultural	San Luis Valley GDA
Solar Reserve; 200 MW, solar tower	Preliminary Application	Land use, ecological resources, visual	San Luis Valley GDA (Saguache)
Cogentrix Solar Services; 30 MW, CPV	Approved/ Underway	Land use, ecological resources, visual	San Luis Valley GDA
Lincoln Renewables; 37 MW PV	County Permit approved	Land use, ecological resources, visual	San Luis Valley GDA
NextEra; 30 MW, PV	County Permit approved	Land use, ecological resources, visual	San Luis Valley GDA
Transmission and Distribution Systems			
San Luis Valley–Calumet-Comanche Transmission Project	Proposed	Land use, ecological resources, visual, cultural	San Luis Valley (select counties)

rural electric providers must provide 10% of their electricity from renewable sources by 2020 (Pew Center on Global Climate Change 2009).

Also in 2007, the General Assembly of Colorado passed Colorado Senate Bill (SB) 07-100, which established a task force to develop a map of existing generation and transmission lines and to identify potential development areas for renewable energy resources within Colorado. These areas, called Renewable Resource Generation Development Areas (GDAs), are regions within Colorado with a concentration of renewable resources that provide a minimum of 1,000 MW of developable electric generating capacity. The task force identified

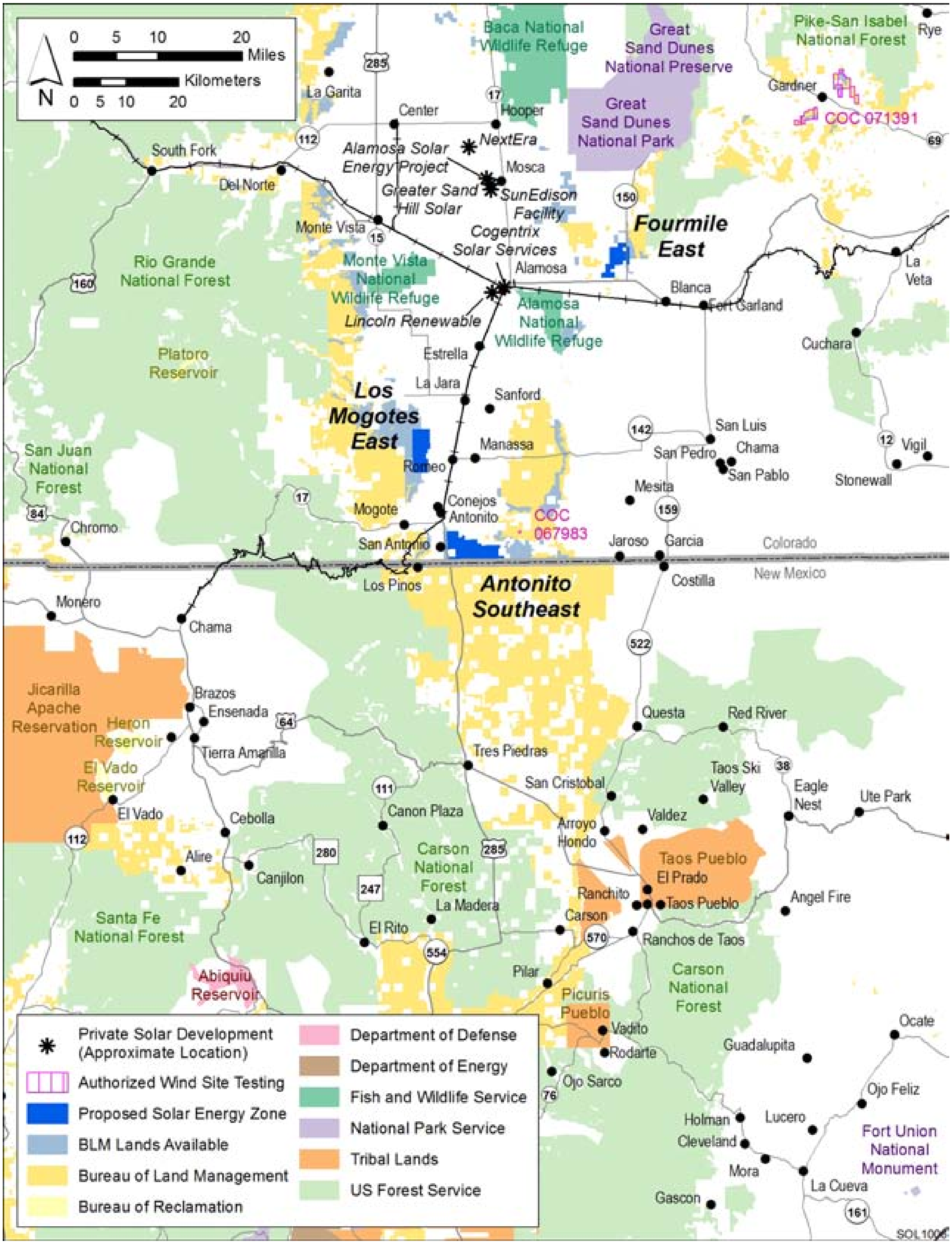

FIGURE 10.1.22.2-1 Existing and Proposed Energy Development Projects within the San Luis Valley

eight wind GDAs (mainly on the Eastern Plain) and two solar GDAs. The National Renewable Energy Laboratory (NREL) conducted detailed analyses of these areas and concluded that the San Luis Valley GDA is one of two regions in southern Colorado capable of generating large blocks of power—as much as 5.5 GW—via utility-scale solar power technologies. Although geothermal power is a potentially vast resource in Colorado (and in the San Luis Valley), no single site was found to generate 1,000 MW. As a result, the task force did not identify geothermal GDAs (Colorado Governor's Energy Office 2007).

In addition to the Antonito Southeast SEZ, the BLM has proposed three other proposed SEZs in the San Luis Valley: the De Tilla Gulch SEZ (1,522 acres [6.2 km^2]), the Fourmile East SEZ (3,882 acres [15.7 km^2]), and the Los Mogotes SEZ (5,918 acres [23.9 km^2]) (Figure 10.1.22.2-1). The four proposed SEZs together constitute 21,050 acres (85 km^2) of land and could provide as much as 3,368 MW of solar energy capacity. The Los Mogotes SEZ is close to the Antonito Southeast SEZ, only 7 mi (11 km) to the northwest; the other two SEZs are much farther away (De Tilla Gulch is about 80 mi [140 km] to the north, and Fourmile East is about 40 mi [64 km] to the northeast).

Solar Energy Development. Several solar power projects are planned or under way in the San Luis Valley GDA, as follows:

- *Xcel Energy/Sun Edison Project.* The 8.2-MW project began operations in August 2007. Located on 82 acres (0.3 km^2) of private land just west of CO 17 near Mosca in Alamosa County, the facility consists of three different solar technologies, including an array of PV panels, a PV system of single-axis trackers, and a system of CSP units. It generates power for distribution both within the San Luis Valley and outside the region.

- *Alamosa Solar Energy Project.* The 30-MW PV project will be located near Mosca, just west of CO 17 and 8 Mile Lane North, on private land currently being used for agriculture. The facility is being built by Iberdrola Renewables in two 15-MW phases and will connect to the San Luis Valley Substation, about 4.5 mi (7.2 km) to the west of the project site. A Special Use and Site Plan application was submitted to Alamosa County in July 2009; the first half of the facility is scheduled to begin operations in early 2011.

- *Greater Sandhill Solar Project.* Located on 200 acres (0.8 km^2) to the east of CO 17 near Mosca (across from the Xcel Energy/Sun Edison Project), the 17-MW PV facility to be built by Xcel Energy and SunPower has been approved by the Colorado Public Utilities Commission and will begin operations in 2011.

- *San Luis Valley Solar Project.* Tessera Solar North America submitted a Final 1041 Permit Application to Saguache County in June 2010 for a 200-MW dish engine solar facility to be built on a 1,525-acre (6.2-km^2) site near Saguache. The facility would employ 8,000 SunCatcher dish engines and cost $300 to

$500 to build. It would use only 10 ac-ft/yr of water for operation and maintenance and employ 45 full-time workers. The permit application identified expected significant effects of the proposed facility on visual resources and on socioeconomics, while effects on biological, cultural, and water resources and from noise were not expected to be significant. Construction would start in late 2010 (TSNA 2010). Tessera has offered to sell power to Xcel Energy. A 500-ft (150-m) transmission line would be built to connect to an existing 230 kV line owned by Xcel.

- *Solar Reserve.* Solar Reserve submitted a Preliminary 1041 Permit Application to Saguache County in July 2010 for a 200-MW solar tower facility. The project would be built in two 100-MW phases, each covering 1,400 acres (5.7 km^2) and employing 17,500 heliostats serving a 650-ft (200-m) power tower in southern Saguache County. A power block will house a steam turbine generator and molten salt thermal energy storage tanks. The facility would use wet cooling. Total water required for operation would be up to 1200 ac-ft/yr. An on-site switchyard would connect to an existing 230-kV line crossing the site. Construction would start in 2011 and operation in June 2013, employing 250 and 50 workers on average, respectively (Solar Reserve 2010).

- *Cogentrix Solar Services.* Cogentix Energy plans to build a 30-MW PV facility near Alamosa. The facility would use dual-axis-mounted concentrating solar cells from Amonix and would be the largest facility using this technology. The facility would cost $140 to $150 million and would be located on 225 acres (0.9 km^2) adjacent to an existing Xcel Energy transmission line. It would employ up to 140 during construction and 5 to 10 during operation and would begin operating in mid-2012. Cogentrix would sell power to Xcel Energy.

- *Lincoln Renewables.* Alamosa County issued a permit to Lincoln Renewables in April 2010 to build a 37-MW PV facility on 255 acres (1.0 km^2) south of Alamosa. As of that date, the project was still in need of interconnection and power purchase agreements. Construction would be completed by 2012, employing 125 workers. Operation would require only a couple of full-time workers.

- *NextEra.* Alamosa County issued a permit to NextEra in August 2010 to build a 30-MW PV facility on 279 acres (1.1 km^2) in northern Alamosa County. As of that date, the project was still in need of a power purchase agreement. Construction would start in 2011, employing 125 workers. Operation would require 1 to 3 full time workers. The plant would require a 3.5-mi (5.6-km) transmission line to connect to the power grid.

Transmission and Distribution System

Colorado SB 07-100 also directed rate-regulated utilities, such as Xcel Energy's Public Service Company of Colorado (Public Service), to develop plans for constructing or expanding transmission facilities to provide for the delivery of electric power consistent with the timing of the development of beneficial energy (including renewable) resources in Colorado. In response, Public Service has identified transmission-constrained areas in south-central Colorado, including the San Luis Valley and Walsenburg areas. Tri-State Generation and Transmission Association (Tri-State) and Public Service are proposing to construct a transmission project called the San Luis Valley–Calumet-Comanche Transmission project to meet the requirements of SB 07-100 and to improve the load service and system reliability throughout the San Luis Valley (Tri-State Generation and Transmission Association, Inc. 2008, 2009; Tri-State and Public Service Company of Colorado 2009) and are pursuing financial support from the USDA Rural Utilities Service electric program. The proposed project would consist of four parts:

1. A new 345- to 230-kV substation called Calumet, located about 6 mi (10 km) north of Tri-State's existing Walsenburg Substation in Huerfano County;

2. A double-circuit 230-kV line between the San Luis Valley Substation just north of Alamosa and the Calumet Substation;

3. A new (second) single-circuit 230-kV line between the Calumet Substation and Tri-State's existing Walsenburg Substation; and

4. A new double-circuit 345-kV transmission line connecting the Calumet Substation to the existing Comanche Substation in Pueblo County.

Parts 2 and 3, the 230-kV projects between the San Luis Valley and Walsenburg to Calumet, would take the place of Tri-State's proposed San Luis Valley Electric System Improvement project.

The segment crossing the San Luis Valley would consist of a new double-circuit 230-kV transmission line extending 95 mi (153 km) from the San Luis Valley Substation near Alamosa eastward to the Walsenburg Substation. The San Luis Valley Substation would also be expanded to a five-breaker ring to allow for the two new 230-kV line bays and future generator interconnections (Tri-State Generation and Transmission Association, Inc. 2009).

A detailed environmental assessment (EA) of the San Luis Valley–Calumet-Comanche Transmission project is planned; public meetings were held in August 2009. Route refinement workshops are scheduled to occur by the end of 2010. The partnership plans to have the transmission lines in service by May 2013 (Tri-State and Public Service Company of Colorado 2009).

10.1.22.2.2 Other Actions

Other ongoing and reasonably foreseeable future actions within the San Luis Valley are identified in Table 10.1.22.2-2 and are described in the following sections.

Mining and Mineral Processing

Mining and mineral-processing activities in the immediate vicinity of the proposed Antonito Southeast SEZ include private facilities, such as an active perlite expanding plant (Harborlite) owned by Dicalite-Dicaperl Corporation, a red rock mining operation (Colorado Lava, Inc.), and a gravel, sand, and landscape rock mining operation (Valdez Gravel).

Grazing Management

Within the San Luis Valley, the BLM's La Jara and Saguache Field Offices authorize grazing use on public lands. The current average active grazing use authorized by these offices is 13,719 and 17,506 AUMs, respectively. While many factors could influence the level of authorized use, including livestock market conditions, natural drought cycles, increasing nonagricultural land development, and long-term climate change, it is anticipated that this average level of use will continue in the near term. Grazing use on private lands in the San Luis Valley is frequently (but not always) related to grazing use of public and other federal lands since it is common for federal grazing permittees to utilize USFS- and BLM-administered lands as part of their annual operating cycle. For these operations, a long-term reduction or increase in federal authorized grazing use would affect the value of the private grazing lands.

Transportation

The travel planning area addressed in the BLM's Travel Management Plan encompasses BLM lands within the San Luis Valley and includes portions of Saguache, Rio Grande, Alamosa, Conejos, and Costilla Counties. The plan for the San Luis Resource Area amends the San Luis Resource Area Resource Management Plan (RMP) by changing all area OHV designations of "OHV Open" to "OHV Limited" on various designated roads and trails. The two exceptions to the amendment are the Manassa area of 179 acres (0.7 km^2) and the Antonito area of 82 acres (0.3 km^2), which will be retained as OHV Open areas. Prior to this amendment, 389,279 acres (1,575 km^2) of the 520,945 acres (2,108 km^2) with OHV area designations (i.e., OHV Open, OHV Limited, OHV Closed) were designated as "OHV Open." The proposed ROD was signed on June 4, 2009 (BLM 2009d).

Recreation

Two scenic railroads operate in the San Luis Valley:

- *Rio Grande Scenic Railroad.* Operated by the SLR&G railroad, the scenic railroad has about 17,600 visitors each year. Scenic routes run between

TABLE 10.1.22.2-2 Reasonably Foreseeable Future Actions near the Proposed Antonito Southeast SEZ and in the San Luis Valley

Description	Status	Resources Affected	Primary Impact Location
Mining and Mineral Processing			
Harborlite (perlite processing plant)	Ongoing	Visual, ecological resources; socioeconomics	Area northwest of the Antonito Southeast SEZ (Conejos County)
Colorado Lava Inc. (Permit #93CN318)	Ongoing	Visual, ecological resources; socioeconomics	Area northwest of the Antonito Southeast SEZ (Conejos County)
Valdez Gravel (Permit #M-91-133)	Ongoing	Visual, ecological resources; socioeconomics	Area south of the Antonito Southeast SEZ (Conejos County)
Transportation			
Travel Management Plan (BLM)	Proposed	Transportation, ecological resources, recreation	San Luis Valley
Recreation			
Rio Grande Scenic Railroad	Ongoing	Visual, ecological resources; socioeconomics	San Luis Valley, including routes adjacent to the Antonito Southeast SEZ (Conejos County)
Cumbres & Toltec Scenic Railroad	Ongoing	Visual, ecological resources; socioeconomics	San Luis Valley, including routes adjacent to the Antonito Southeast SEZ (Conejos County)
Water Management			
Rio Grande Compact	Ongoing	Water, ecological resources	San Luis Valley
San Luis Valley Project—Conejos Division (CWCD)	Ongoing	Water, ecological resources	San Luis Valley
Conservation			
Rio Grande Riparian Enhancement Project	Proposed	Ecological resources	San Luis Valley (areas along the Rio Grande)
Old Spanish National Historic Trail Comprehensive Management Plan (BLM and NPS)	Proposed	Cultural, visual resources	San Luis Valley (and immediately west of the Antonito Southeast SEZ)
Sangre de Cristo National Heritage Area	Ongoing	Cultural, visual resources	San Luis Valley (areas along the east side)
San Luis Valley Regional Habitat Conservation Plan	Ongoing	Ecological resources	Areas along the Rio San Antonio (near Antonito)

Alamosa and La Veta, Alamosa and Monte Vista, and Alamosa and Chama (New Mexico) via Antonito. The route between Alamosa and La Veta is especially famous for traversing over the historic La Veta Pass, the highest point (at 9,242 ft [2,817 m]) that standard gauge track crosses the Rocky Mountains (RGSR 2009).

- *Cumbres & Toltec Scenic Railroad.* The Cumbres & Toltec Scenic Railroad is a narrow gauge railroad that runs along the Colorado–New Mexico border. It has depots in Antonito and Chama (New Mexico) (CTSR 2009).

Water Management

Water management is of great importance in the San Luis Valley because it supports agriculture and the raising of livestock, the primary economic activities in the valley. It is estimated that an average of more than 2.8 million ac-ft (3.5 billion m^3) of water enters and leaves the valley each year. Surface water inputs are estimated to be about 1.2 million ac-ft (1.5 billion m^3), providing recharge to the valley's aquifers and nearly all the water for irrigation. Several actions by the State of Colorado, the Rio Grande Water Conservation District (RGWCD), and the U.S. Bureau of Reclamation (BOR) affect the distribution priorities of water in the San Luis Valley. These include the Rio Grande Compact, the San Luis Valley Project (Conejos and Closed Basin Divisions), and the recent Subdistrict 1 Water Management Plan.

Rio Grande Compact. The Rio Grande Compact is an agreement among the states of Colorado, New Mexico, and Texas signed in 1938 and ratified in 1939 to apportion the waters of the Upper Rio Grande Basin (north of Fort Quitman, Texas) among the three states. The compact established a sliding scale for the annual volume of water that must be delivered to the Colorado–New Mexico border (as measured at the Lobatos streamflow gage) that depends on the volume of water measured each year at the Del Norte, Colorado streamflow gage. Under the compact, Colorado is obligated to provide an annual delivery of 10,000 ac-ft (12 million m^3) of water into the Rio Grande at the Colorado–New Mexico state line (as measured at the Lobatos gage station) less quantities available for depletion from the Rio Grande at Del Norte and the Conejos River. If the delivery is not met, it creates a debit that has to be repaid in later years. Delivery requirements are administered by the State Engineer and the Colorado Division of Water Resources, Water Division III, in Alamosa (Hinderlider et al. 1939; SLV Development Resources Group 2007).

San Luis Valley Project—Conejos Division. The Conejos Division encompasses the Platoro Dam and Reservoir, located on the Conejos River within the Rio Grande National Forest. Managed by the Conejos Water Conservancy District, the Platoro Project provides flood control and storage of supplemental water for the irrigation of about 81,000 acres (328 km^2) within the district. The reservoir also provides recreational opportunities such as fishing, boating, hiking, and camping (Simonds 2009).

Conservation

There are several conservation-related projects and plans in the San Luis Valley, as follows:

Rio Grande Riparian Enhancement Project. This riparian enhancement project along the Rio Grande is to be completed by the BLM with American Recovery and Reinvestment Act of 2009 (ARRA) funds. The project falls under a Categorical Exclusion under NEPA.

Old Spanish Historic Trail Comprehensive Management Plan. In preparation by the BLM and the NPS. The purpose of the plan is to provide a long-term strategy for managing and interpreting the Old Spanish Historic Trail.

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

The Sangre de Cristo NHA covers more than 3,000 mi^2 (7,770 km^2) of land in Alamosa, Conejos, and Costilla Counties and encompasses the Monte Vista National Wildlife Refuge, the Baca National Wildlife Refuge, and the Great Sand Dunes National Park and Preserve. In addition, it has more than 20 cultural properties listed on the NRHP (including the Cumbres & Toltec Scenic Railroad). The NHA has been home to native tribes, Spanish explorers, and European settlers over more than 11,000 years of settlement (NPS 2009b; SLV Development Resources Group 2009). Three of the four SEZs (Fourmile East, Los Mogotes East, and Antonito Southeast) are within the Sangre de Cristo NHA; the De Tilla Gulch SEZ is about 15 mi (24 km) to the north.

San Luis Valley Habitat Conservation Plan. The USFWS, with the RGWCD and the State of Colorado, is developing a regional Habitat Conservation Plan (HCP) to address more than 150 mi (241 km) of riparian habitat and land use activities on more than 2 million acres (8,090 km^2) of land that affect the southwestern willow flycatcher, the bald eagle, and the yellow-billed cuckoo throughout the San Luis Valley. Funds were granted in 2004 and 2005 to prepare the plan and NEPA documentation (USFWS 2009b). The NOI to prepare an environmental analysis and to hold public scoping meetings was published by the USFWS in the *Federal Register* on January 7, 2005 (70 FR 5). The agency's intent is to apply for an incidental take permit (ITP) for the flycatcher, bald eagle, and yellow-billed cuckoo and possible other rare and/or sensitive species that may be affected by various activities within the San Luis Valley. The Notice of Availability (NOA) for the draft EIS and receipt of application for an ITP were published on June 23, 2006 (71 FR 121). It is not clear at the time of this report whether a final EIS was issued.

Miscellaneous Other Actions

The BLM has several small-scale and administrative projects that require NEPA documentation that are not addressed individually in this cumulative impacts analysis. These projects include many that pertain to grazing permits, such as permit renewals, transfer of permits, changes in grazing dates (seasons), changes in pasture rotations; and changes in AUMs. Other small-scale projects on the NEPA register include the construction of a wildlife boundary fence, an illegal dump remediation project, rock removal, weed control, and a creek restoration project. Some of these projects could occur within 50 mi (80 km) of the Antonito Southeast SEZ.

10.1.22.3 General Trends

Table 10.1.22.3-1 lists general trends within the San Luis Valley with the potential to contribute to cumulative impacts; these trends are discussed in the following sections.

10.1.22.3.1 Population Growth

The 2006 official population estimate for the San Luis Valley (48,291) represents a 4.5% increase over that reported by the 2000 Census, with an annual increase of about 0.75% over the 6-year period (Table 10.1.22.3-2). The growth rate in Conejos County over the same 6-year period was 2.2%. Most of this growth was in unincorporated areas. Population growth

TABLE 10.1.22.3-1 General Trends in the San Luis Valley

General Trend	Impacting Factors
Population growth	Urbanization Increased use of roads and traffic Land use modification Employment Education and training Increased resource use (e.g., water and energy) Tax revenue
Energy demand	Increased resource use Energy development (including alternative energy sources) Energy transmission and distribution
Water availability	Drought conditions and water loss Conservation practices Changes in water distribution
Climate change	Water cycle changes Increased wildland fires Habitat changes Changes in farming production and costs

within the valley is expected to increase at a rate of about 0.6% each year from 2006 to 2011, then 1.1% each year after that to 2016. This represents about 60 to 70% of the projected Colorado statewide growth rates of 1.0% for 2006 to 2011 and 1.5% for 2012 to 2016. In the 10-year period between 2006 and 2016, population growth within Conejos County is projected to be 9.2% (SLV Development Resources Group 2007).

13.1.22.3.2 Energy Demand

The growth in energy demand is related to population growth through increases in housing, commercial floorspace, transportation, manufacturing, and services. Given that population growth is expected in the San Luis Valley (by as much as 19% between 2006 and 2016), an increase in energy demand is also expected. However, the Energy Information Administration (EIA) projects a decline in per-capita energy use through 2030, mainly because of improvements in energy efficiency and the high cost of oil throughout the projection period. Primary energy consumption in the United States between 2007 and 2030 is expected to grow by about 0.5% each year, with the fastest growth projected for the commercial sector (at 1.1% each year). Energy consumption for the transportation, residential, and industrial sectors is expected to grow by about 0.5%, 0.4%, and 0.1%, respectively, each year (EIA 2009).

10.1.22.3.3 Water Availability

Significant water loss has occurred in the San Luis Valley over the past century. Since 1890, the average annual surface water flows of the Rio Grande (near Del Norte) have averaged about 700,000 ac-ft (863 million m^3). Annual flows peaked in 1920 with a flow of 1 million ac-ft (1.2 billion m^3), about 143% of the average. The lowest annual flows were recorded in 2002 at

TABLE 10.1.22.3-2 Population Change in the San Luis Valley Counties and Colorado from 2000 to 2006, with Population Forecast to 2016

	Population			Population Forecast		
	2000	2006	Percentage Increase 2000 to 2006	2011	2016	Percentage Increase 2006 to 2016
San Luis Valley	46,190	48,291	4.5	51,293	54,765	18.6
Colorado	4,301,261	4,812,289	11.9	5,308,500	5,308,300	23.4
Counties						
Alamosa	14,966	15,765	5.3	16,948	18,326	22.5
Conejos	8,400	8,587	2.2	8,966	9,373	11.6
Saguache	5,917	6,568	11.0	7,078	7,582	28.1

Source: SLV Development Resources Group (2007).

154,000 ac-ft (190 million m^3), about 24% of the average. Three of the five years between 2003 and 2007 have been below the average; although flows in 2007 have measured slightly above it (710,000 ac-ft, or 876 million m^3). A comparison of streamflows across the valley shows a similar trend; with both surface water and groundwater data in 2002 indicating extreme to exceptional drought severity. However, data from 2007 suggest a possible easing of the drought (Thompson 2002; SLV Development Resources Group 2007).

Water in the San Luis Valley is used predominantly for crop irrigation; including both center pivot and flood irrigation techniques. For a typical potato farm, a sprinkler system on a 125-acre (0.5-km^2) circle applies about 210 ac-ft (259,000 m^3) during a 100-day growing season, 70% of which (146 ac-ft, or 180,000 m^3) is consumed in the growing crop. In comparison, flood irrigation (not common for potato farming) draws 290 ac-ft (358,000 m^3) during a 100-day growing season and consumes about 50% (144 ac-ft, or 178,000 m^3). An alfalfa farm requires about one and a half times the water required by a typical potato or barley farm. Table 10.1.22.3-3 compares daily water use by sector. Total daily water withdrawals and consumptive use are highest in Conejos County, a county that has a large share of its crops in alfalfa (accounting for more than one-third of its water consumption) (SLV Development Resources Group 2007).

Over the past 20 years, groundwater consumption in the San Luis Valley has increased. This increase is attributed mainly to changes in crop patterns from less water-consumptive crops to more water-consumptive crops; changes in the type and frequency of irrigation; the increasing number of acres under irrigation; and more heavy reliance on wells that were formerly only used sporadically for irrigation. These changes, combined with a declining water supply due to prolonged drought conditions over the past decade, have reduced the groundwater supply available for crop irrigation. Since 1976, it is estimated that the unconfined aquifer has lost more than 1 million ac-ft (1.2 billion m^3) (RGWCD 2009; SLV Development Resources Group 2007).

TABLE 10.1.22.3-3 Daily Water Use by Sector in Colorado, 1995

	Withdrawals					
			Sector (Mgal)			
Region	Total (Mgal)	Percentage Groundwater	Irrigation	Public Supply	Industrial	Consumptive Use (Mgal)
Alamosa	414	29	411 (109)[a]	2	2	171
Conejos	732	3.9	727 (111)	3	–[b]	264
Saguache	426	34	423 (210)	2	–	66
San Luis Valley	2,176	19	2,159	15	4	843
Colorado	13,840	16	12,735 (3,404)	705	123	5,235

[a] Numbers in parentheses represent the number of irrigated acres (in thousands) in the region (USGS 2000).

[b] A dash indicates no water use for the sector.

Source: SLV Development Resources Group (2007).

The severe drought recorded in 2002 marked an unparalleled situation in the San Luis Valley in terms of the lack of surface water supplies, a lack of precipitation, a lack of residual soil moisture, and poor vegetation health. Well production decreased significantly, with declining groundwater levels in the unconfined aquifer and decreasing artesian pressure in the confined aquifer. In response, water conservation and irrigation strategies (including crop abandonment) were considered by area farmers to minimize water usage (and evapotranspiration rates) and to reduce the risk of over-irrigating crops (Thompson 2002).

Most of the cities in the San Luis Valley draw their water from deep wells in the confined aquifer. Water used for the public supply is only a small fraction of that used for agriculture (Table 10.1.22.2-5). Because of drought conditions over the past decade, some residential wells in the San Luis Valley are drying up. Since 1972, the State Engineer has not allowed any new high-capacity wells (i.e., wells with yields greater than 300 gpm, or 1,136 L/min) to be constructed in the confined aquifer (SLV Development Resources Group 2007).

The San Luis Valley has about 230,000 acres (931 km^2) of wetlands that provide important wildlife habitat. Only about 10% of the wetlands in the valley occur on public land; conservation efforts with landowner cooperation are becoming popular through the use of land trusts and similar alternatives. Streams, reservoirs, and lakes within the San Luis Valley provide high-quality water and, when sufficient water levels are present, support trout fisheries. Boating in the valley's streams, reservoirs, and lakes has declined in recent years. Drought impacts over the past decade have reduced the depths of surface water bodies in the valley; many are completely dry (SLV Development Resources Group 2007).

10.1.22.3.4 Climate Change

According to a recent report prepared for the CWCB (Ray et al. 2008), temperatures in Colorado increased by about 2°F (1.1°C) between 1977 and 2006. Climate models project continued increasing temperatures in Colorado—as much as 2.5°F (1.4°C) by 2025 and 4°F (2.2°C) by 2050 (relative to the 1950 to 1999 baseline temperature). By 2050, seasonal increases in temperature could rise as much as 5°F (2.8°C) in summer and 3°F (1.7°C) in winter. These changes in temperature would have the effect of shifting the climate typical of the Eastern Plains of Colorado westward and upslope, bringing temperature regimes that currently occur near the Colorado−Kansas border into the Front Range.

Because of the high variability in precipitation across the state, current climate models have not been able to identify consistent long-term trends in annual precipitation. However, projections do indicate a seasonal shift in precipitation, with a significant increase in the proportion of precipitation falling as rain rather than snow. A precipitous decline in snowpack at lower elevations (below 8,200 ft [2,499 m]) is expected by 2050.

In the past 30 years, the onset of streamflows from melting snow (called the "spring pulse") has shifted to earlier in the season by 2 weeks. This trend is expected to continue as spring temperatures warm. Projections also suggest a decline in runoff for most of the river basins in Colorado by 2050. Hydrologic studies of the Upper Colorado River Basin estimate average decreases in runoff of 6 to 20% by 2050 (as compared to the twentieth century average).[26] These changes in the water cycle, combined with increasing temperatures and related changes in groundwater recharge rates and soil moisture and evaporation rates, will increase the potential for severe drought and reduce the total water supply, while creating greater demand pressures on water resources.

In general, the physical effects of climate change in the western United States include warmer springs (with earlier snowmelt), melting glaciers, longer summer drought, and increased wildland fire activity (Westerling et al. 2006). All these factors contribute to detrimental changes to ecosystems (e.g., increases in insect and disease infestations, shifts in species distribution, and changing in the timing of natural events). Adverse impacts on human health, agriculture (crops and livestock), infrastructure, water supplies, energy demand (due to increased intensity of extreme weather and reduced water for hydropower), and fishing, ranching, and other resource-use activities are also predicted (GAO 2007; NSTC 2008; Backlund et al. 2008).

The State of Colorado has plans to reduce its GHG emissions by 80% over the next 40 years (Ritter 2007). Initiatives to accomplish this goal will focus on modifying farm practices (e.g., less frequent tilling, improving storage and management of livestock manure, and capturing livestock-produced methane), improving standards in the transportation sector, providing reliable and sustainable energy supplies (e.g., small-scale hydropower, solar, wind, and geothermal energy), and joining the Climate Registry of North American GHG emissions, among others.

10.1.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Antonito Southeast SEZ on the basis of the following assumptions: (1) because of the relatively small size of the proposed SEZ (less than 10,000 acres [40.5 km^2]), only one project would be constructed at a time, and (2) maximum total disturbance over 20 years would be about 7,783 acres (31 km^2) (80% of the entire proposed SEZ). For purposes of analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. In addition, about 4 mi (6 km) of new transmission line will be needed to reach the nearest existing line, a 69-kV transmission line located to the north of the Antonito Southeast SEZ. Further, it is likely that a line upgrade will be needed, considering that the existing line is less than the 230 kV assumed to be needed for utility-scale solar facilities and that its available capacity is unknown. Regarding site access, because a major road (U.S. 285) passes directly to the west of the proposed SEZ, no major road construction activities outside of the SEZ would be needed for development to occur in the SEZ.

Cumulative impacts that would result from the construction, operation, and decommissioning of solar energy development projects within the proposed SEZ when added to

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

other past, present, and reasonably foreseeable future actions described in the previous section in each resource area are discussed below. At this stage of development, because of the uncertain nature of the future projects in terms of location within the proposed SEZ, size, number, and the types of technology that would be employed, the impacts are discussed qualitatively or semi-quantitatively, with ranges given as appropriate. More detailed analyses of cumulative impacts would be performed in the environmental reviews for the specific projects in relation to all other existing and proposed projects in the geographic areas.

10.1.22.4.1 Lands and Realty

The area covered by the proposed Antonito Southeast SEZ is largely undeveloped. Just to the north and northwest of the SEZ are some private agricultural lands. In general, the areas surrounding the SEZ are rural in nature. Numerous dirt/ranch roads provide access throughout the SEZ. The SEZ also has numerous livestock management facilities, including fences and water projects, within it.

Construction of utility-scale solar energy facilities within the SEZ would preclude use of those areas occupied by the solar energy facilities for other purposes. The areas that would be occupied by the solar facilities would be fenced, and access to those areas by both the general public and wildlife would be eliminated. Traditional uses of public lands (there is no agriculture on these sites) would no longer be allowed.

If the area is developed as an SEZ, it is likely that improvements to the infrastructure and increased availability of energy from the solar facilities could attract other users to the area. As a result, the area could acquire more industry. Development of the SEZs could introduce a highly contrasting industrialized land use into areas that are largely rural. As a result, the contribution to cumulative impacts of utility-scale solar projects on public lands on and around the Antonito Southeast SEZ could be significant, particularly if the SEZ is fully developed with solar projects.

10.1.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

There are no specially designated areas within the SEZ but there are such areas in the general vicinity. These areas include four ACECs, two WSAs, two WAs, a scenic byway, a NHA, and a historic trail. Construction of utility-scale solar energy facilities within the SEZ would have the potential for cumulatively contributing to the visual impacts on these specially designated areas. The exact nature of impacts would depend on the specific technologies employed and the locations selected within the SEZ. These impacts would be in addition to impacts from any other ongoing or future activities. However, development of the SEZ, especially full development, would be a dominant factor in the viewshed from large portions of these specially designated areas.

10.1.22.4.3 Rangeland Resources

The main current land use of the BLM-administered public lands in the SEZ is grazing. If utility-scale solar facilities are constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. Depending on the number and size of potential projects, the impact on rangers who currently utilize the same lands could be significant. If water rights supporting agricultural use are purchased to support solar development, some areas that are currently farmed by using that water would be converted to dryland uses.

Because the closest wild horse HMA is about 75 mi (120 km) from the proposed SEZ, solar energy development would not contribute to cumulative impacts on wild horses and burros managed by the BLM.

10.1.22.4.4 Recreation

It is likely that limited outdoor recreation (e.g., backcountry driving, OHV use, and hunting for both small and big game) occurs on or in the immediate vicinity of the SEZ. Construction of utility-scale solar projects on the SEZ would preclude recreational use of the affected lands for the duration of the projects. However, improvements to or additional access roads could increase the amount of recreational use in unaffected areas of the SEZ or in the immediate vicinity. There would be a potential for visual impacts on recreational users of the surrounding specially designated areas (Section 10.1.22.3.2). The overall cumulative impacts on recreation could be large for the users of the areas affected by the solar projects, but would be relatively small for users of areas outside of the affected areas.

10.1.22.4.5 Military and Civilian Aviation

The SEZ is located under two MTRs. There are no civilian facilities in the vicinity of the SEZ. Recent information from the DoD indicates that there are no concerns about solar development in the SEZ. Considering other ongoing and reasonably foreseeable future actions discussed in Section 10.1.22.2, the cumulative impacts from the solar energy development in the proposed SEZ would be small.

10.1.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project, including any associated transmission lines, would contribute to the soil loss due to wind erosion. Construction of new roads within the SEZ, or improvements to existing roads would also contribute to soil erosion. During construction, operations, and decommissioning of the solar facilities, travel back and forth by the workers at the facilities, visitors and delivery personnel to the facilities, or waste haulers from the facilities would also contribute to soil loss. These losses would be in addition to losses occurring as a result of disturbance caused by other users in the area, including from construction of other renewable energy facilities, recreational users, and agricultural users. Erosion of exposed soils could also lead to the generation of fugitive dust, which could affect local air quality (see Section 10.1.22.3.12). As discussed in Section 10.1.7.3, design features would be employed to minimize erosion and loss of soil during the construction, operation, and decommissioning phases of the solar facilities and any associated transmission lines. Overall, solar energy facility contributions to cumulative impacts on soil resources would be small and temporary during the construction and decommissioning of the facilities.

Landscaping of solar energy facility areas could alter drainage patterns and lead to increased siltation of surface water streambeds, in addition to that from other development activities and agriculture. However, with the required design features in place, cumulative impacts would be small.

10.1.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)

There are no mining claims or oil and gas leases in the SEZ. Lands in the SEZ were recently closed to "locatable mineral" entry, pending the outcome of this PEIS. These lands would continue to be closed to all incompatible forms of mineral development if the area is designated as an SEZ. However, some mineral uses might be allowed. For example, oil and gas development utilizing directional drilling techniques would still be possible. Also, the production of common minerals, such as sand and gravel and mineral materials used for road construction, might take place in areas not directly developed for solar energy production. No geothermal development has occurred within or adjacent to the SEZ, nor is there any known or expected future development of geothermal resources in the same area.

10.1.22.4.8 Water Resources

The water requirements for various technologies if they were to be employed on the proposed SEZ to develop utility-scale solar energy facilities are described in Sections 10.1.9.2. It is stated that if the SEZ were to be fully developed over 80% of its available land area, the amount of water needed during the peak construction year for all evaluated solar technologies would be 686 to 964 ac-ft (846,200 to 1.2 million m^3). During operations, the amount of water needed for all evaluated solar technologies would range from 43 to 23,371 ac-ft/yr (53,000 to 28.8 million m^3). The amount of water needed during decommissioning would be similar to or less than the amount used during construction. These numbers would compare with 1,100 ac-ft/day (402,680 ac-ft/yr) in Conejos County that was withdrawn from primarily surface waters in 2005. Therefore, cumulatively the additional water resource needed for solar facilities in the SEZ would constitute a relatively small increment (up to 6%, the ratio of the annual operations water requirement to the annual amount withdrawn in Conejos County). However, as discussed in Sections 10.1.9.1.3, the water resources in the area are fully appropriated, and any new users would have to purchase a more senior water right (e.g., an old irrigation right), retire that historic consumptive use, and transfer that amount of historic consumptive use to the new project. Additionally, the proposed water management rules being developed for the Rio Grande Basin will impose limits on groundwater withdrawals and set requirements for augmentation water plans that can affect the process of securing water supplies (see Sections 10.1.9.1.3 and 10.1.9.2.4). The strict management of water resources in the Rio Grande Basin act to ensure that any impacts from a new, water use would continue to be equivalent to or less than those from current uses and that no net increase or decrease in the total amount of water used would occur.

Small quantities of sanitary wastewater would be generated during the construction and operation of the potential utility-scale solar energy facilities. The amount generated from solar facilities would be in the range of 9 to 74 ac-ft (11,100 to 91,300 m^3) during the peak construction year and would range from less than 1 to 22 ac-ft/yr (up to 27,100 m^3/yr) during operations. Because of the small quantity, the sanitary wastewater generated by the solar energy facilities would not be expected to put undue strain on available sanitary wastewater treatment facilities in the general area of the SEZ. For technologies that rely on conventional wet- or dry-cooling systems, there would also be 246 to 442 ac-ft/yr (303,200 to 545,200 m^3/yr) of blowdown water from cooling towers. This water would be treated on-site (e.g., in settling ponds) and injected into the ground, released to surface water bodies, or reused.

10.1.22.4.9 Vegetation

The proposed Antonito Southeast SEZ is located primarily within the San Luis Shrublands and Hills ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands. These plant community types generally have a wide distribution within the San Luis Valley area, and thus other ongoing and reasonably foreseeable future actions would have a cumulative effect on them. Because of the long history of livestock grazing, the plant communities present within the SEZ have likely been affected by grazing. If utility-scale solar energy projects were to be constructed within the SEZ, all vegetation within the footprints of the facilities would likely be removed during land-clearing and land-grading operations. In addition, any wetlands within the footprint of the facility would need to be avoided or impacts mitigated. Wetland or riparian habitats outside of the SEZ that are supported by groundwater discharge could be affected by hydrologic changes resulting from project activities. The fugitive dust generated during the construction of the solar facilities could increase the dust loading in habitats outside a solar project area, which could result in reduced productivity or changes in plant community composition. Similarly, surface runoff from project areas after heavy rains could increase sedimentation and siltation in areas downstream. Other activities that would contribute to the overall dust generation in the area would include construction of new solar facilities or other facilities, agriculture, recreation, and transportation. Programmatic and SEZ-specific design features would be used to reduce the impacts from solar energy projects and thus the overall cumulative impacts on plant communities and habitats.

10.1.22.4.10 Wildlife and Aquatic Biota

More than 325 species of amphibians (over 10 species), reptiles (over 10 species), birds (over 235 species), and mammals (over 70 species) occur in and around the proposed Antonito Southeast SEZ (CDOW 2009). The construction of utility-scale solar energy projects in the SEZ and any associated transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, and wildlife injury or mortality. Unless mitigated, these impacts, when added to impacts that would result from other activities in the general area, could be moderate to large. In general, impacted species with broad distributions and occurring in a variety of habitats would be less affected than species with a narrowly defined habitat within a restricted area. The required programmatic and SEZ-specific design features would reduce the severity of impacts on wildlife. The design features include pre-disturbance biological surveys to identify key habitat areas used by wildlife followed by avoidance or minimization of disturbance to those habitats (e.g., wetlands such as Alta Lake in the proposed Antonito Southeast SEZ or areas of crucial habitat such as severe winter range for elk).

The proposed De Tilla Gulch and Fourmile East SEZs, and the operating and planned solar facilities near the Fourmile East SEZ are smaller areas, and likely too far away from the Antonito Southeast to have cumulative impacts on wildlife and aquatic biota. However, the proposed Los Mogotes SEZ is only about 7 mi (11 km) from the Antonito Southeast SEZ. Additionally, there are other ongoing and reasonably foreseeable future actions (Section 10.1.22.2) occurring in the vicinity of the Antonito Southeast SEZ. If development of solar facilities occurred at both proposed SEZs in the future or if other actions occurred in the vicinity, there could be cumulative impacts on wildlife and aquatic biota habitat. However, many of the wildlife species have extensive available habitat within the affected counties (e.g., elk and pronghorn). Nonetheless, several new solar facilities and the other actions would have a cumulative impact on wildlife. Where projects are closely spaced, the cumulative impact on a particular species could be moderate to large.

For example, solar energy development in the proposed Antonito Southeast SEZ would encompass an area of severe winter range for elk. The implementation of programmatic and SEZ-specific design features would reduce the impacts from solar energy projects and thus the overall cumulative impacts on wildlife.

The only surface water body on the proposed SEZ is Alta Lake, a wetland depression located in the northwestern corner of the SEZ. Because the lake can periodically dry up, no fish are present. Impacts on Alta Lake are discussed in Section 10.1.11.4.2 Cumulative impacts on aquatic biota and habitats resulting from solar facilities within the SEZ and other reasonably foreseeable activities would most likely occur as a result of groundwater drawdown or sedimentation of downgradient streams. Since net groundwater use should not change because of regulations governing use in the San Luis Valley, cumulative impacts on aquatic biota and habitats from groundwater drawdown should not occur. Design features to prevent erosion and sedimentation would reduce cumulative impacts on stream habitat and aquatic biota.

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

One species listed under the ESA (southwestern willow flycatcher) has the potential to occur within the affected area of the SEZ. The Gunnison's prairie dog is the only species that is a candidate for listing as threatened or endangered under the ESA that may occur near the proposed Antonito Southeast SEZ. Numerous additional species occurring on or in the vicinity of the SEZ are listed as threatened or endangered by the States of Colorado or New Mexico, or listed as a sensitive species by the BLM. Design features to be used to reduce or eliminate the potential for effects on these species from the construction and operation of utility-scale solar energy projects include avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. The impacts of full-scale solar energy development on threatened, endangered, and sensitive species would be minimized if design features were implemented, including avoidance of occupied or suitable habitats, avoidance of occupied areas, and translocation of individuals. This approach would also minimize the contribution of potential solar energy projects to cumulative impacts on protected species. Depending on other projects occurring in the area at the time, there may still be some cumulative impacts on protected species. However, other projects would likely also employ mitigation measures to reduce or eliminate the impacts on protected species as required by the ESA and other applicable federal and state laws and regulations.

The proposed De Tilla Gulch and Fourmile East SEZs, and the operating and planned solar facilities near the Fourmile East SEZ, are smaller areas and likely too far away from the Antonito Southeast SEZ to have cumulative impacts on special status species. However, the proposed Los Mogotes SEZ is only about 7 mi (11 km) from the Antonito Southeast SEZ. Special status species with potential habitat impacts from solar development that are common to both the Los Mogotes SEZ and the Antonito Southeast SEZ are the Bodin milkvetch, grassy slope sedge, least moonwort, northern moonwort, Rocky Mountain blazing-star, western moonwort, short-eared owl, Rio Grande chub, Rio Grande sucker, and southwestern willow flycatcher.

There are also other ongoing and reasonably foreseeable future actions (Section 10.1.22.2) occurring in the vicinity of the proposed Antonito Southeast SEZ. Together, several new solar facilities and the other actions would have a cumulative impact on wildlife. Where projects are closely spaced, the cumulative impact on a particular species could be moderate to large.

10.1.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuels, the site preparation and construction activities associated with solar energy facilities would be responsible for some amount of air pollutants. Most of the emissions would be particulate matter (fugitive dust) and emissions from vehicles and construction equipment. When these emissions are combined with those from other projects near solar energy development or when they are added to natural dust generation from winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency, or road paving or treatment.

Other planned energy production and distribution activities in the San Luis Valley include construction and operation of two smaller (less than 300 acres [1.2 km^2]) PV facilities near the Fourmile East SEZ, and construction of a power line running east from Alamosa to Walsenburg. Construction of these projects would result in a temporary increase in particulate emissions. In addition, since the Los Mogotes East and Antonito Southeast SEZs are within about 12 mi (19 km) of each other, construction of solar facilities at the two SEZs could have cumulative impacts. However, because of the limited duration of construction activities and the likelihood that those activities would occur at different times, adverse cumulative air quality impacts are not expected. If two solar facilities were being constructed at approximately the same time at the two SEZs, specific schedules could be managed to reduce air quality impacts.

Over the long term and across the region, the development of solar energy may have beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need for energy production that results in higher levels of emissions, such as coal, oil, and natural gas. As discussed in Section 10.1.13, during operations of solar energy facilities, only a few sources of air emissions exist, and their emissions would typically be relatively small. However, the amount of criteria air pollutant, VOCs, TAP, and GHG emissions that would be avoided if the solar facilities were to displace the energy that otherwise would have been generated from fossil fuels could be relative large. For example, if the Antonito Southeast SEZ were fully developed with solar facilities up to 80% of its size, the quantity of pollutants avoided could be as large as 5.7% of all emissions from the current electric power systems in Colorado.

10.1.22.4.13 Visual Resources

The San Luis Valley floor is very flat and is characterized by wide open views. Generally good air quality and a lack of obstructions allow visibility for 50 mi (80 km) or more under favorable atmospheric conditions. The proposed SEZ is a generally flat to gently rolling, largely treeless plain, with the strong horizon line being the dominant visual feature. The visual resource inventory (VRI) values for the SEZ and immediate surroundings are VRI Class III, indicating moderate relative visual values. The inventory indicates relatively low levels of use and public interest; however, the site is within the viewshed of the West Fork of the North Branch of the Old Spanish Trail, indicating high visual sensitivity. Aside from high sensitivity associated with the viewshed of the Old Spanish Trail, the site is also visible from several ACECs and in general is close to other specially designated areas.

Development of utility-scale solar energy projects within the SEZ would contribute to the cumulative visual impacts in the general vicinity of the SEZ and in the San Luis Valley. However, the exact nature of the visual impact and the mitigation measures that would be appropriate would depend on the specific project locations within the SEZ and on the solar technologies used for the project. Such impacts and potential mitigation measures would be considered in visual analyses conducted for future specific projects. In general, large visual impacts on the SEZ would be expected to occur as a result of the construction, operation, and decommissioning of utility-scale solar energy projects. These impacts would be expected to involve major modification of the existing character of the landscape and could dominate the views for some nearby viewers. Additional impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines.

Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, some lands outside the SEZ would also be subjected to visual impacts related to the construction, operation, and decommissioning of utility-scale solar energy facilities. Some of the affected lands outside the SEZ would include potentially sensitive scenic resource areas, including the West Fork of the North Branch of the Old Spanish Trail, the San Luis Hills and San Antonio WSAs; the San Luis Hills, San Antonio Gorge, and Cumbres & Toltec Scenic Railroad scenic ACECs; the Los Caminos Antiguos Scenic Byway, the Cumbres & Toltec Scenic Railroad and its historic depot, and the communities of Antonito and Conejos. Other sensitive visual resource areas, including congressionally designated wilderness areas, WSRs, national scenic trails, and scenic highways would also be subject to minor or minimal visual impacts. Visual impacts resulting from solar energy development within the SEZ would be in addition to impacts caused by other potential projects in the area such as other solar facilities on private lands, transmission lines, and other renewable energy facilities, like wind mills. The presence of new facilities would normally be accompanied by increased numbers of workers in the area, traffic on local roadways, and support facilities, all of which would add to cumulative visual impacts.

In addition to cumulative visual impacts associated with views of particular future development, as additional facilities are added several projects might become visible from one location, or in succession, as viewers move through the landscape, such as driving on local roads. In general, the new projects would likely vary in appearance, and depending on the number and type of facilities, the resulting visual disharmony could exceed the visual absorption capability of the landscape and add significantly to the cumulative visual impact.

10.1.22.4.14 Acoustic Environment

The areas around the proposed Antonito Southeast SEZ and in the San Luis Valley area, in general, are relatively quiet. The existing noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, animal noise, industrial activities, and community activities and events, along with OHV use across the SEZ. The construction of solar energy facilities could increase the noise levels over short durations because of the noise generated by construction equipment during the day. After the facilities are constructed and begin operating, there would be little or minor noise impacts for any of the technologies except from solar dish engine facilities and from parabolic trough or power tower facilities using TES. If one or more of these types of facilities were to be constructed close to the boundaries of an SEZ or on different SEZs relatively close to each other (i.e., Antonito Southeast and Los Mogotes East), residents living nearby could be affected by the noise generated by these machines, particularly at night when the noise is more discernable due to relatively low background levels.

10.1.22.4.15 Paleontological Resources

Little surveying for paleontological resources has been conducted in the San Luis Valley. For reasons described in Section 10.1.16, few, if any, impacts on significant paleontological resources are likely to occur in the proposed SEZ. However, the specific sites selected for future projects would be surveyed if determined necessary by the BLM, and any paleontological resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. No significant cumulative impacts on paleontological resources are expected.

10.1.22.4.16 Cultural Resources

The San Luis Valley is rich in cultural history with settlements dating as far back as 11,000 years. Several geographic features in the valley may have cultural significance. However, as the area occupied by the proposed Antonito Southeast SEZ has not been surveyed for cultural resources, no archeological sites, historic structures or features, or traditional cultural properties have been formally recorded within the SEZ. There are, however, several historic properties, including a scenic railroad and a historic trail, located in close proximity to the SEZ. It is possible that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, could contribute cumulatively to cultural resource impacts. However, the specific sites selected for future projects would be surveyed, and any cultural resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. Similarly, through ongoing consultation with the Colorado SHPO and appropriate Native American governments, it is likely that most adverse effects on significant resources in the San Luis Valley could be mitigated to some degree, but not necessarily eliminated.

10.1.22.4.17 Native American Concerns

Government-to-government consultation is under way with Native American governments with possible traditional ties to the San Luis Valley. To date no specific concerns regarding the proposed Antonito Southeast SEZ have been raised to the BLM. The Jicarilla Apache have judicially established a tribal land claim in proximity to the SEZ, but on the basis of available maps, the claim does not appear to include any portions of the SEZ and should not contribute to any impacts on that claim. Blanca Peak has been identified as a culturally significant mountain for the Navajo, the Jicarilla Apache, and possibly the people of the Taos Pueblo. It is possible that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, could contribute cumulatively to visual impacts in the valley as viewed from Blanca Peak and to the loss of traditionally important plant species and animal habitat. Continued discussions with the area Tribes through government-to-government consultation is necessary to effectively consider and mitigate the Tribes' concern tied to solar energy development in the San Luis Valley.

10.1.22.4.18 Socioeconomics

Solar energy development projects in the proposed Antonito Southeast SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZs and in the surrounding multicounty ROI. The effects could be positive (e.g., creation of jobs and generation of extra income, increased revenues to local governmental organizations through additional taxes paid by the developers and workers) or negative (e.g., added strain on social institutions such as schools, police protection, and health care facilities). Impacts from solar development would be most intense during facility construction, but of greatest duration during operations. Construction would temporarily increase the number of workers in the area needing housing and services in combination with temporary workers involved in other new projects in the area, including other renewable energy development. The number of workers involved in the construction of solar projects in the peak construction year could range from about 120 to 1,600 depending on the technology being employed, with solar PV facilities at the low end and solar trough facilities at the high end. The total number of jobs created in the area could range from approximately 220 (solar PV) to as high as 3,000 (solar trough). Cumulative socioeconomic effects in the ROI from construction of solar facilities would occur to the extent that multiple construction projects of any type were ongoing at the same time. It is a reasonable expectation that this condition would occur within a 50-mi (80-km) radius of the SEZ occasionally over the 20-or-more year solar development period.

Annual impacts during the operation of solar facilities would be less, but of 20- to 30-year duration, and could combine with those from other new projects in the area. The number of workers needed at the solar facilities would be in the range of 17 to 340, with approximately 24 to 530 total jobs created in the region. Population increases would contribute to general upward trends in the region in recent years. The socioeconomic impacts overall would be positive, through the creation of additional jobs and income. The negative impacts, including some short-term disruption of rural community quality of life, would not likely be considered large enough to require specific mitigation measures.

10.1.22.4.19 Environmental Justice

Minority populations have been identified within 50 mi (80 km) of the proposed SEZ in both Colorado and New Mexico; no low-income populations are present. Any impacts from solar development could have cumulative impacts on minority populations in combination with other development in the area. Such impacts could be both positive, such as from increased economic activity, and negative, such as visual impacts, noise, fugitive dust, and loss of agricultural jobs from conversion of lands. However, these impacts are not expected to be disproportionately high on the minority populations. If needed, mitigation measures can be employed to reduce the impacts on the population in the vicinity of the SEZ, including the minority populations. As the overall scale and environmental impacts of potential projects within the ROI are expected to be generally low, it is not expected that the proposed Antonito Southeast SEZ would contribute to cumulative impacts on minority and low income populations.

10.1.22.4.20 Transportation

A two-lane highway (U.S. 285) passes by the proposed Antonito Southeast SEZ. CO 17 is approximately 2 mi (3 km) northwest of the SEZ. The SLRG Railroad also serves the area. The AADT on these highways currently ranges from about 1,300 to 3,900. During construction activities, there could be up to 1,000 workers commuting to the construction site at the SEZ, which could increase the AADT on these highways by 2,000 vehicles. This increase in highway traffic from construction workers could have moderate cumulative impacts in combination with existing traffic levels and increases from additional future projects in the area. However, if construction were occurring concurrently in the proposed Antonito Southeast and Los Mogotes East SEZs, which are relatively close to each other and are both served by U.S. 285, the increase in traffic during shift changes could be significant. Local road improvements may be necessary near site access points. Any impacts during construction activities would be temporary. The impacts could be mitigated to some degree by having different work hours within an SEZ or between two SEZs. Traffic increases during operation would be relatively small because of the low number of workers needed to operate solar facilities and would have little contribution to cumulative impacts.

10.1.23 References

Note to Reader: This list of references identifies Web pages and associated URLs where reference data were obtained for the analyses presented in this PEIS. It is likely that at the time of publication of this PEIS, some of these Web pages may no longer be available or their URL addresses may have changed. The original information has been retained and is available through the Public Information Docket for this PEIS.

AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project Design Refinements*. Available at http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf. Accessed Sept. 2009.

Alamosa-La Jara Water Users Protection Association v. Gould, 1983, 674 P.2d 914, 931 Colo.

AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the U.S*, Chicago, Ill. Available at http://www.ama-assn.org/ama/pub/category/2676.html.

Backlund, P., et al., 2008, *The Effects of Climate Change on Agriculture*, *Land Resources*, *Water Resources*, *and Biodiversity in the United States*, Synthesis and Assessment Product 4.3 by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C., May. Available at http://www.sap43.ucar.edu/documents/SAP_4.3_6.18.pdf. Accessed July 2008.

Baker, S.G., et al., 2007, "Protohistoric and Historic Native Americans," pp. 29–87 in M.C. Church et al, *Colorado History: A Context for Historical Archaeology*, Colorado Council of Professional Archaeologists, Denver.

Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*, submitted to the California Energy Commission, March. Available at http://www.energy.ca.gov/sitingcases/beacon/index.html.

Bean, L.E., 2001, *Land of the Blue Sky People*, 7th printing, O&V Printing, Alamosa, Colo.

Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control Engineering, Washington, D.C.

BLM (Bureau of Land Management), 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal*, Denver, Colo.

BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program*, Colorado State Office, Denver, Colo., Jan.

BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28, U.S. Department of the Interior, Jan.

BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Jan.

BLM, 1991, *San Luis Resource Area*, *Proposed Resource Management Plan and Final Environmental Impact Statement*, U.S. Department of the Interior, Sept.

BLM, 1996, *White River Resource Area Proposed Resource Management Plan and Final Environmental Impact Statement*, Colorado State Office, White River Resource Area, Craig District, Colo., June.

BLM, 2001, *Colorado Water Rights Fact Sheet*. Available at http://www.blm.gov/nstc/WaterLaws/colorado.html. Accessed Nov. 2009.

BLM, 2007, *Proposed Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado*, *Utah*, *and Wyoming and Programmatic Environmental Impact Statement*, FES 08-2, Sept.

BLM, 2009a, *Rangeland Administration System*, Allotment Master, Feb. 7. Available at http://www.blm.gov/ras/index.htm. Last updated Aug. 24, 2009. Accessed Nov. 24, 2009.

BLM, 2009b, *Environmental Assessment Record (CO-500-2005-016-EA) of the San Luis Resource Area Travel Management Plan*, BLM San Luis Valley Public Lands Center. Available at http://www.blm.gov/co/st/en/fo/slvplc/Travel_Management.html. Accessed Feb. 4, 2010.

BLM, 2009c, *The Sangre de Cristo National Heritage Area Feasibility Study*, draft report provided by B.N. Hall, (BLM, Denver, Colo., in e-mail to J. May (Argonne National Laboratory, Lakewood, Colo.), Oct. 8.

BLM, 2009d, *Proposed Decision Record (CO-500-2005-016-EA) to Amend Off-Highway Vehicle Designations in the San Luis Area Resource Management Plan*, BLM San Luis Valley Public Lands Center, signed by D.S. Dallas on June 4, 2009.

BLM, 2010a, *San Luis Valley Resource Area Noxious and Invasive Species Management Environmental Assessment*, DOI-BLM-CO-140-2009-004-EA.

BLM, 2010b, *Solar Energy Interim Rental Policy*, U.S. Department of Interior. Available at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html.

BLM, 2010c, *Visual Resource Inventory Prepared for the U.S. Department of the Interior*, *Bureau of Land Management*, *Saguache Field Office*, *Saguache*, *Colorado*, Sept.

BLM and USFS, 2010a, *GeoCommunicator: NILS National Integrated Land System Interactive Maps*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed Nov. 15, 2009.

BLM and USFS, 2010b, *GeoCommunicator: Mining Claim Map.* Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

BLM and USFS, 2010c, *GeoCommunicator: Energy Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

Blume, F., and A.F. Sheehan, 2002, *Quantifying Seismic Hazard in the Southern Rocky Mountains through GPS Measurements of Crustal Deformation—Abstract*, Paper No. 227-5, The Geological Society of America, 2002 Annual Meeting, Denver, Colo.

Brendle, D. L., 2002, *Geophysical Logging to Determine Construction*, *Contributing Zones*, *and Appropriate Use of Water Levels Measured in Confined-Aquifer Network Wells*, *San Luis Valley*, *Colorado*, *1998–2000*, U.S. Geological Survey, Water Resources Investigations Report, 02–4058.

Brister, B.S., and R.R. Gries, 1994, *Tertiary Stratigraphy and Tectonic Development of the Alamosa Basin (Northern San Luis Basin)*, *Rio Grande Rift*, *South-Central Colorado*, Geological Society of America Special Paper 291.

Brown, J., 2010, personal communication from Brown (Realty Specialist, Colorado Renewable Energy Team, San Luis Public Lands Center, Monte Vista, Colo.) to K. Wescott (Argonne National Laboratory, Argonne, Ill.), Oct. 6.

BTS (Bureau of Transportation Statistics), 2008, *Air Carriers: T-100 Domestic Segment (All Carriers)*, Research and Innovative Technology Administration, U.S. Department of Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311. Accessed June 23, 2009.

Burnell, J.R., et al., 2008, *Colorado Mineral and Energy Industry Activities*, *2007*, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

Burroughs, R.L., 1974, *Neogene Volcanism in the Southern San Luis Basin*, *New Mexico*, Geological Society Guildebook, 25th Field Conference, Ghost Ranch (Central-Northern New Mexico). Available at: http://nmgs.nmt.edu/publications/guidebooks/downloads/25/25_p0291_p0294.pdf. Accessed Jan. 20, 2010.

Burroughs, R.L., 1981, *A Summary of the Geology of the San Luis Basin*, *Colorado–New Mexico with Emphasis on the Geothermal Potential for the Monte Vista Graben*, Special Publication 17, DOE/ET/28365-10, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

Button, V.T., 1980, *Archaeological Investigations in the Closed Basin of Colorado's San Luis Valley*, Report No: WP-SLV-CRI-001, prepared for the U.S. Department of the Interior, Water and Power Resources Service, Southwest Regional Office, Amarillo, Texas, March.

Callaway, D., et al., 1986, "Ute," pp. 336–367 in *Handbook of North American Indians*, *Vol. 11*, *Great Basin*, W. D'Azevedo (editor), Smithsonian Institution, Washington, D.C.

Castetter, E.F., 1935, *Ethnobiological Studies in the American Southwest*, *I. Uncultivated Native Plants Used as Sources of Food*, *The University of New Mexico Bulletin no. 266*, University of New Mexico Press, Albuquerque.

CDA (Colorado Department of Agriculture), 2010, *Colorado Department of Agriculture*, *Noxious Weed Management Program*, *Noxious Weed* List. Available at http://www.colorado.gov/cs/Satellite?c=Page&cid=1174084048733&pagename=Agriculture-Main%2FCDAGLayout. Accessed Jan. 22, 2010.

CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990*, *1995*, *1999–2007*. Available at http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf.

CDOT (Colorado Department of Transportation), undated, *Traffic Information for Conejos County*. Available at http://www.dot.state.co.us/App_DTD_DataAccess/Traffic/index.cfm?fuseaction=TrafficMain&MenuType=Traffic. Accessed June 20, 2009.

CDOW (Colorado Division of Wildlife), 2008, *Natural Diversity Information Source Data*, Colorado Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/ftp/ftp_response.asp. Accessed Oct. 21, 2009.

CDOW, 2009, *Natural Diversity Information Source*, *Wildlife Species Page*, Colorado Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlife.asp. Accessed Aug. 29, 2009.

CDPHE (Colorado Department of Public Health and Environment), 2008a, *Colorado 2007 Air Quality Data Report*, Air Quality Control Division, Denver, Colo., July. Available at http://www.colorado.gov/airquality/documents/2007AnnualDataReport.pdf. Accessed Sept. 2, 2009.

CDPHE, 2008b, *Colorado's Stormwater Program Fact Sheet*. Available at http://www.cdphe.state.co.us/wq/permitsunit.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec. Available at http://www.whitehouse.gov/CEQ/.

CGS (Colorado Geological Survey), 2001, "When the Ground Lets You Down – Ground Subsidence and Settlement Hazards in Colorado," in *Rock Talk*, Vol. 4, No. 4, Oct.

Chapman, S.S., et al., 2006, *Ecoregions of Colorado* (color poster with map, descriptive text, summary tables, and photographs; map scale 1:1,200,000), U.S. Geological Survey, Reston, Va.

Chick, N., 2009, personal communication from Chick (Colorado Department of Public Health and Environment, Denver, Colo.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), Sept. 4.

Church, M. C., et al., 2007, *Colorado History: A Context for Historical Archaeology*, Colorado Council of Professional Archaeologists.

CNHP (Colorado Natural Heritage Program), 2009, *Colorado Natural Heritage Program*. Available at http://www.cnhp.colostate.edu/. Accessed Sept. 9, 2009.

Colorado District Court 2004, *Case Number 2004CW24*, *Concerning the Matter of the Rules Governing New Withdrawals of Ground Water in Water Division No. 3 Affecting the Rate or Direction of Movement of Water in the Confined Aquifer System*, District Court, Water Division No. 3.

Colorado District Court 2010, *Case Number 06CV64 & 07CW52*, *In the Matter of the Rio Grande Water Conservation District*, *in Alamosa County*, *Colorado and Concerning the Office of the State Engineer's Approval of the Plan of Water Management for Special Improvement District No. 1 of the Rio Grande Water Conservation District*, District Court, Water Division No. 3.

Colorado DWR (Division of Water Resources), 2005, *Water Well Construction Rules*, 2 CCR 402-2.

Colorado DWR, 2008, *Guide to Colorado Well Permits*, *Water Rights*, *and Water Administration*, Jan.

Colorado DWR, 2010a, *Colorado's Decision Support Systems*. Available at http://cdss.state.co.us/DNN/default.aspx.

Colorado DWR, 2010b, *Water Administration*. Available at http://water.state.co.us/wateradmin/waterright.asp.

Colorado DWR, 2010c, *San Luis Advisory Committee*. Available at http://water.state.co.us/wateradmin/SanLuisValleyBasin.asp.

Colorado Governor's Energy Office, 2007, *Connecting Colorado's Renewable Resources to the Markets—Report of the Colorado Senate Bill 07-091 Renewable Resource Generation Development Areas Task Force*, Denver, Colo.

Colorado SHPO (Colorado State Historic Preservation Office), 2009, Data on file, Denver, Colo.

Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008, U.S. Environmental Protection Agency, Research Triangle Park, N.C.

Crone, A.J., et al., 2006, *Data Related to the Late Quaternary Surface Faulting on the Sangre de Cristo Fault*, *Rito Seco Site*, *Costilla County*, *Colorado*, U.S. Geological Survey Scientific Investigations Map 2955, Version 1.0.

CTSR (Cumbres & Toltec Scenic Railroad), 2009, *Cumbres & Toltec Scenic Railroad*. Available at http://www.cumbrestoltec.com/. Accessed Nov. 1, 2009.

Dick, H., 1975, *A Surface Survey of Indian Camps on the Blanca Wildlife Refuge*, *San Luis Valley*, *Colorado*, Manuscript on file, Department of Anthropology, Adams State College, Colo.

Diefenbach, A.K., et al., 2009, *Chronology and References of Volcanic Eruptions and Selected Unrest in the United States*, *1980-2008*, U.S. Geological Survey Open File Report 2009-1118.

DOE (U.S. Department of Energy), 2009a, *Report to Congress*, *Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation*, Jan. 13.

DOE, 2009b, *Jobs and Economic Development Impacts (JEDI) Mode*, U.S. Department of Energy, Energy Efficiency and Renewable Energy, July. Available at http://www.windpoweringamerica.gov/filetail.asp?itemid=707.

Dyer, H.C., 2009, *Paleontological Ground Truthing Survey in the Rio Grande National Forest*, *Colorado*, Rio Grande National Forest, Monte Vista, Colo., Sept. 15.

EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections to 2030*, DOE/EIA-0383, March.

Eldred, K.M., 1982, "Standards and Criteria for Noise Control—An Overview," *Noise Control Engineering* 18(1):16–23.

Emery, P.A., 1979, "Geohydrology of the San Luis Valley, Colorado, USA," IAHS-AISH Publication No. 128, in *The Hydrology of Areas of Low Precipitation—L'Hydrologie des Régions à Faibles Precipitations*, Proceedings of the Canberra Symposium (Actes du Colloque de Canberra), Dec.

Emery, P.A., 1994, *Hydrogeology of the San Luis Valley*, *Colorado*, *An Overview—National Park Service*, Field Trip 20, Section 2, Paper 3. Available at www.nps.gov/archive/grsa/resources/docs/Trip2023.pdf. Accessed June 29, 2009.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA-550/9-74-004, Washington, D.C., March. Available at http://www.nonoise.org/library/levels74/levels74.htm. Accessed Nov. 17, 2008.

EPA, 2009a, *Energy CO_2 Emissions by State*. Available at http://www.epa.gov/climatechange/emissions/state_energyco2inv.html, last updated June 12, 2009. Accessed June 23, 2009.

EPA, 2009b, *AirData: Access to Air Pollution Data.* Available at http://www.epa.gov/oar/data/. Accessed Sept. 12, 2009.

EPA, 2009c, *Preferred/Recommended Models—AERMOD Modeling System.* Available at http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.

EPA, 2009d, *eGRID.* Available at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, last updated Oct. 16, 2008. Accessed Jan. 12, 2009.

EPA, 2010, *National Ambient Air Quality Standards (NAAQS)*. Available at http://www.epa.gov/air/criteria.html, last updated June 3, 2010. Accessed June 4, 2010.

FEMA (Federal Emergency Management Agency), 2009, FEMA Map Service Center. Available at http://www.fema.gov. Accessed Nov. 20.

Fire Departments Network, 2009, *Fire Departments by State*. Available at http://www.firedepartments.net/.

Fowler, C.S., 1986, "Subsistence," pp.64-97 in *Handbook of North American Indians*, *Vol. 11*, *Great Basin*, W.L. d'Azevedo (editor), Smithsonian Institution, Washington, D.C.

GAO (Government Accounting Office), 2007, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, Report to Congressional Requesters, GAO-07-863, Aug.

Gibson, M., 2010, personal communication from Gibson (San Luis Valley Water Conservancy District, Alamosa, Colo.) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

Graham, T.B., 2001, *Survey of Ephemeral Pool Invertebrates at Wupatki NM: An Evaluation of the Significance of Constructed Impoundments as Habitat*, WUPA-310, final report for Wupatki National Monument and Southwest Parks and Monuments Association, Sept.

Guthrie, M.R., et al., 1984, *Colorado Mountains Prehistoric Context*, Colorado Historical Society, Denver, Colo.

Haas, D., 2010, personal communication with attachment regarding the West Fork of the Old Spanish Trail, from Haas (BLM State Archaeologist, Colorado State Office, Lakewood, Colo.) to K. Wescott (Archaeologist, Argonne National Laboratory, Argonne, Ill.) Jan. 19, 2010.

Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., May. Available at http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.

Heide, R., 2009, *National Heritage Area in the Works*. Available at http://www.coloradopreservation.org/news/articles/Heritage_Area_04.doc. Accessed Oct. 19, 2009.

Hinderlider, M.C., et al., 1939, *Rio Grande Compact*, *with Amendments*, adopted Dec. 19. Available at http://wrri.nmsu.edu/wrdis/compacts/Rio-Grande-Compact.pdf. Accessed Nov. 10, 2009.

Harmon, E.J., 2009, *San Luis Valley Hydrogeology: An Overview*, a presentation by HRS Water Consultants. Available at http://water.state.co.us/wateradmin/SanLuisValley/Presentations/HarmonSLV.pdf. Accessed Aug. 10, 2010.

Joe, T., 2008, personal communication regarding tribal consultation request for solar energy development on BLM lands from Joe (Program Manager for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to Ms. S. Sierra (State Director, Bureau of Land Management, Salt Lake City, Utah), July 3.

Joe, T.H., Jr., 2009, personal communication regarding joint BLM and DOE PEIS for solar energy development, from Joe (Supervisory Anthropologist for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to S. Borchard (California Desert District Manager, Bureau of Land Management, Riverside, Calif.), July 3.

Kelson, K.I., and S.F. Personius (compilers), 1996, "Fault Number 2015, Mesita Fault," *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Aug. 26, 2009.

Kirkham, R.M., and W.P. Rogers, 1981, "Earthquake Potential in Colorado," *Colorado Geological Survey Bulletin 43*.

Laney, P., and J. Brizzee, 2005, *Colorado Geothermal Resources*, INEEL/MIS-2002-1614, Rev. 1, prepared for U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Geothermal Technologies Program, Nov.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

Leonard, G.J., and K.R. Watts, 1989, *Hydrogeology and Simulated Effects of Ground-Water Development on an Unconfined Aquifer in the Closed Basin Division*, *San Luis Valley*, *Colorado*, U.S. Geological Survey Water Resources Investigations Report 87-4284, Denver, Colo.

Lindsey, K.D., 1983, *Paleontological Inventory and Assessment of the San Luis Resource Area*, prepared by Denver Museum of Natural History for U.S. Bureau of Land Management, Canon City District, Colo., Dec. 31.

Lipman, P.W., and H.H. Mehnert, 1979, "The Taos Plateau Volcanic Field, Northern Rio Grande Rift, New Mexico," in *Rio Grande Rift: Tectonics and Magmatism*, Robert E. Riecker (editor), American Geophysical Union.

Lipman, P.W., 2006, *Geologic Map of the Central San Juan Caldera Cluster*, *Southwestern Colorado*, U.S. Geological Survey pamphlet to accompany Geologic Investigations Series I-2799.

Lipman, P.W., et al., 1970, *Volcanic History of the San Juan Mountains*, *Colorado*, *as Indicated by Potassium-Argon Dating*, Geological Society of America Bulletin, Vol. 81.

Machete, M.N., 2006, "Pliocene to Middle Pleistocene Evolution of the Upper Rio Grande, Northern New Mexico and Southern Colorado," *GSA Program with Abstracts*, Rocky Mountain Section, 58th Annual Meeting, May 17 through 19. Available at http://gsa.confex.com/gsa/2006RM/finalprogram/abstract_104051.htm. Accessed August 10, 2010.

Machette, M.N., and R.A. Thompson, 2007, "Water in the San Luis Basin—Lake Alamosa's Legacy," in *Geological Society of America Abstracts with Programs*, 39, No. 6, p. 365.

Manci, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service National Ecology Research Center, Ft. Collins, Colo.

Martorano, M.A., 1999, "Protohistoric Stage," pp. 138-144 in *Colorado Prehistory: A Context for the Rio Grande Basin*, M.A. Martorano et al., Colorado Council of Professional Archaeologists, Denver, Colo..

Martorano, M.A, et al., 1999, *Colorado Prehistory: A Context for the Rio Grande Basin*, Colorado Council of Professional Archaeologists, Denver, Colo.

Mayo, A.L., et al., 2007, "Groundwater Flow Patterns in the San Luis Valley, Colorado, USA Revisited: an Evaluation of Solute and Isotopic Data," *Hydrogeology Journal* 15:383–408.

McCalpin, J., 1986, "Quaternary Tectonics of the Sangre de Cristo and Villa Grove Fault Zones," in *Contributions to Colorado Seismicity and Tectonics: A 1986 Update*, Colorado Geological Survey Special Publication 28.

McCollough, R., 2009, "New Mexico TES Data Request," personal communication with attachment from McCollough (Data Services Manager, Natural Heritage New Mexico, Albuquerque, New Mexico) to L. Walston (Argonne National Laboratory, Argonne, Ill.), Sept. 17.

McDermott, P., 2009, personal communication from McDermott (Office of the State Engineer, Alamosa, Colo.) to T. Martinez (Argonne National Laboratory, Argonne, Ill.), Dec.

McDermott, P., 2010, personal communication from McDermott (Engineer with Colorado Division of Water Resources, Division 3) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

MIG (Minnesota IMPLAN Group), Inc., 2010, *State Data Files*, Stillwater, Minn.

Miggins, D.P., et al., 2002, "Extension and Uplift of Northern Rio Grande Rift: Evidence from $^{40}Ar/^{39}Ar$ Geochronology from the Sangre de Cristo Mountains, South-Central Colorado and Northern New Mexico," Geological Society of America, Special Paper 362.

Miller, N.P., 2002, "Transportation Noise and Recreational Lands," in *Proceedings of Inter-Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at http://www.hmmh.com/cmsdocuments/N011.pdf. Accessed Aug. 30, 2007.

Moose, V., 2009, "Comments on Solar Energy Development Programmatic EIS," letter from Moose (Tribal Chairperson, Big Pine Paiute Tribe of the Owens Valley, Big Pine, Calif.) to Argonne National Laboratory (Argonne, Ill.), Sept. 14.

Murphey, P.C., and D. Daitch, 2007, "Figure D2, Colorado-PFYC," in *Paleontological Overview of Oil Shale and Tar Sands Areas in Colorado*, *Utah*, *and Wyoming*, prepared for U.S Department of the Interior, Bureau of Land Management, Dec.

National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding, Water Science and Technology Boar, and Commission on Geosciences, Environment, and Resources, National Academy Press, Washington, D.C.

NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life*, Version 7.1, NatureServe, Arlington, Va. Available http://www.natureserve.org/explorer. Accessed: Oct. 1, 2010.

NCDC (National Climate Data Center), 2009a, *2008 Local Climatological Data Annual Summary with Comparative Data*, *Alamosa*, *Colorado (KALS)*, National Oceanic and Atmospheric Administration. Available at http://www7.ncdc.noaa.gov/IPS/lcd/lcd.html. Accessed Aug. 26, 2009.

NCDC, 2009b, *Integrated Surface Data (ISD)*, *DS3505 Format*, database, Asheville, N.C. Available at ftp://ftp3.ncdc.noaa.gov/pub/data/noaa. Accessed Aug. 26, 2009.

NCDC, 2009c, *Climates of the States (CLIM60): Climate of Colorado*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl. Accessed Aug. 26, 2009.

NCDC, 2010, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms. Accessed Oct. 8, 2010.

NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*, U.S. Department of Education. Available at http://www.nces.ed.gov/ccd/districtsearch/.

NMDGF (New Mexico Department of Game and Fish), 2009, *Biota Information System of New Mexico Database Query*, Sante Fe, N.M. Available at http://www.bison-m.org/databasequery.aspx. Accessed Oct. 9, 2009.

NPS (National Park Service), 2008, *National Heritage Areas*, National Heritage Areas Program Office, Washington, D.C. Available at http://www.nps.gov/history/heritageareas.

NPS, 2009a, *Sand Sea Wonders: A Natural History of the Great Sand Dunes.* Available at http://www.nps.gov/archive/grsa/resources/history_brief.htm. Accessed Nov. 2, 2009.

NPS, 2009b, *Sangre de Cristo National Heritage Area*. Available at http://www.nps.gov/grsa/parknews/sangre-de-cristo-nha.htm. Accessed Nov. 10, 2009.

NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO) Database for Alamosa County*, *Colorado*. Available at: http://SoilDataMart.nrcs.usds.gov.

NRCS (Natural Resources Conservation Service), 2009, *Web Soil Survey*, U.S. Department of Agriculture, Washington, D.C. Available at http://websoilsurvey.nrcs.usda.gov/. Accessed Aug. 21.

NSTC (National Science and Technology Council), 2008, *Scientific Assessment of the Effects of Global Change on the United States*, A Report of the Committee on Environment and Natural Resources, May.

Old Spanish Trail Association, 2007, *The Old Spanish Trail*, map published by the La Vereda del Norte Chapter, B&B Printers, Gunnison, Colo.

Opler, M.E., 1936, "A Summary of Jicarilla Apache Culture," *American Anthropologist* 38(2):202-223.

Pew Center on Global Climate Change, 2009, *Renewable and Alternative Energy Portfolio Standards (with reference to Colorado House Bill 07-1281)*. Available at http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm. Accessed Nov. 4, 2009.

Ray, A.J., et al., 2008, *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation*, a report by the Western Water Assessment for the Colorado Water Conservation Board. Available at http://cwcb.state.co.us/NR/rdonlyres/B37476F5-BE76-4E99-AB01-6D37E352D09E/0/ClimateChange_FULL_Web.pdf. Accessed Nov. 2, 2009.

RGSR (Rio Grande Scenic Railroad), 2009, *Rio Grande Scenic Railroad Information Web Site*. Available at http://www.riograndescenicrailroad.com/. Accessed Nov. 11, 2009.

RGWCD (Rio Grande Water Conservation District), 2009, *Proposed Plan of Water Management —Special Improvement District 1 (aka Closed Basin Subdistrict)*, May 11, 2009 draft. Available at http://www.rgwcd.org/Pages/Subdistricts/Subdistrict1_1.htm. Accessed Nov. 9, 2009.

RGWCD, 2010, *Draft: San Luis Valley Well and Water-Level Database*. Available at http://www.rgwcd.org/wl/. Accessed Aug. 4.

Ritter, B., Jr., 2007, *Colorado Climate Action Plan: A Strategy to Address Global Warming*, Nov.

Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona*, *Colorado*, *New Mexico*, *Utah*, U.S. Geological Survey, HA 730-C.

SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National Survey on Drug Use and Health*, *2004*, *2005 and 2006*, Office of Applied Studies, U.S. Department of Health and Human Services. Available at http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage.

Scott, G., 2001, *Historic Trail Map of the Trinidad*, Geological Investigations Series I-2745, U.S. Department of the Interior, U.S. Geological Survey, Denver, Colo. Available at http://pubs.usgs.gov/imap/i-2745/i-2745.pdf. Accessed Oct. 6, 2010.

SES (Sterling Energy Systems) Solar Two, LLC, 2008, Application for Certification, submitted to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission, Sacramento, Calif., June. Available at http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php. Accessed Oct. 1, 2008.

Simmons, V.M., 1999, *The San Luis Valley: Land of the Six-Armed Cross*, 2nd ed., University Press of Colorado, Niwot, Colo.

Simmons, V.M., 2000, *The Ute Indians of Utah*, *Colorado*, *and New Mexico*, University of Colorado Press, Boulder, Colo.

Simonds, W.J., 2009, *The San Luis Valley Project*, Bureau of Reclamation. Available at http://www.usbr.gov/history/sanluisv.html. Accessed Nov. 4, 2009.

SLRG (San Luis & Rio Grande Railroad), 2009, *San Luis & Rio Grande Railroad*. Available at http://www.sanluisandriograndereailroad.com. Accessed June 25, 2009.

SLV (San Luis Valley) Development Resources Group, 2007, *Comprehensive Economic Development Strategy*, prepared with support from Planning and Assistance Grant 05-83-04371, Alamosa, Colo. Available at http://www.slvdrg.org/ceds.php. Accessed Nov. 3, 2009.

SLV Development Resources Group, 2009, *SLV TIGER Discretionary Grant Application with Appendices (Appendix 1—SLVRMI Map Showing the Sangre de Cristo NHA)*. Available at http://slvdrg.org/tigergrant.php. Accessed Nov. 10, 2009.

Smith, M., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425–450.

Spero, V., and M.A. Martorano, 1999, "Native American Perspectives," pp. 196-197 in M.A. Martorano et al., *Colorado Prehistory: A Context for the Rio Grande Basin*, Colorado Council of Professional Archaeologists, Denver, Colo.

State Demography Office, 2009, *Preliminary Population Forecasts for Colorado Counties, 2000–2010*. Available at http://dola.colorado.gov/dlg/demog/population/forecasts/counties1yr.xls.

Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin Company, Boston, Mass.

Stoeser, D.B., et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States: Central States–Montana*, *Wyoming*, *Colorado*, *New Mexico*, *North Dakota*, *South Dakota*, *Nebraska*, *Kansas*, *Oklahoma*, *Texas*, *Iowa*, *Missouri*, *Arkansas*, *and Louisiana*, *Version 1.2*, U.S. Geological Survey Open File Report 2005-1351, updated Dec. 2007.

Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen (Bureau of Land Management, Washington, D.C.), and L. Resseguie (Bureau of Land Management, Washington, D.C.), Sept. 14, 2009.

Strait, R., et al., 2007, *Colorado Greenhouse Gas Inventory and Reference Case Projections 1990–2020*, prepared by Center for Climate Strategies, Washington, D.C., for Colorado Department of Public Health and Environment, Denver, Colo., Jan. Available at http://www.cdphe.state.co.us/ap/down/GHGEIJan07.pdf. Accessed Sept. 11, 2009.

Texas v. Colorado, 1968, 391 U.S. 901, 88 S. Ct. 1649, 20 L. Ed.2d 416.

Thompson, R.A., et al. 1991, *Oligocene Basaltic Volcanism of the Northern Rio Grande Rift: San Luis Hills*, *Colorado*, Journal of Geophysical Research, Vol. 96, No. B8, July 30.

Thompson, K., 2002, *Dealing with Drought: Part Two*, prepared for Agro Engineering, Inc. Available at http://www.agro.com/WaterResources/Dealingwithdrought2.PDF. Accessed Nov. 9, 2009.

Tiller, V.E., 1983, “Jicarilla Apache,” pp. 440 – 461 in *Handbook of North American Indians*, *Vol. 10*, *Southwest*, A. Oritz (editor), Smithsonian Institution, Washington, D.C.

Time, 1941, “New Mexico: End of the Chili Line.” Available at http://www.time.com/time/magazine/article/0,9171,766037,00.html. Accessed Nov. 2, 2009.

Topper, R., et al., 2003, *Ground Water Atlas of Colorado*, Colorado Geological Survey, Special Publication, 53. Available at http://geosurvey.state.co.us/wateratlas.

Tri-State Generation and Transmission Association, Inc., 2008, *San Luis Valley Electric System Improvement Project Alternative Evaluation and Macro Corridor Study*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State Generation and Transmission Association, Inc., 2009, *San Luis Valley–Calumet-Comanche Transmission Project Alternative Evaluation*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State and Public Service Company of Colorado, 2009, *Southern Colorado Transmission Improvements—Renewable Energy Development.* Available at http://www.socotransmission.com/Purpose/renewables.cfm. Accessed Nov. 4, 2009.

TSNA (Tessera Solar North America), 2010, *San Luis Valley Solar Project Tessera Solar North America 1041 Final Application to Saguache County*, *Colorado*, June.

Tweto, O., 1979, Geologic Map of Colorado (Scale 1:500,000), U.S. Geological Survey, prepared in cooperation with the Geological Survey of Colorado.

University of New Mexico, 2009, *Population Projections for New Mexico and Counties*, Bureau of Business and Economic Research. Available at http://bber.unm.edu/demo/table1.htm.

U.S. Bureau of the Census, 2009a, *County Business Patterns*, *2008*, Washington, D.C. Available at http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html.

U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009c, *QT-P32*. *Income Distribution in 1999 of Households and Families: 2000. Census 2000 Summary File (SF 3) – Sample Data.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009d, *S1901*, *Income in the Past 12 Months*, *2006–2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.
U.S. Bureau of the Census, 2009e, *GCT-PH1*, *GCT-PH1*, *Population*, *Housing Units*, *Area*, *and Density: 2000*, *Census 2000 Summary File (SF 1)—100-Percent Data.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009f, *T1*, *Population Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009g, *GCT2510*, *Median Housing Value of Owner-Occupied Housing Units (Dollars)*, *2006–2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009h, *QT-H1*, *General Housing Characteristics*, *2000*, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009i, *GCT-T9-R*, *Housing Units*, *2008. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009j, *S2504*, *Physical Housing Characteristics for Occupied Housing Units 2006-2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3) - Sample Data.* Available at http://factfinder.census.gov/.

USDA (U.S. Department of Agriculture), 2004, *Understanding Soil Risks and Hazards—Using Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel (editor).

USDA, 2009a, *2007 Census of Agriculture: Colorado State and County Data*, *Volume 1*, *Geographic Area Series*, National Agricultural Statistics Service, Washington, D.C. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Colorado/index.asp.

USDA, 2009b, *2007 Census of Agriculture: New Mexico State and County Data*, *Volume 1*, *Geographic Area Series*, National Agricultural Statistics Service, Washington, D.C. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New Mexico/index.asp.

USDA, 2010, *United States Department of Agriculture Plants Database*. Available at http://plants.usda.gov/index.html. Accessed Jan. 25, 2010.

U.S. Department of Commerce, 2009, *Local Area Personal Income*, Bureau of Economic Analysis. Available at http://www.bea.doc.gov/bea/regional/reis/.

U.S. Department of the Interior, 2010, *Native American Consultation Database*, National NAGPRA Online Databases, National Park Service. Available at http://grants.cr.nps.gov/nacd/index.cfm.

U.S. Department of Justice, 2008, "Table 80: Full-time Law Enforcement Employees, by State by Metropolitan and Nonmetropolitan Counties, 2007," *2007 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division, Sept. Available at http://www.fbi.gov/ucr/cius2007/data/table_80.html. Accessed June 17, 2010.

U.S. Department of Justice, 2009a, *2008 Crime in the United States*, "Table 8: Offences Known to Law Enforcement, by State and City," Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Justice, 2009b, *2008 Crime in the United States*, "Table 10: Offences Known to Law Enforcement, by State and by Metropolitan and Non-metropolitan Counties," Federal

Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected Areas: Employment Status of the Civilian Noninstitutional Population*, *1976 to 2007*, *Annual Averages*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau/staadata.txt.

U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates by State*, Bureau of Labor Statistics. Available at http://www.bls.gov/web/laumstrk.htm.

U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau/.

USFS (U.S. Forest Service), 2005, *Rio Grande Chub (Gila Pandora): A Technical Conservation Assessment*, prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project, Fort Collins, Colo.

USFWS (U.S. Fish and Wildlife Service), 2009a, *National Wetlands Inventory*, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Available at http://www.fws.gov/wetlands/.

USFWS, 2009b, *San Luis Valley*, *Colorado Regional Habitat Conservation Plan (HCP)*. Available at http://www.fws.gov/mountain-prairie/endspp/conservation/index.htm. Accessed Nov. 10, 2009.

USFWS, 2010, *Environmental Conservation Online System (ECOS)*, U.S. Fish and Wildlife Service, Available at http://www.fws.gov/ecos/ajax/ecos/indexPublic.do. Accessed May 28, 2010.

USGS (U.S. Geological Survey), 2000, *Estimated Use of Water in the United States*, *County Level Data for 2000*. Available at http://water.usgs.gov/watuse/data/2000/. Accessed Oct. 22, 2009.

USGS, 2004, *National Gap Analysis Program, Provisional Digital Land Cover Map for the Southwestern United States*, Version 1.0, RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2005a, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—Land Cover Descriptions*, RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at http://earth.gis.usu.edu/swgap/legend_desc.html. Accessed Jan. 22, 2010.

USGS, 2005b, *National Gap Analysis Program, Southwest Regional GAP Analysis Project*, U.S. Geological Survey National Biological Information Infrastructure. Available at http://fws-nmcfwru.nmsu.edu/swregap/habitatreview/Review.asp. Accessed Sept. 23, 2010.

USGS, 2007, *National Gap Analysis Program*, 2007, *Digital Animal-Habitat Models for the Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm. Accessed Jan. 22, 2010.

USGS, 2008, *National Seismic Hazard Maps – Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 Years (Interactive Map)*. Available at: http://gldims.cr.usgs.gov/nshmp2008/viewer.htm. Accessed Aug. 4, 2010.

USGS, 2010a, *National Earthquake Information Center (NEIC –Circular Area Database Search (within 100-km of the center of the proposed Red Sands SEZ)*. Available at http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php. Accessed Aug. 25, 2010.

USGS, 2010b, *Glossary of Terms on Earthquake Maps –Magnitude*. Available at: http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude. Accessed Aug. 8, 2010.

USGS, 2010c, *National Water Information System*. Available at http://wdr.water.usgs.gov/nwisgmap. Accessed Aug. 3.

USGS and CGS (Colroado Geological Survey), 2009, *Quaternary Fault and Fold Database for the United States*. Available at: http://earthquake.usgs.gov/regional/qfaults/. Accessed Sept. 11, 2009.

Wells, S. J., 2008, *Archaeological Inventory and National Register Evaluation for the Baca Land Exchange La Jara Parcels Conejos County*, *Colorado*, prepared by the Western Archaeological and Conservation Center, Tucson, Ariz., and Fort Lewis College, Durango, Colo., for the National Park Service, Denver, Colo., the Bureau of Land Management, Lakewood, Colo., and the U.S. Fish and Wildlife Service, Lake, Colo., WACC Publications in Anthropology 101, Nov.

Westerling, A.L., et al., 2006, "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity," *Science* 313: 940–943.

WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System (EDMS)*. Available at http://www.wrapedms.org/default.aspx. Accessed June 4, 2009.

WRCC (Western Regional Climate Center), 2009, *Western U.S. Climate Historical Summaries.* Available at http://www.wrcc.dri.edu/Climsum.html. Accessed Aug. 21, 2009.

WRCC, 2010a, *Monthly Climate Summary*, *Blanca*, *Colorado (050776).* Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co0776. Accessed July 22, 2010.

WRCC, 2010b, *Monthly Climate Summary*, *La Vetta Pass*, *Colorado (054870).* Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co4870. Accessed July 22, 2010.

WRCC, 2010c, *Average Pan Evaporation Data by State*. Available at http://www.wrcc.dri.edu/htmlfiles/westevap.final.html. Accessed Jan. 19, 2010.

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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.

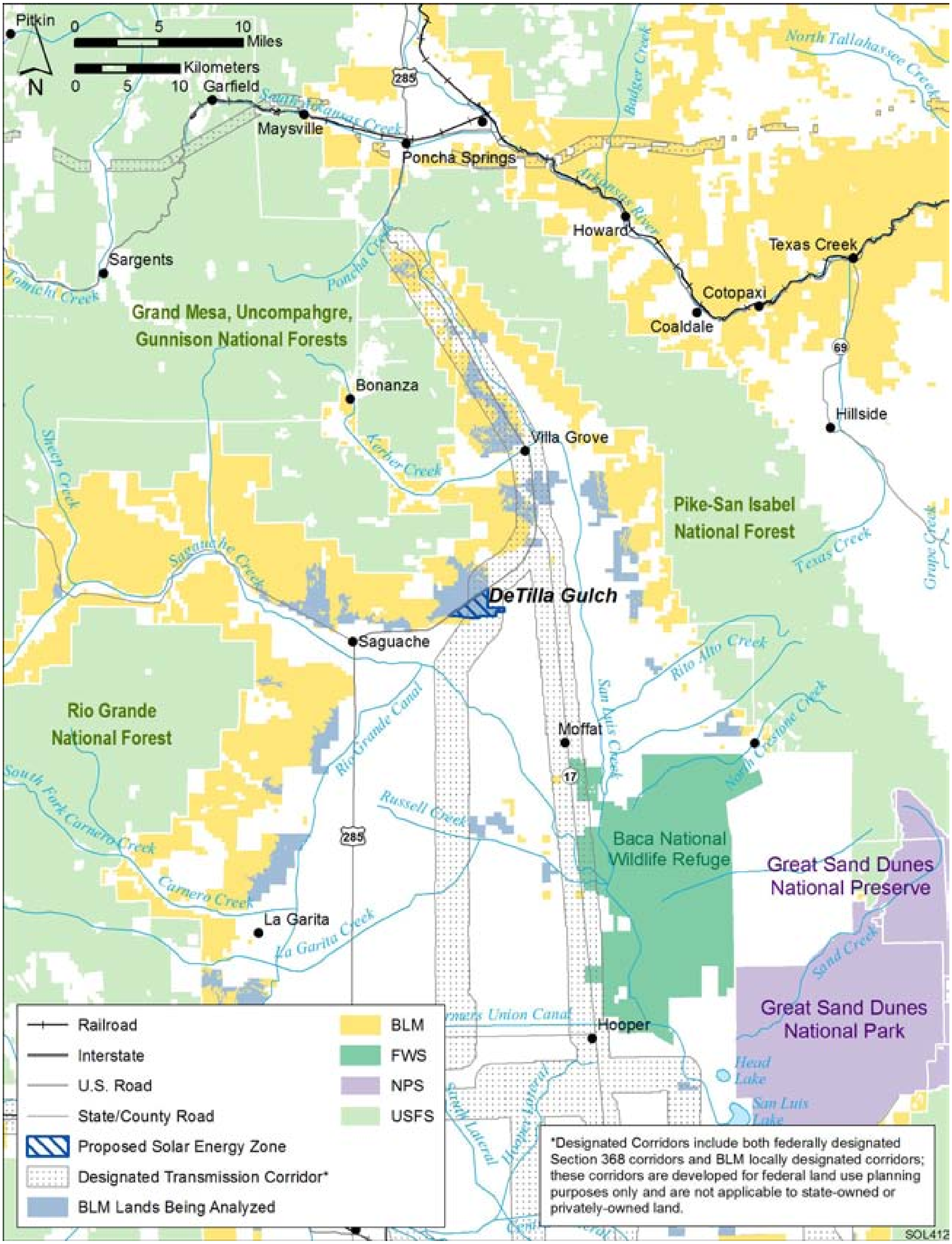

FIGURE 10.2.1.1-1 Proposed De Tilla Gulch SEZ

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.

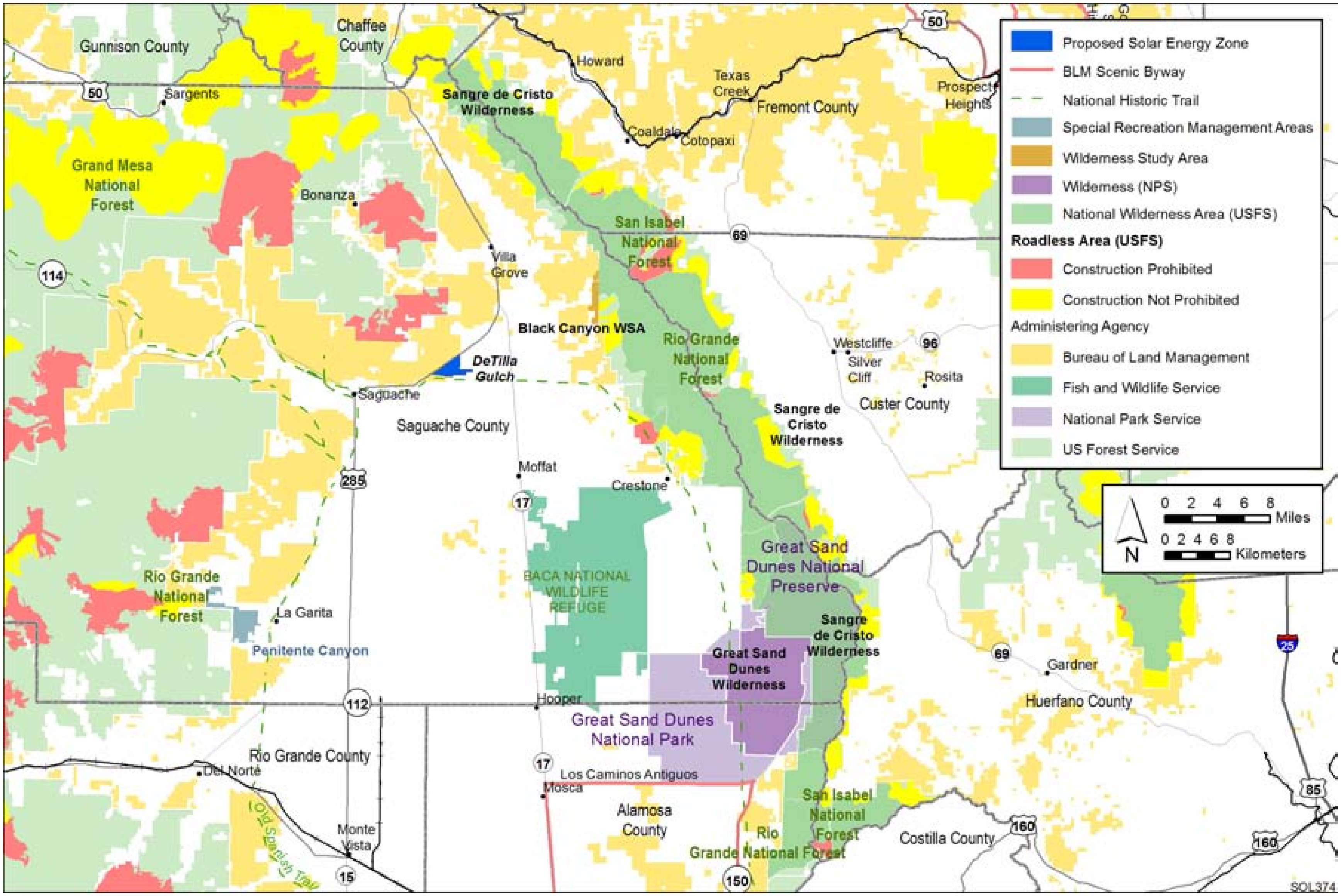

FIGURE 10.2.3.2-1 Specially Designated Areas in the Vicinity of the Proposed De Tilla Gulch SEZ

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).

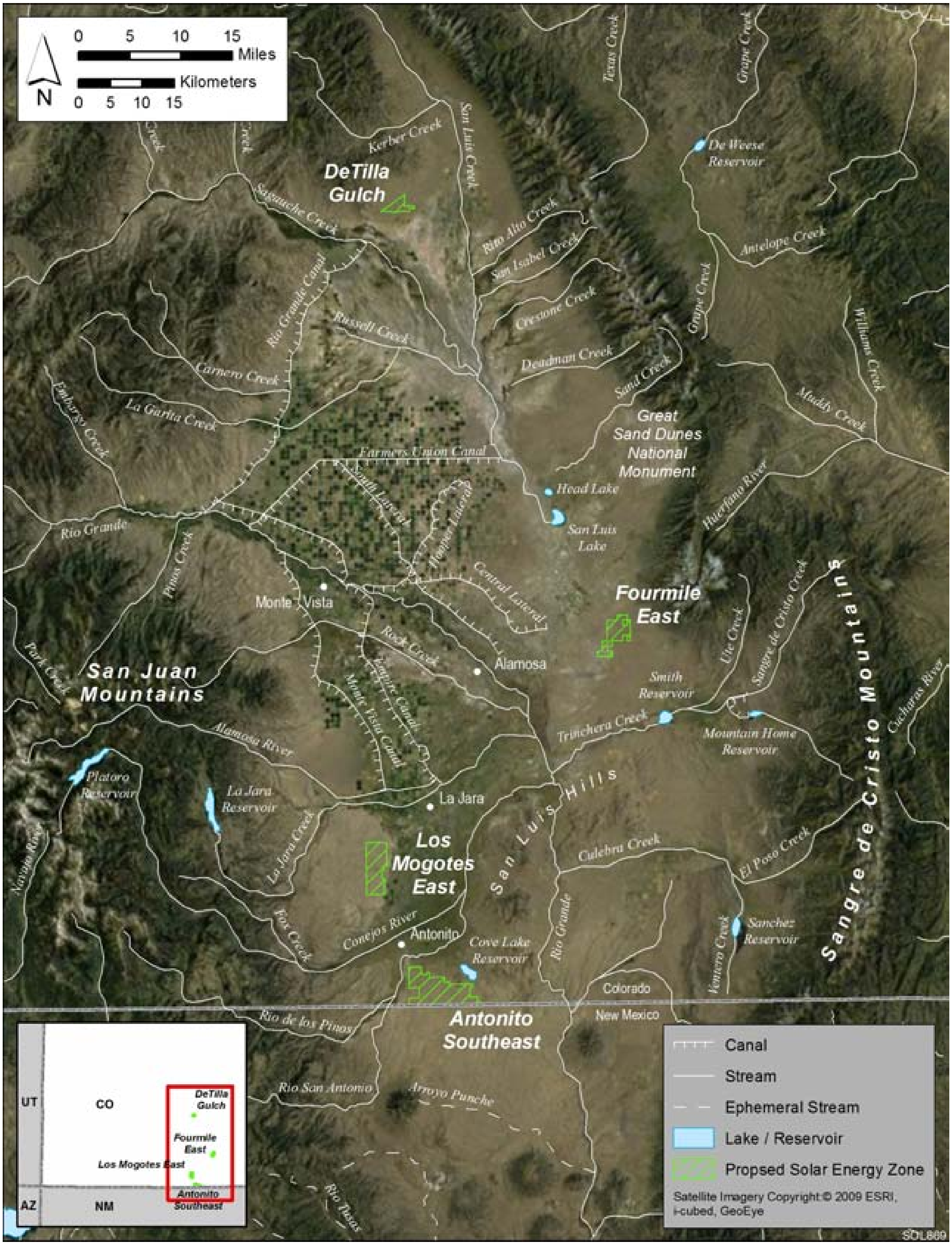

FIGURE 10.2.7.1-1 Physiographic Features of the San Luis Valley

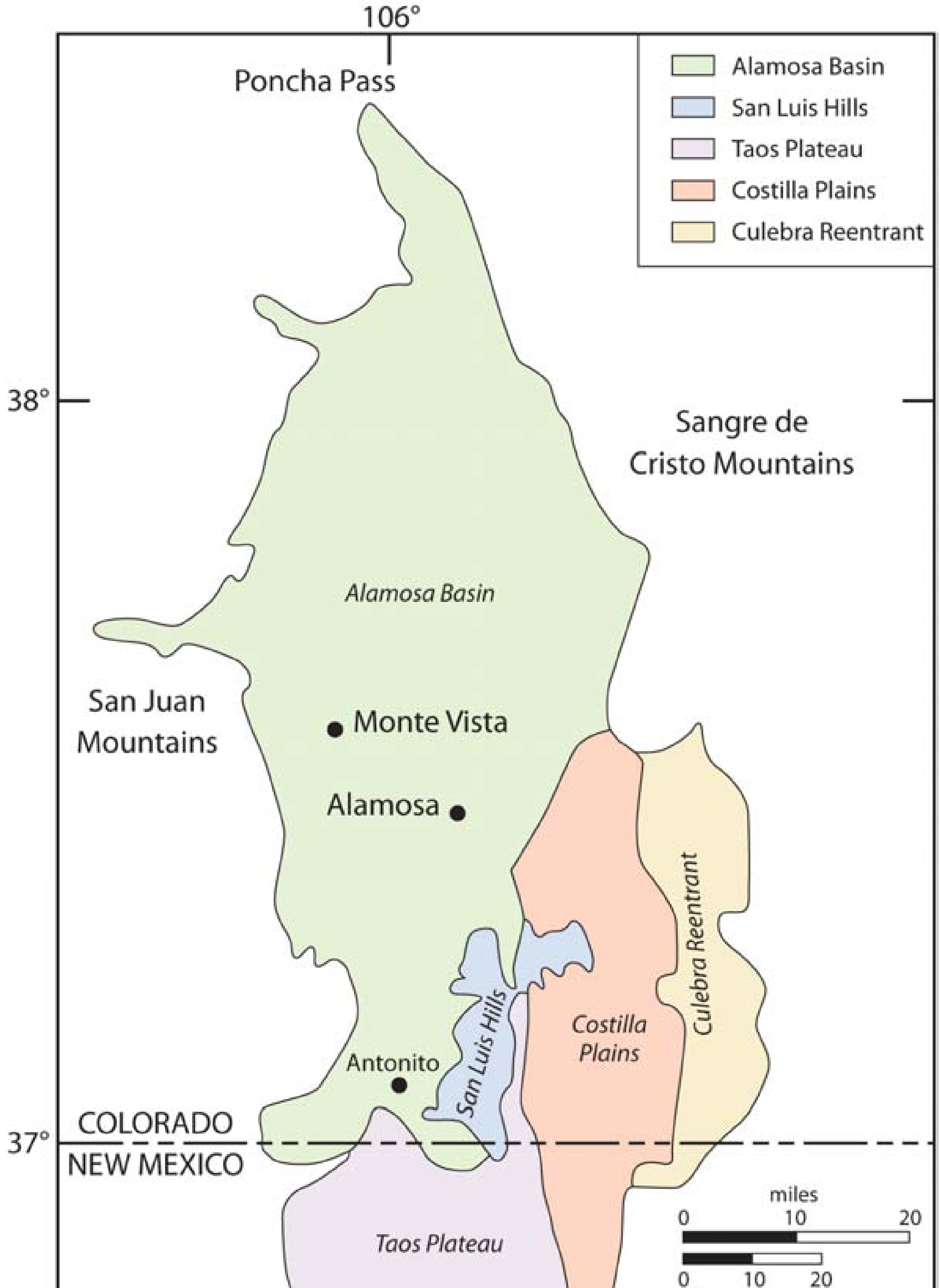

FIGURE 10.2.7.1-2 Physiographic Subdivisions within the San Luis Basin (modified from Burroughs 1981)

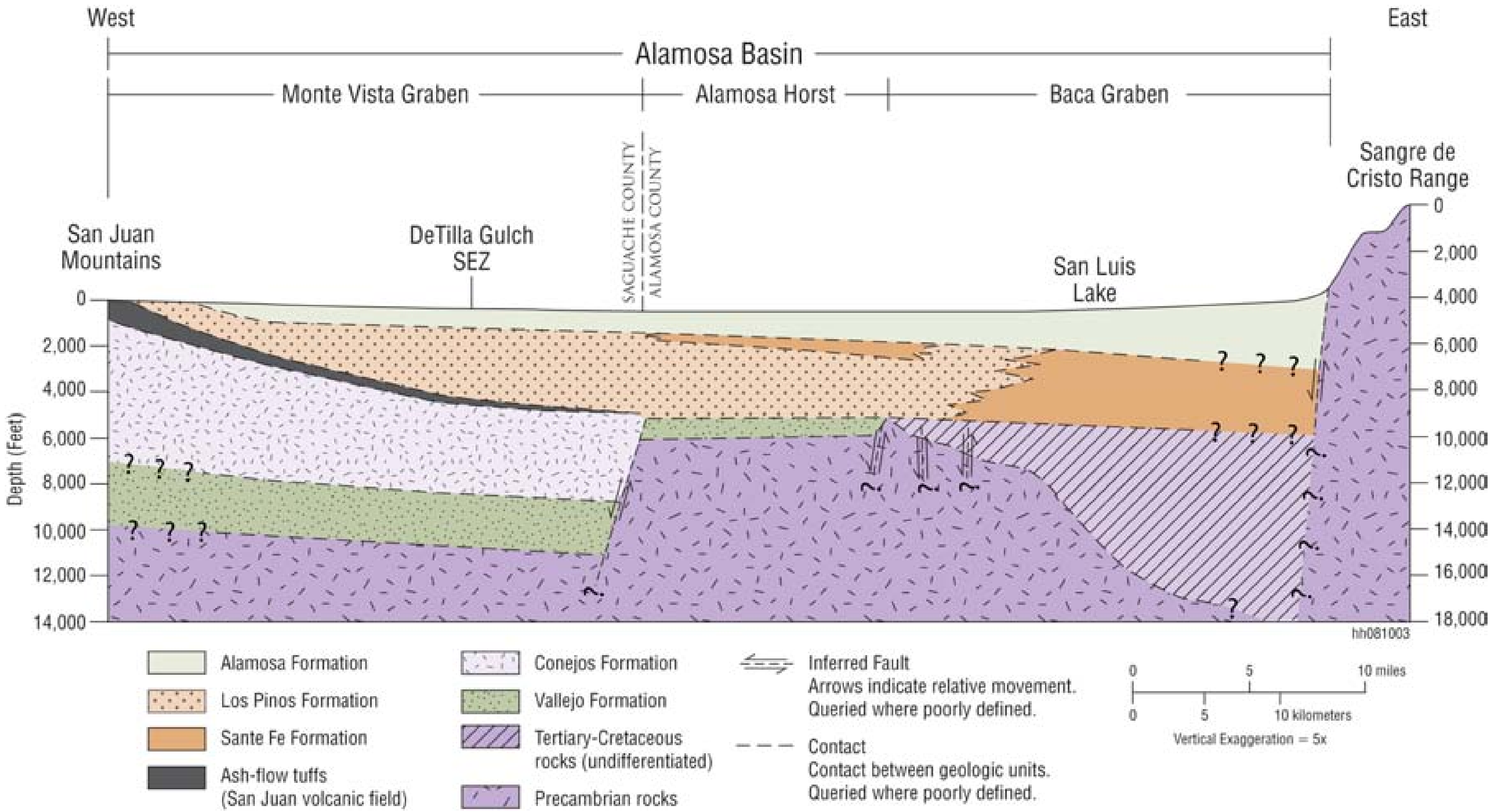

FIGURE 10.2.7.1-3 Generalized Geologic Cross Section (West to East) across the Northern Part of the Alamosa Basin (see Figure 10.2.7.1-6 for Section Location [modified from Leonard and Watts 1989])

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).

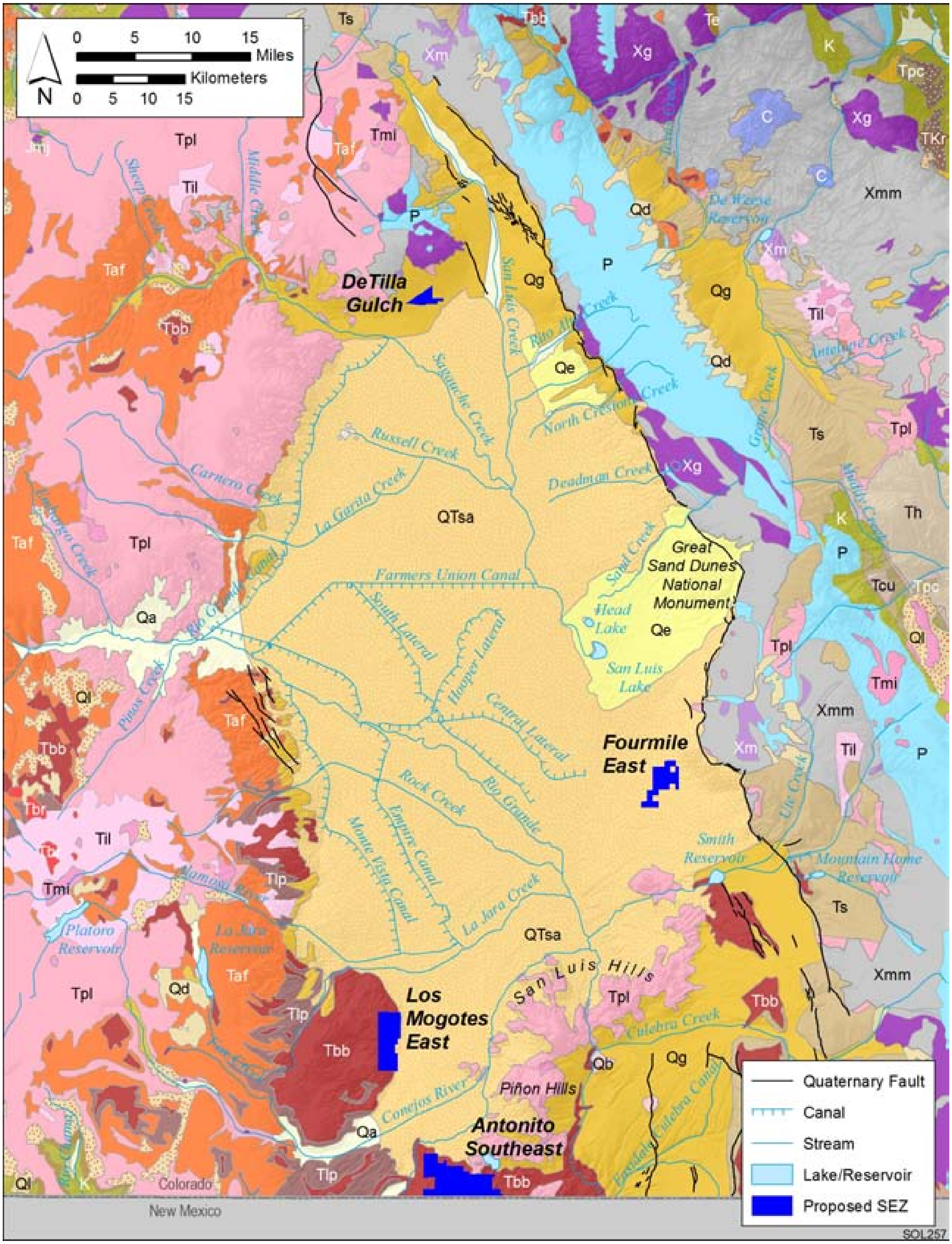

FIGURE 10.2.7.1-4 Geologic Map of the San Luis Valley and Vicinity (adapted from Stoeser et al. 2007 and Tweto 1979)

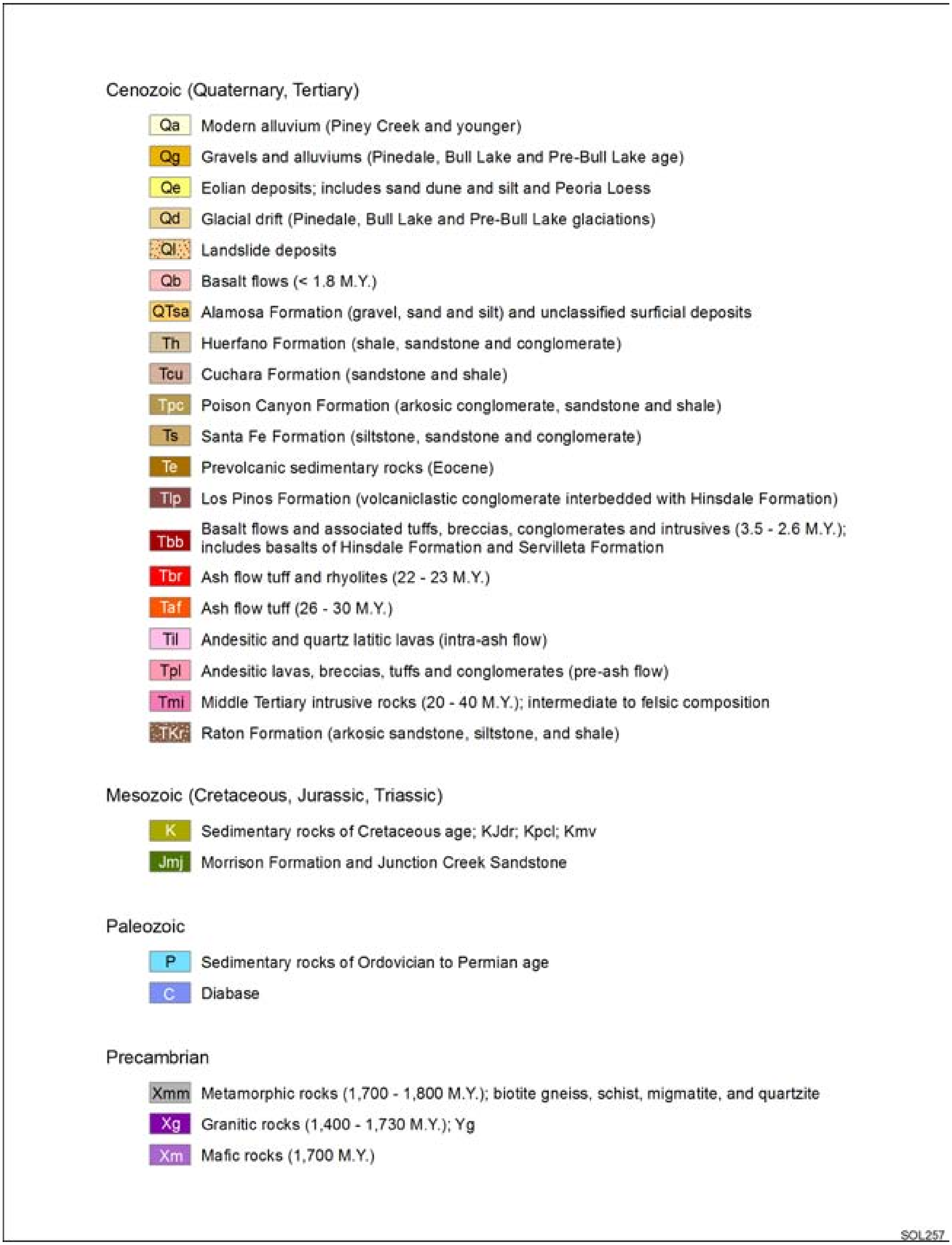

FIGURE 10.2.7.1-4 (Cont.)

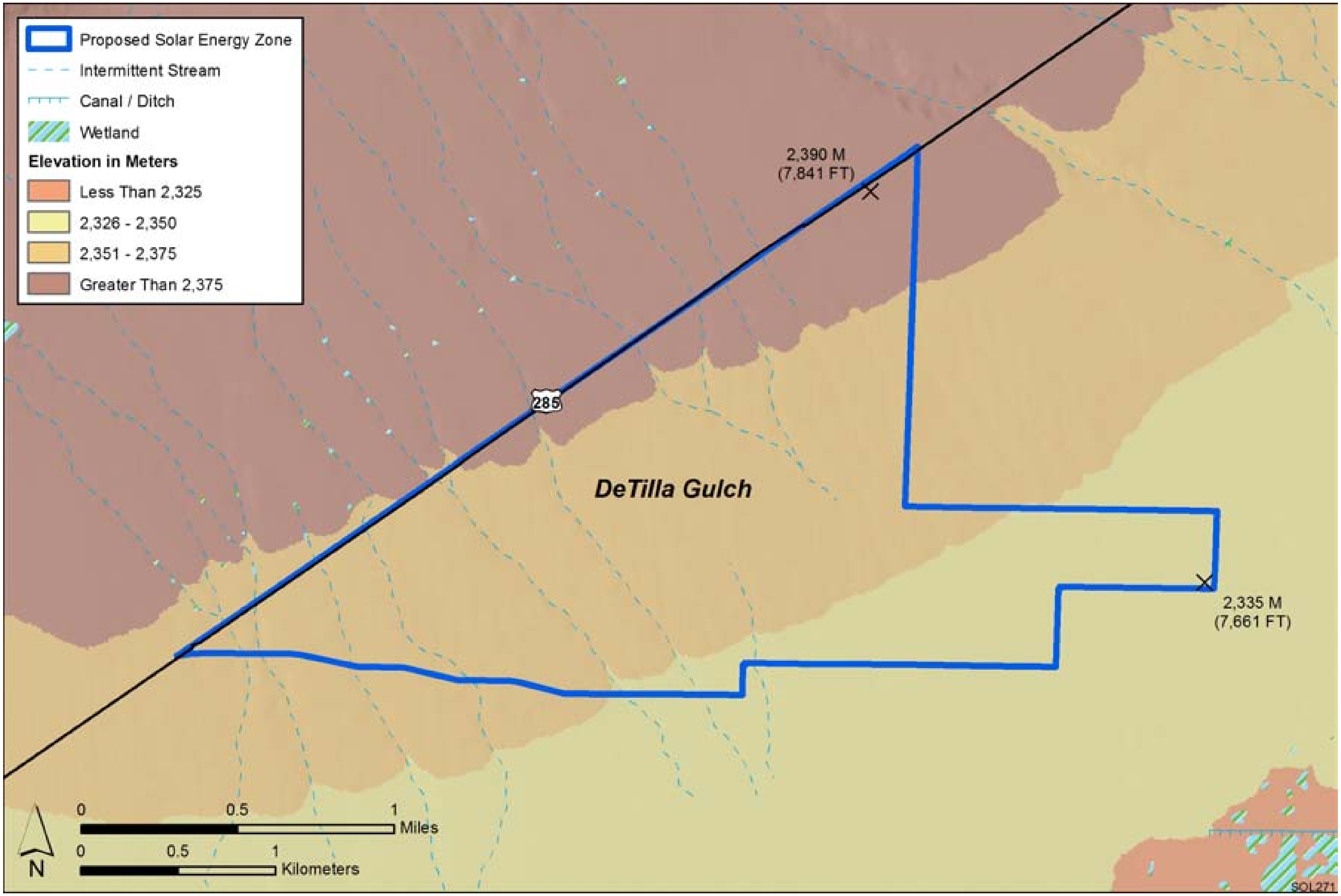

FIGURE 10.2.7.1-5 General Terrain of the Proposed De Tilla Gulch SEZ

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).

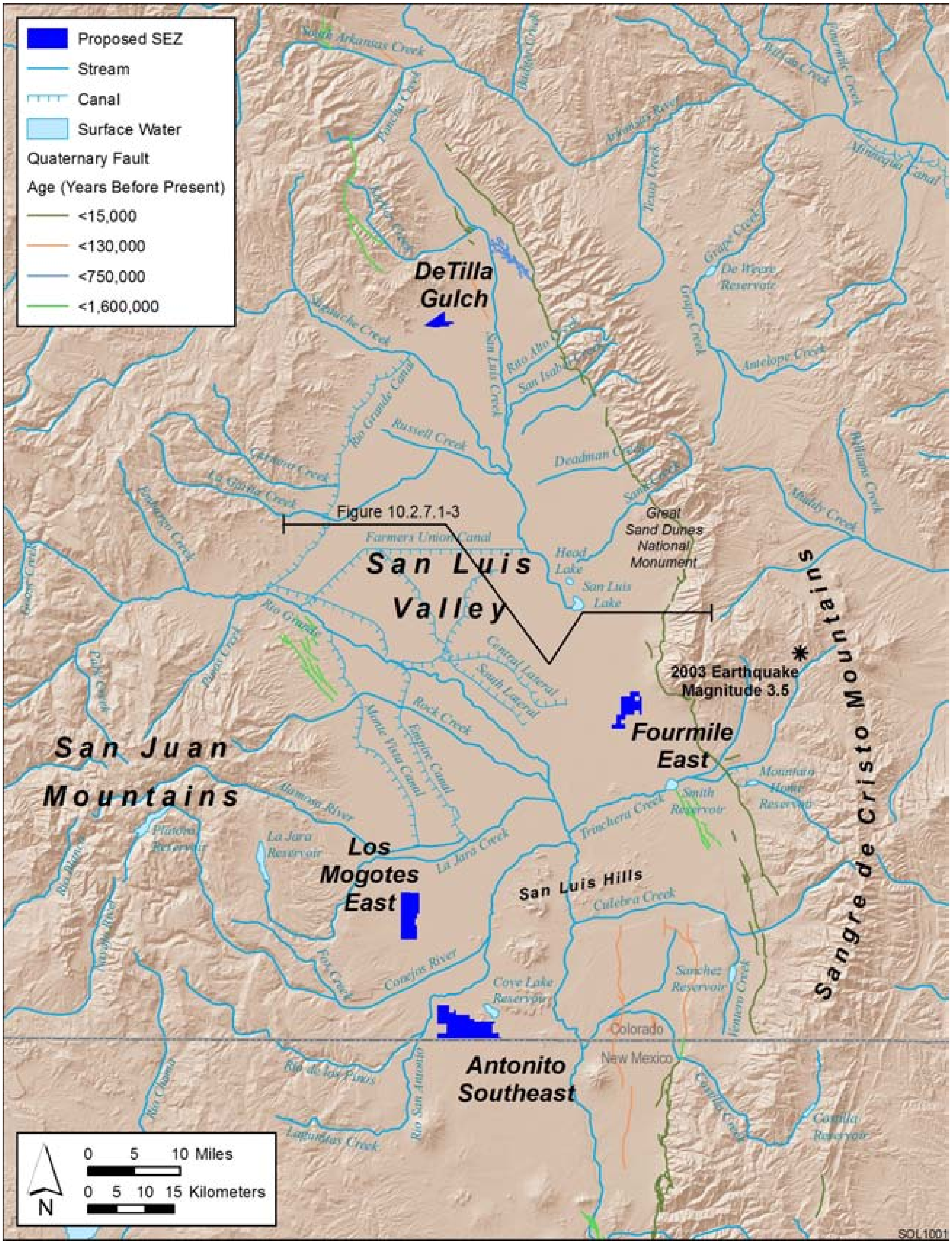

FIGURE 10.2.7.1-6 Quaternary Faults in the San Luis Valley (USGS and CGS 2009; USGS 2010c)

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).

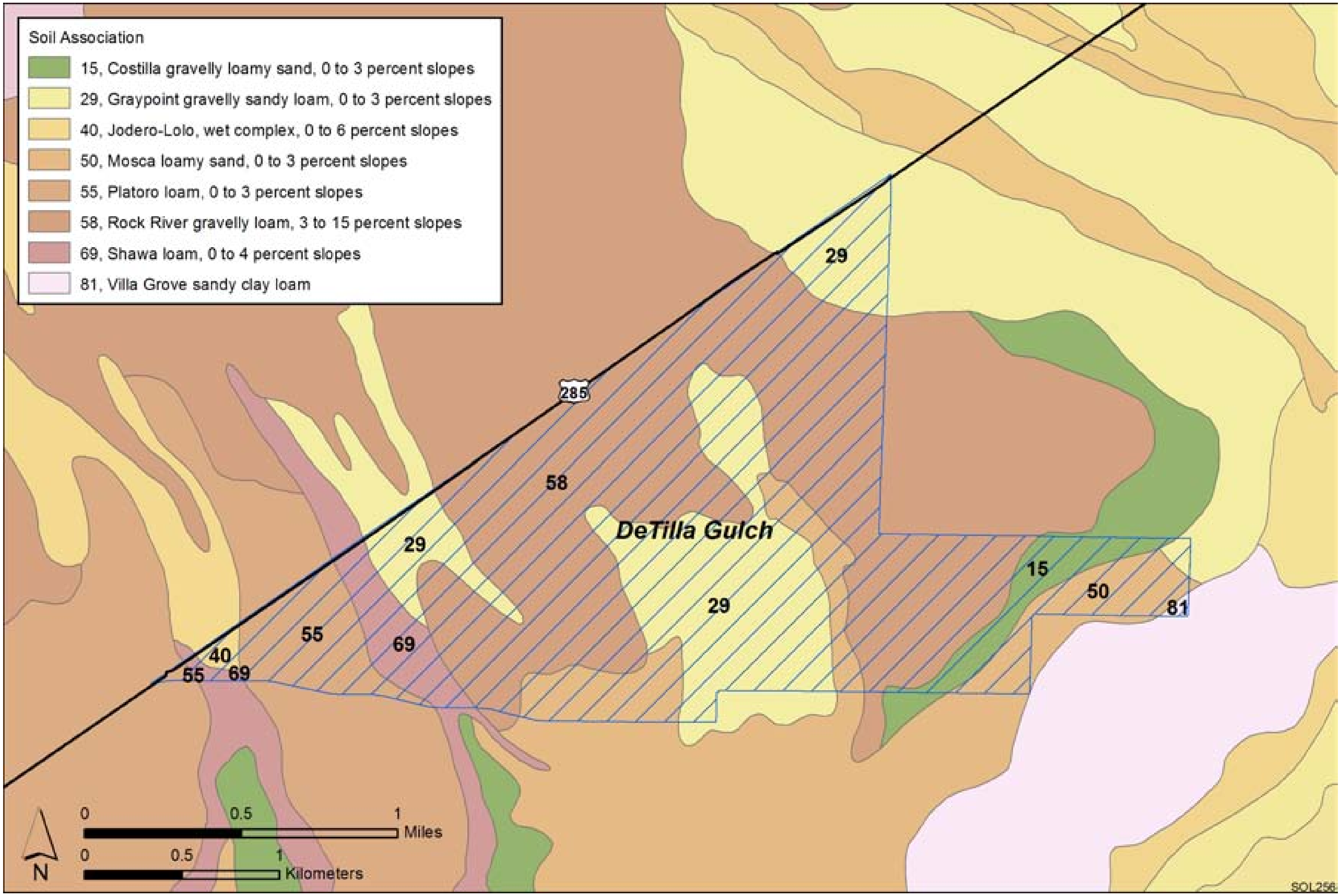

FIGURE 10.2.7.1-7 Soil Map for the Proposed De Tilla Gulch SEZ (NRCS 2008)

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

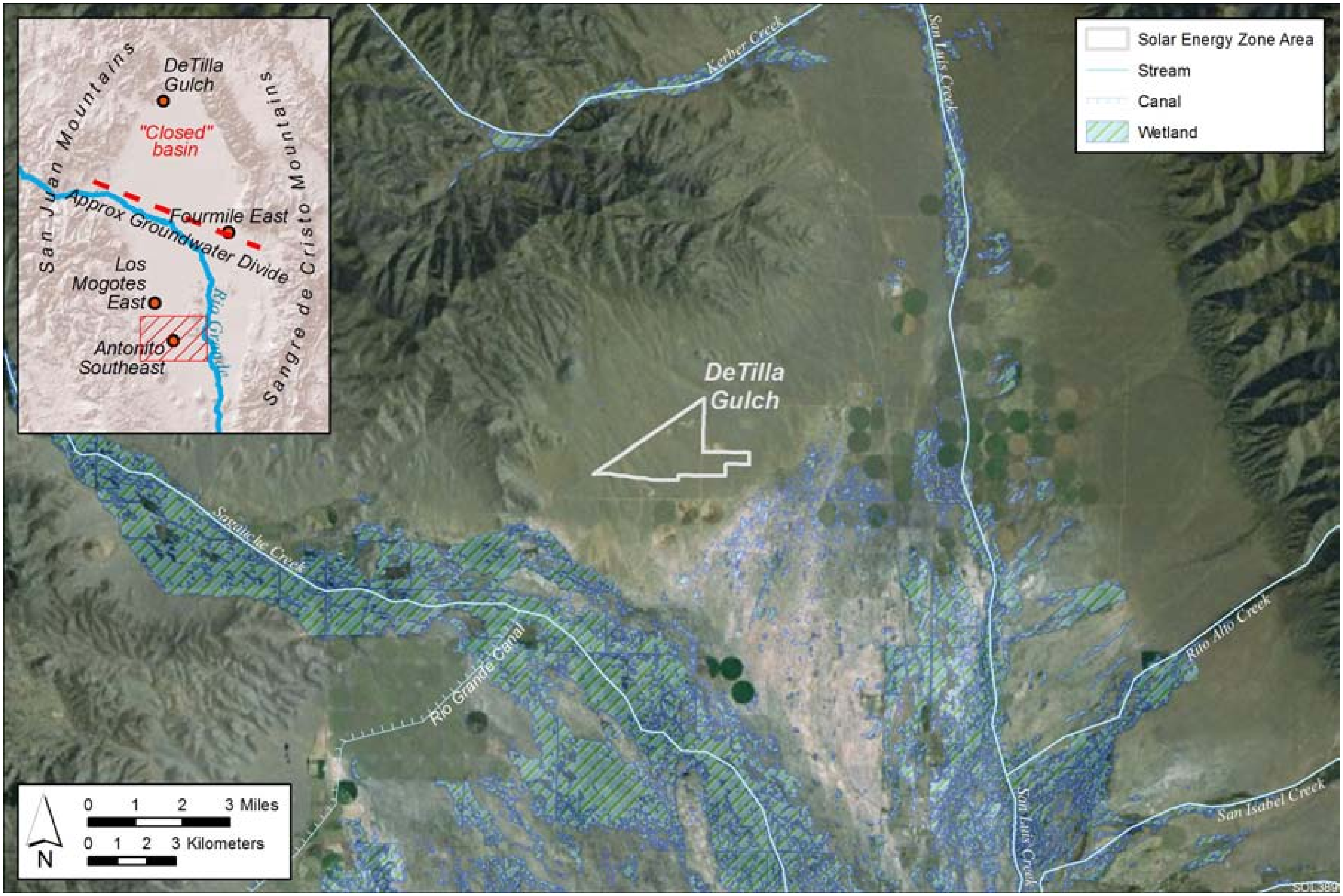

FIGURE 10.2.9.1-1 Surface Water Features in the San Luis Valley

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

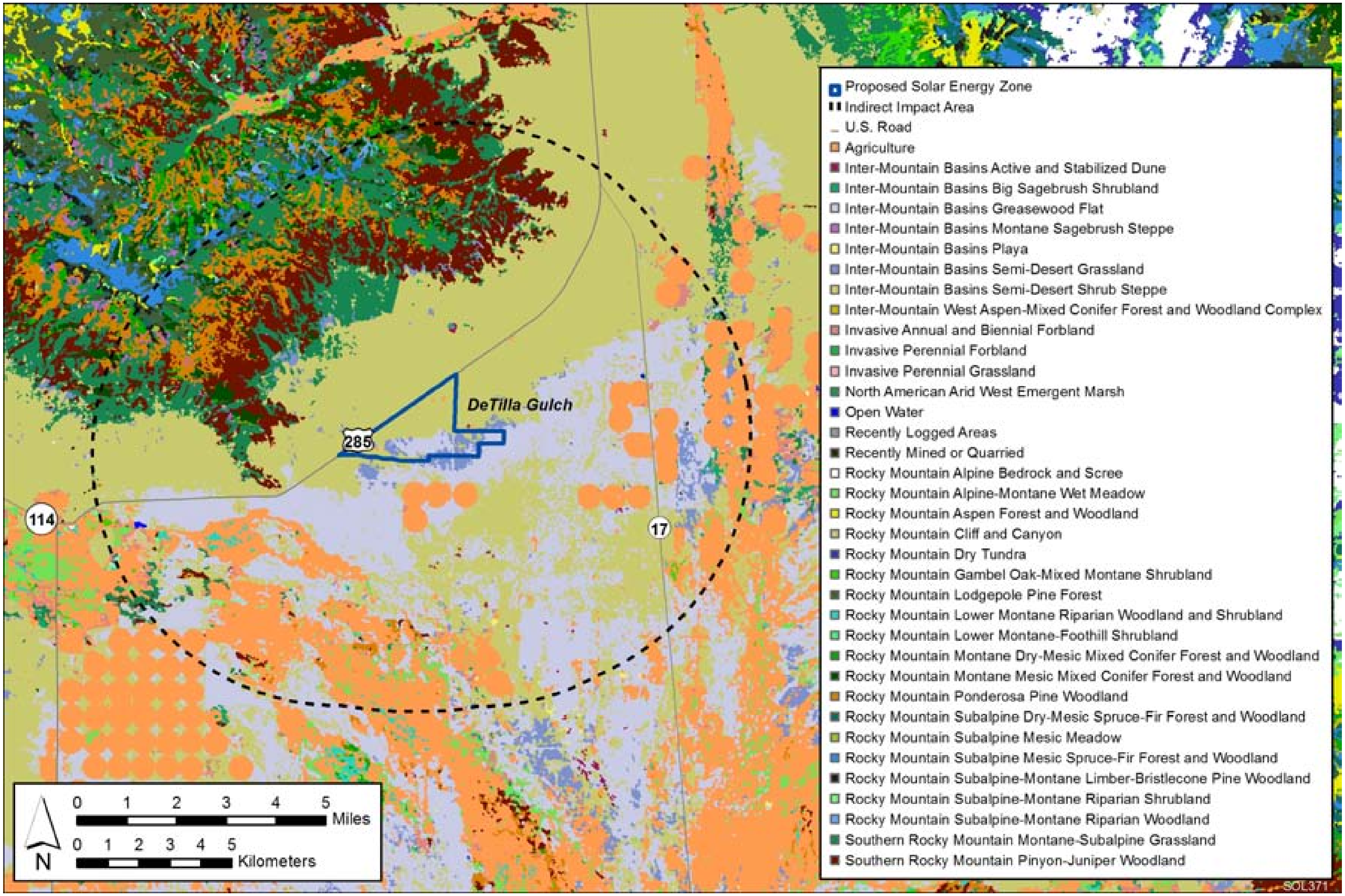

FIGURE 10.2.10.1-1 Land Cover Types within the Proposed De Tilla Gulch SEZ (Source: USGS 2004)

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

	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]
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.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b]		Overall Impact Magnitude[e]
	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
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.

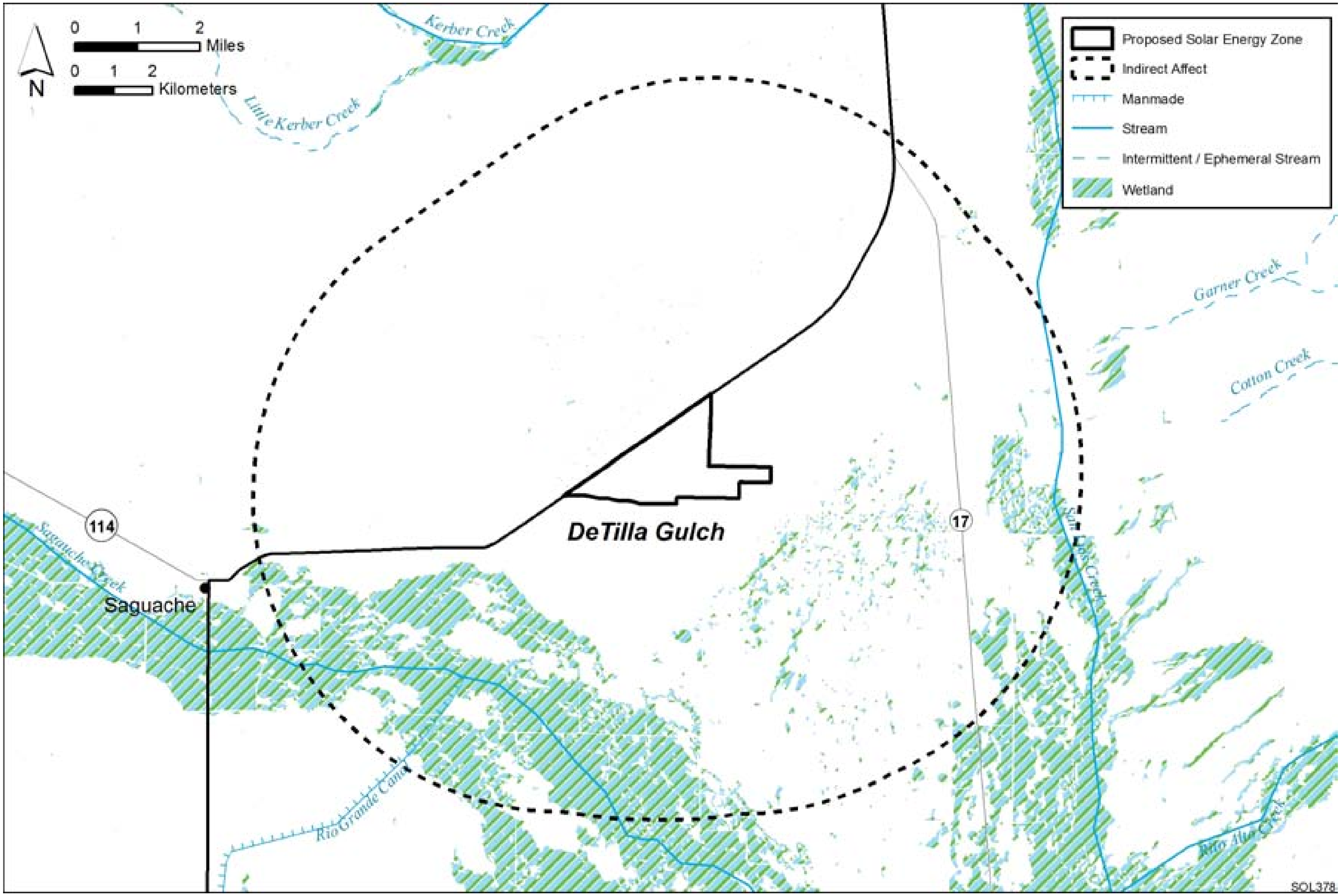

FIGURE 10.2.10.1-2 Wetlands within the Proposed De Tilla Gulch SEZ (Source: USFWS 2009)

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]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
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.

Footnotes on next page.

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TABLE 10.2.11.1-1 (Cont.)

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

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area.

[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.

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]: 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.)				
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]: 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.)				
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]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
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]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
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]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
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]: 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.)				
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]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
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*: ≤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).

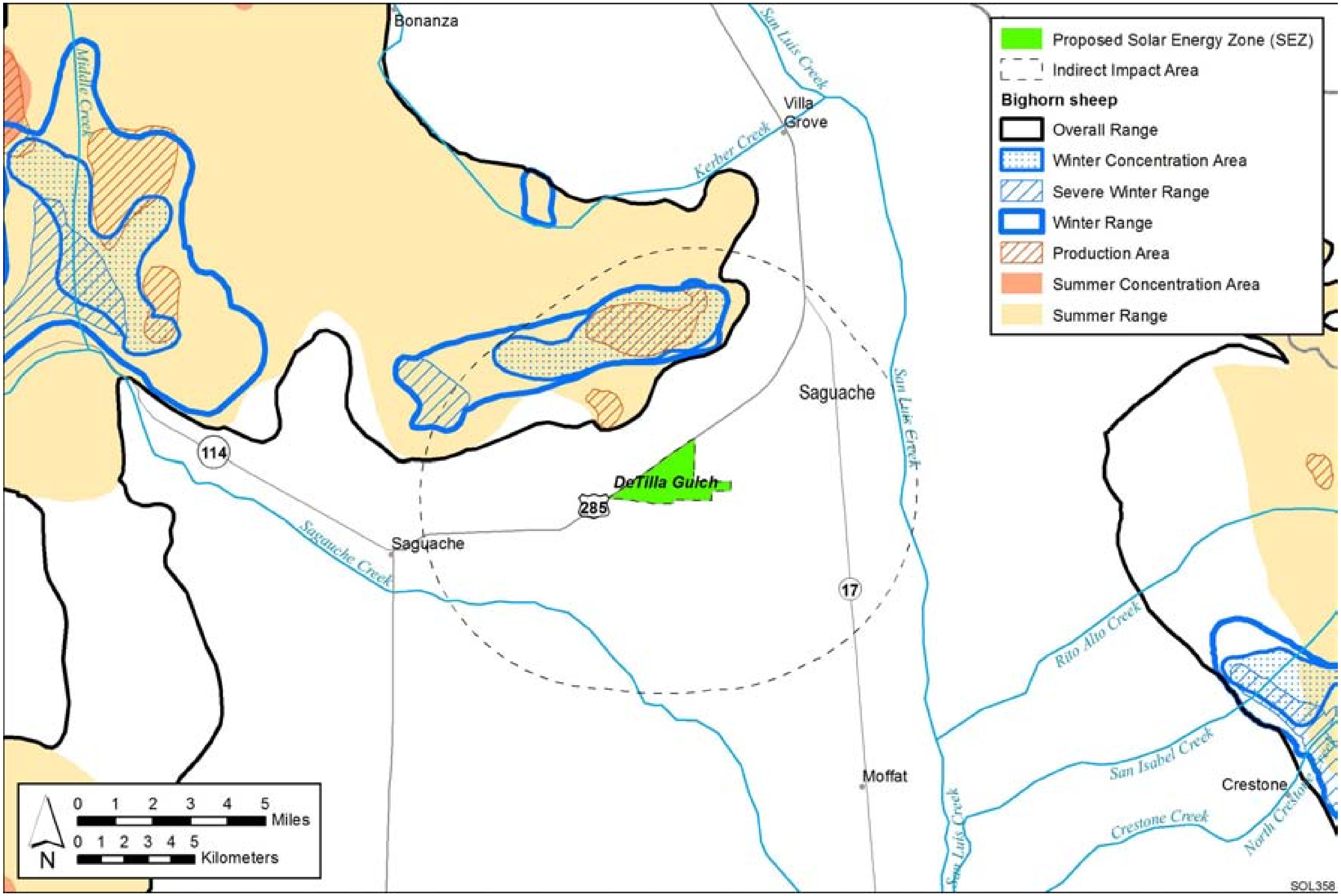

FIGURE 10.2.11.3-1 Bighorn Sheep Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

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.

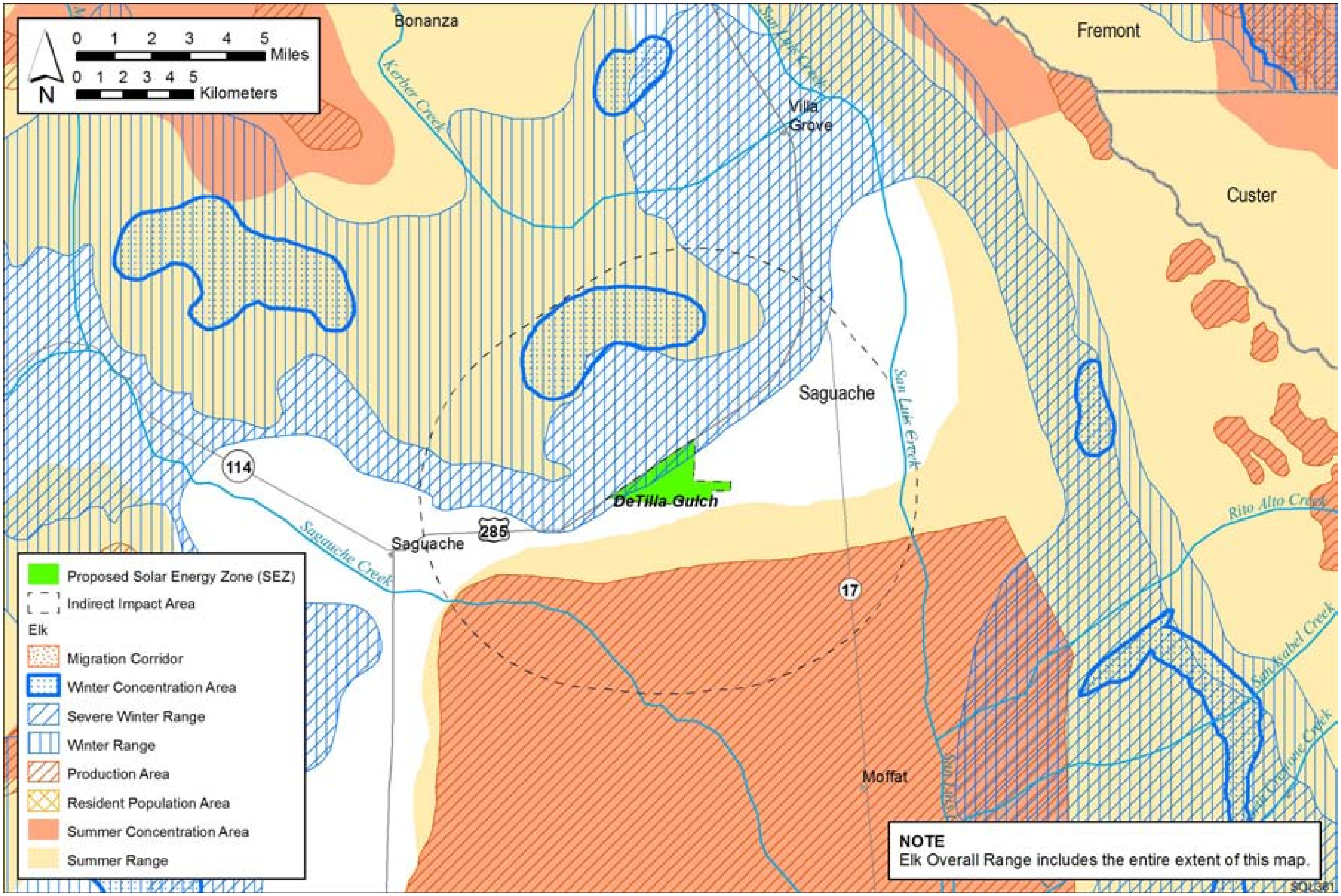

FIGURE 10.2.11.3-2 Elk Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

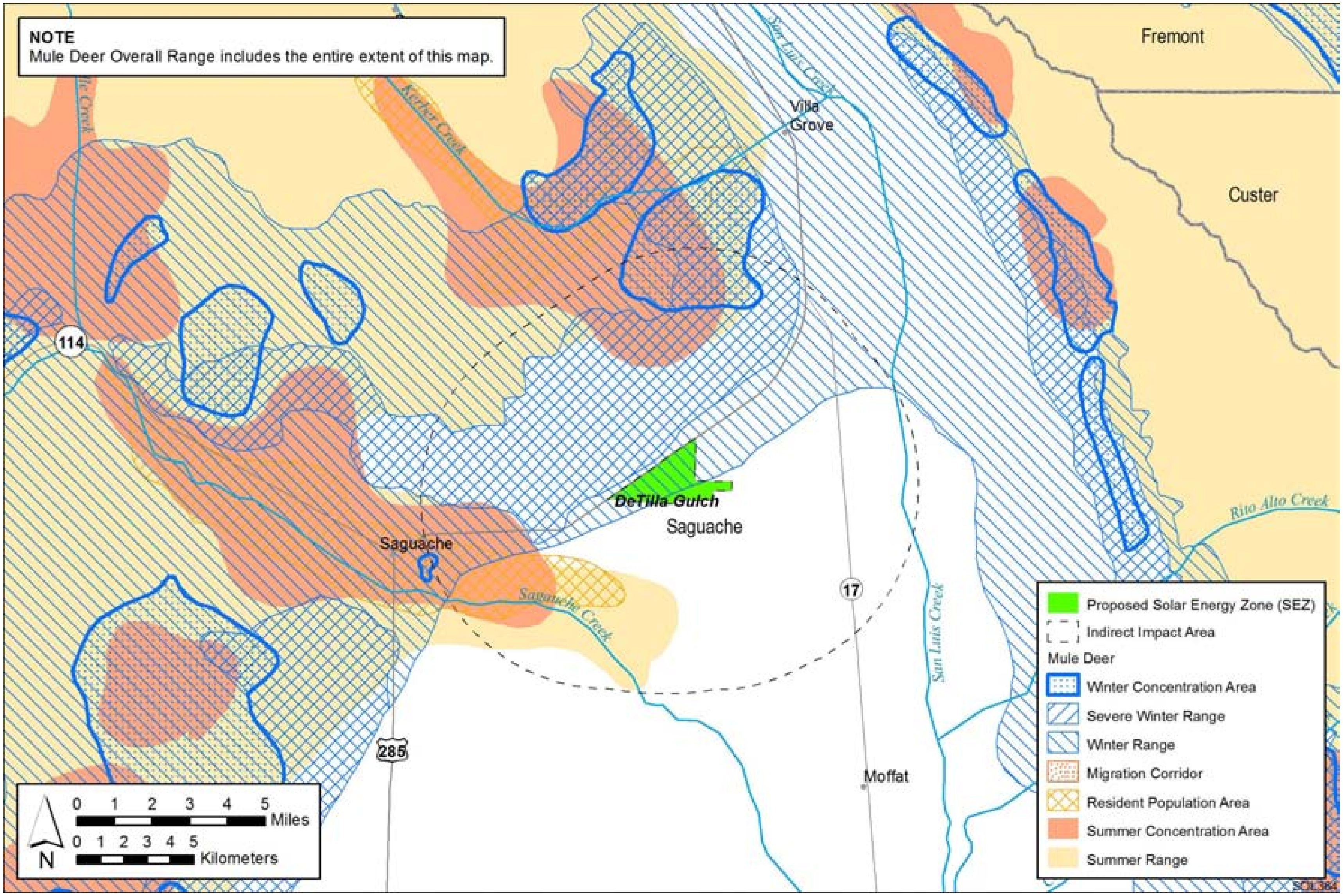

FIGURE 10.2.11.3-3 Mule Deer Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

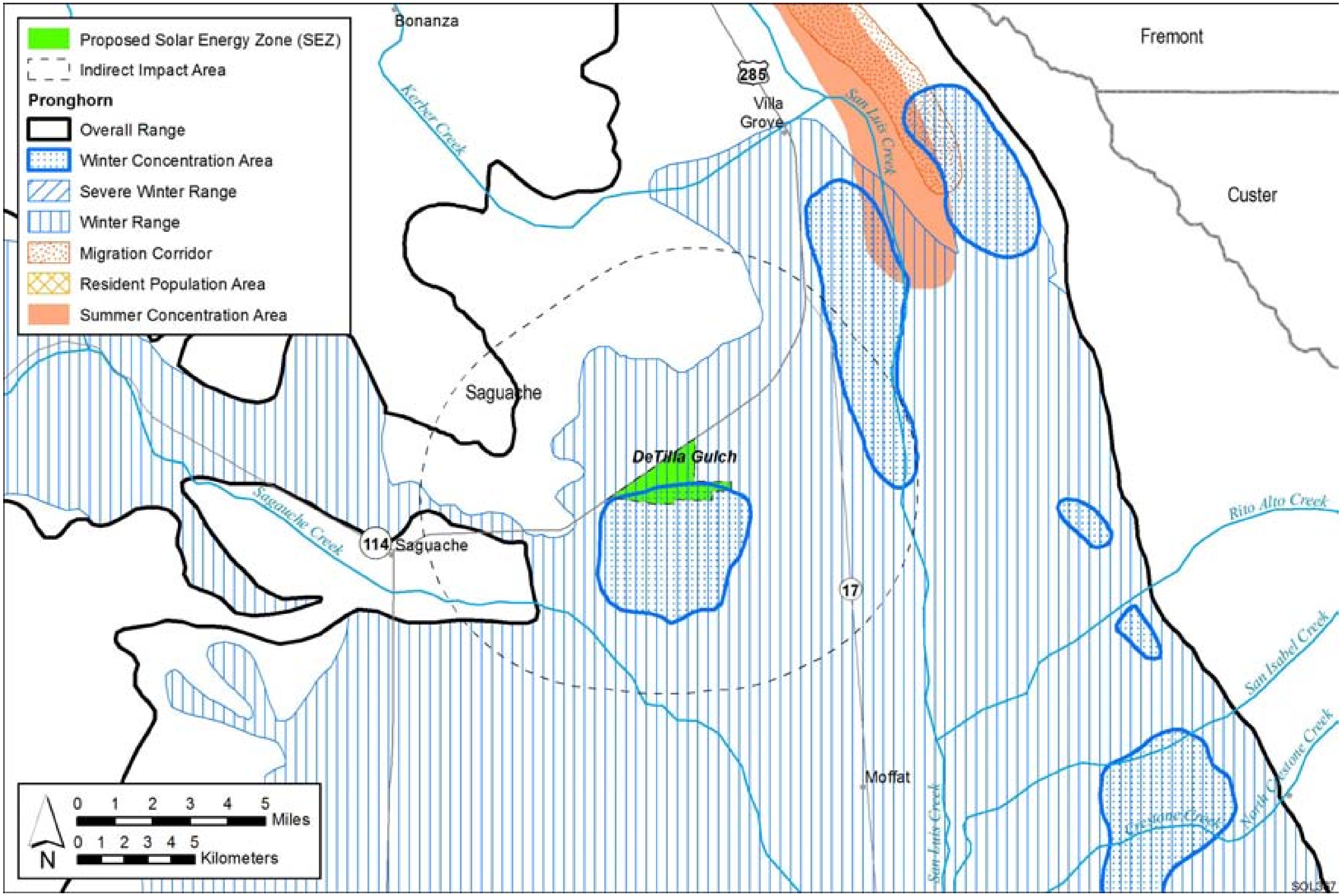

FIGURE 10.2.11.3-4 Pronghorn Activity Areas within the Region That Encompasses the Proposed De Tilla Gulch SEZ (Source: CDOW 2008)

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]		Area of Habitat within SEZ Region[e]	Overall Impact Magnitude[f]
	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]		
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).

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]	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.

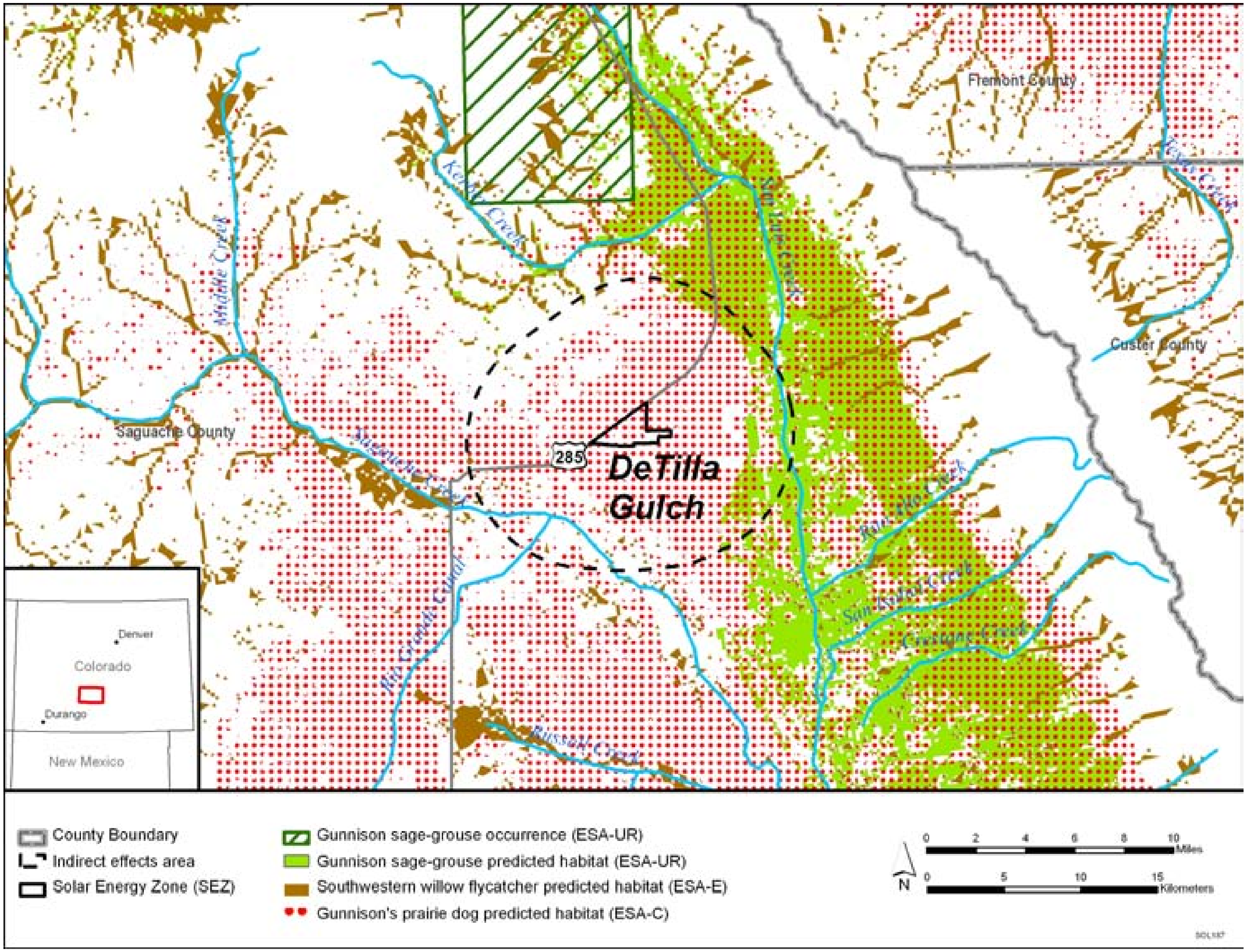

FIGURE 10.2.12.1-1 Locations of Species Listed as Endangered, Threatened, Candidates for Listing, or Species under Review for Listing under the ESA That May Occur in the Proposed De Tilla Gulch SEZ Affected Area (Sources: CNHP 2009; NatureServe 2010; USGS 2007)

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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.

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.

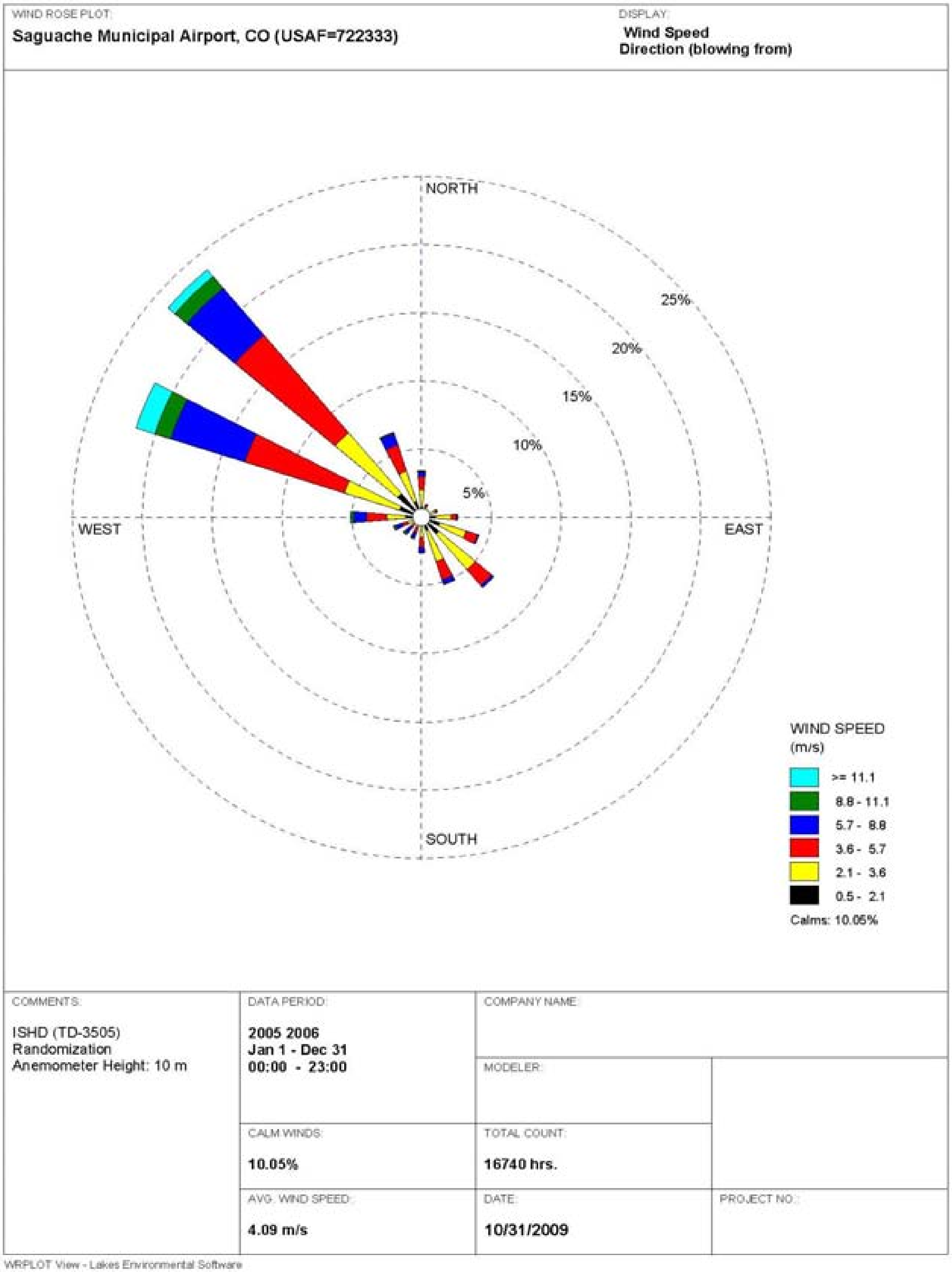

FIGURE 10.2.13.1-1 Wind Rose at 33-ft (10.2-m) Height at Saguache Municipal Airport, Saguache, Colorado, 2005–2006 (Source: NCDC 2009b)

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

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).

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.

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

			Highest Background Concentration Level	
Pollutant[a]	Averaging Time	NAAQS/ SAAQS[b]	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
	8-hour	9 ppm	1 ppm (11%)	CR 517, 2005–2006
O_3	1-hour	0.12 ppm[j]	NA	NA
	8-hour	0.075 ppm	0.063 ppm (84%)	Southern Ute Site, 7571 Highway 550, 2004–2006
PM_{10}	24-hour	150 $\mu g/m^3$	27 $\mu g/m^3$ (18%)	Battle Mountain Gold Mine, San Luis, West
	Annual	50 $\mu g/m^3$ [k]	13 $\mu g/m^3$ (26%)	Site, 1991
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	16 $\mu g/m^3$ (46%)	Great Sand Dunes, 1998–2002
	Annual	15.0 $\mu g/m^3$	4 $\mu g/m^3$ (27%)	
Pb[l]	Calendar quarter	1.5 $\mu g/m^3$	0.02 $\mu g/m^3$ (1.3%)	Pueblo, 2002
	Rolling 3-month	0.15 $\mu g/m^3$ [m]	NA	NA

[a] Notation: CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm; 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

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

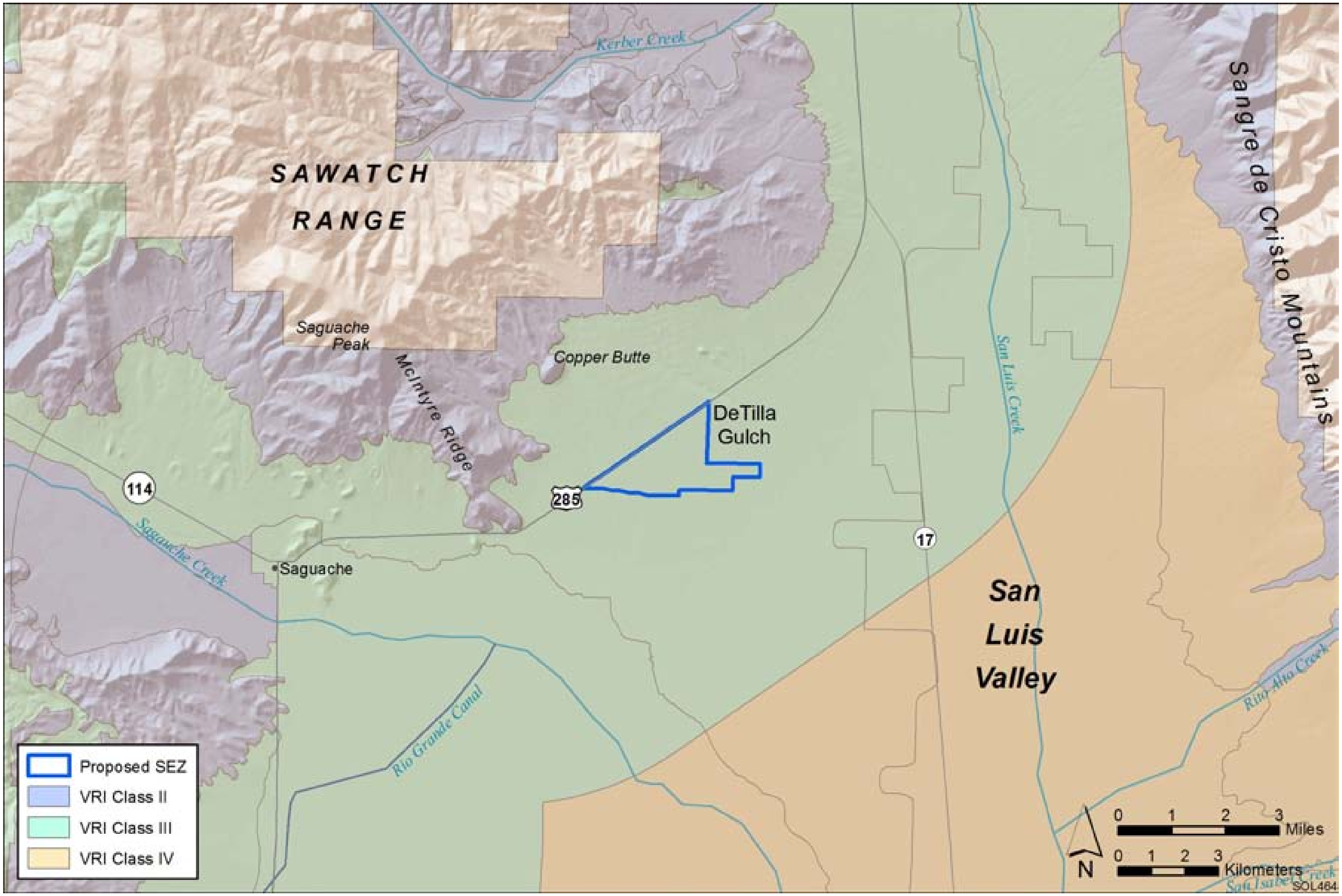

FIGURE 10.2.14.1-3 Visual Resource Inventory Values for the Proposed De Tilla Gulch SEZ and Surrounding Lands

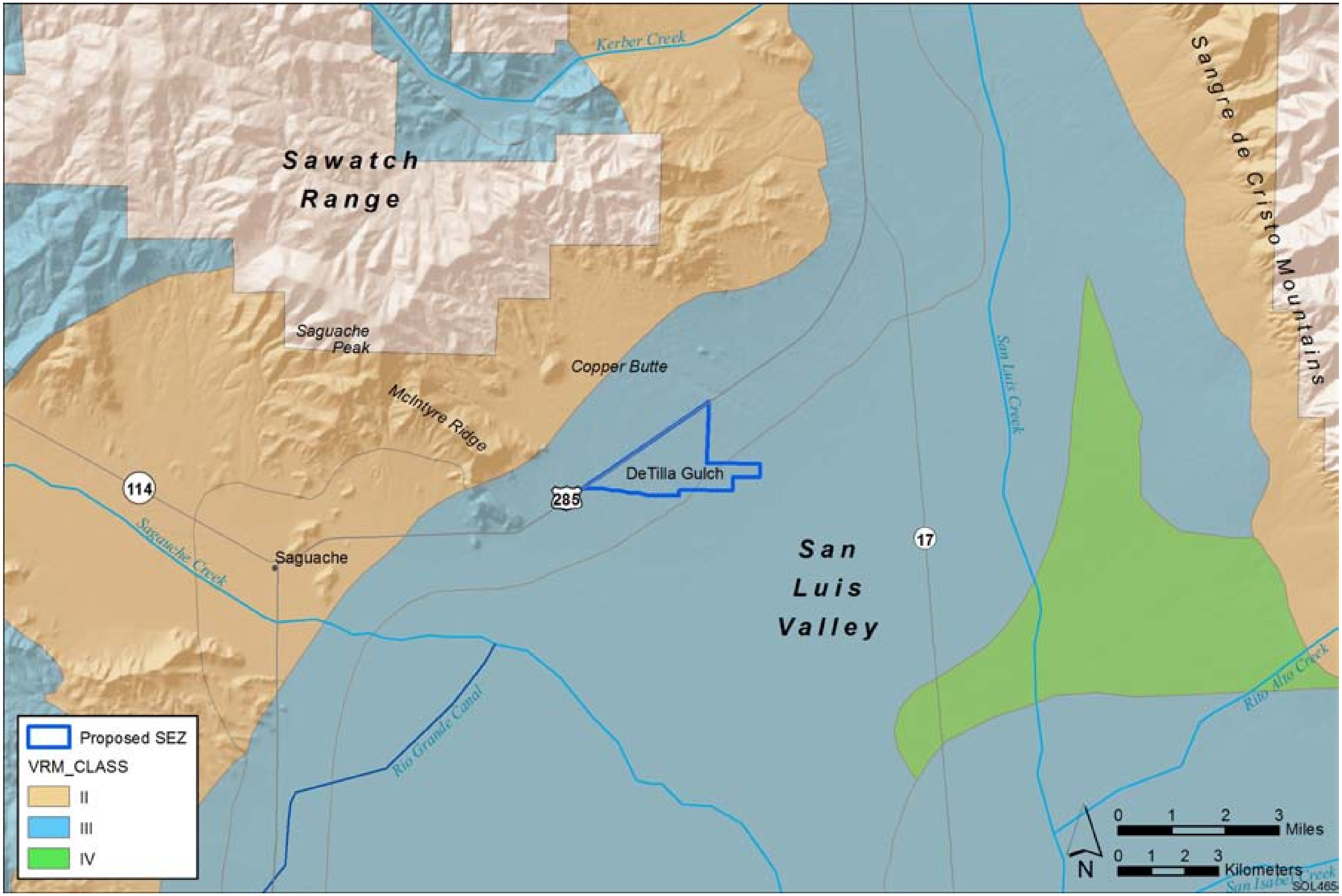

FIGURE 10.2.14.1-4 Visual Resource Management Classes for the Proposed De Tilla Gulch SEZ and Surrounding Lands

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.

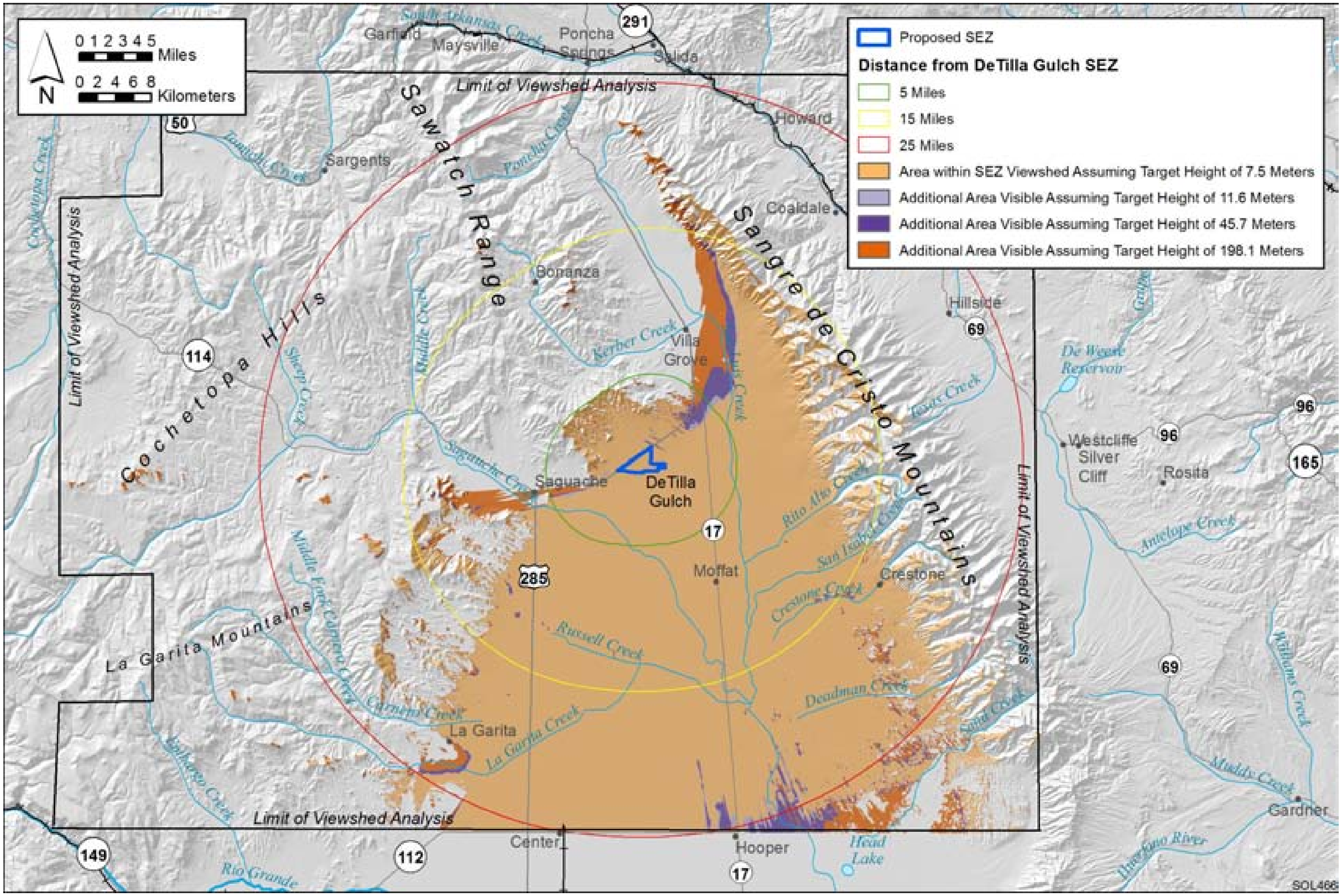

FIGURE 10.2.14.2-1 Viewshed Analyses for the Proposed De Tilla Gulch SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

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,

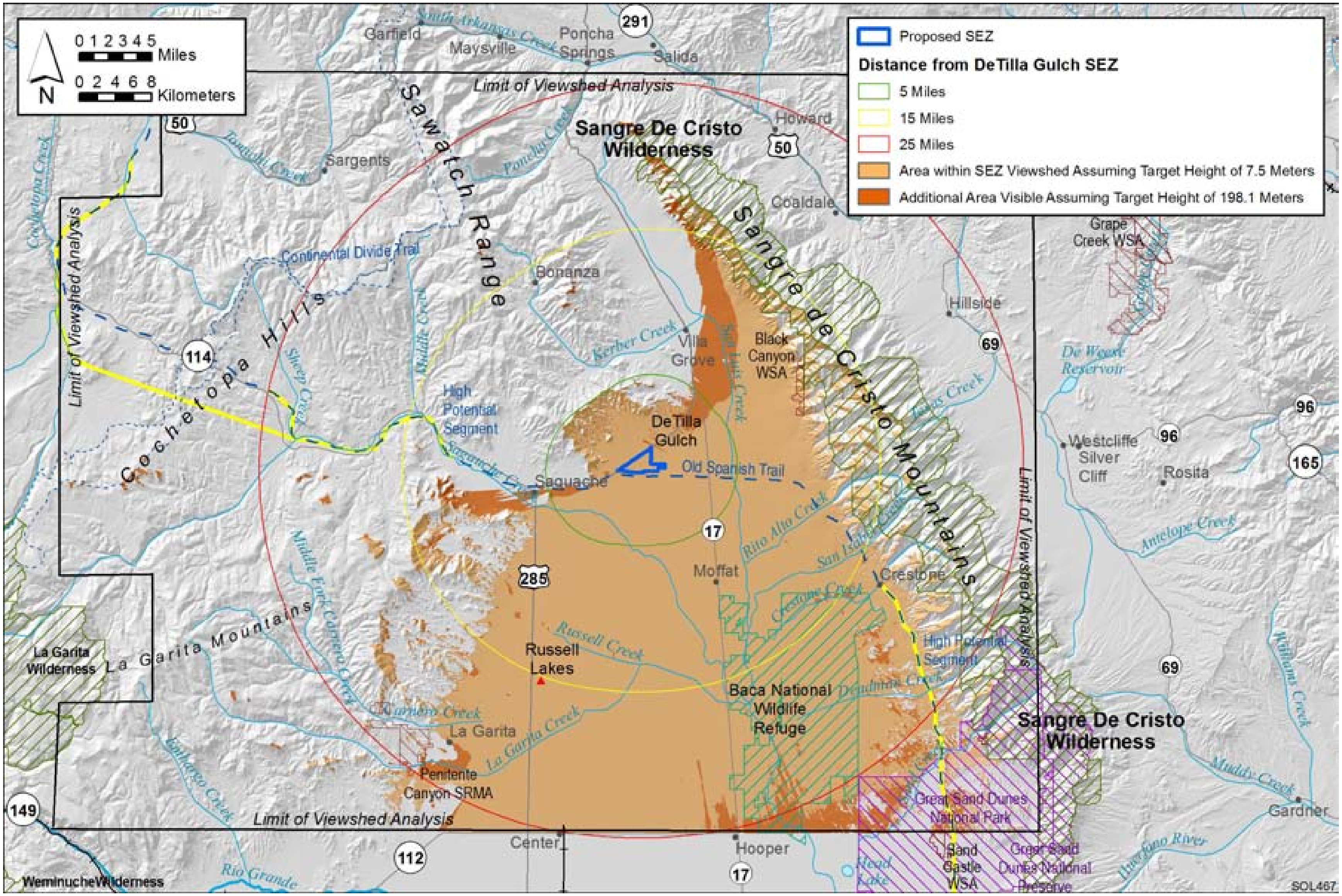

FIGURE 10.2.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds

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.

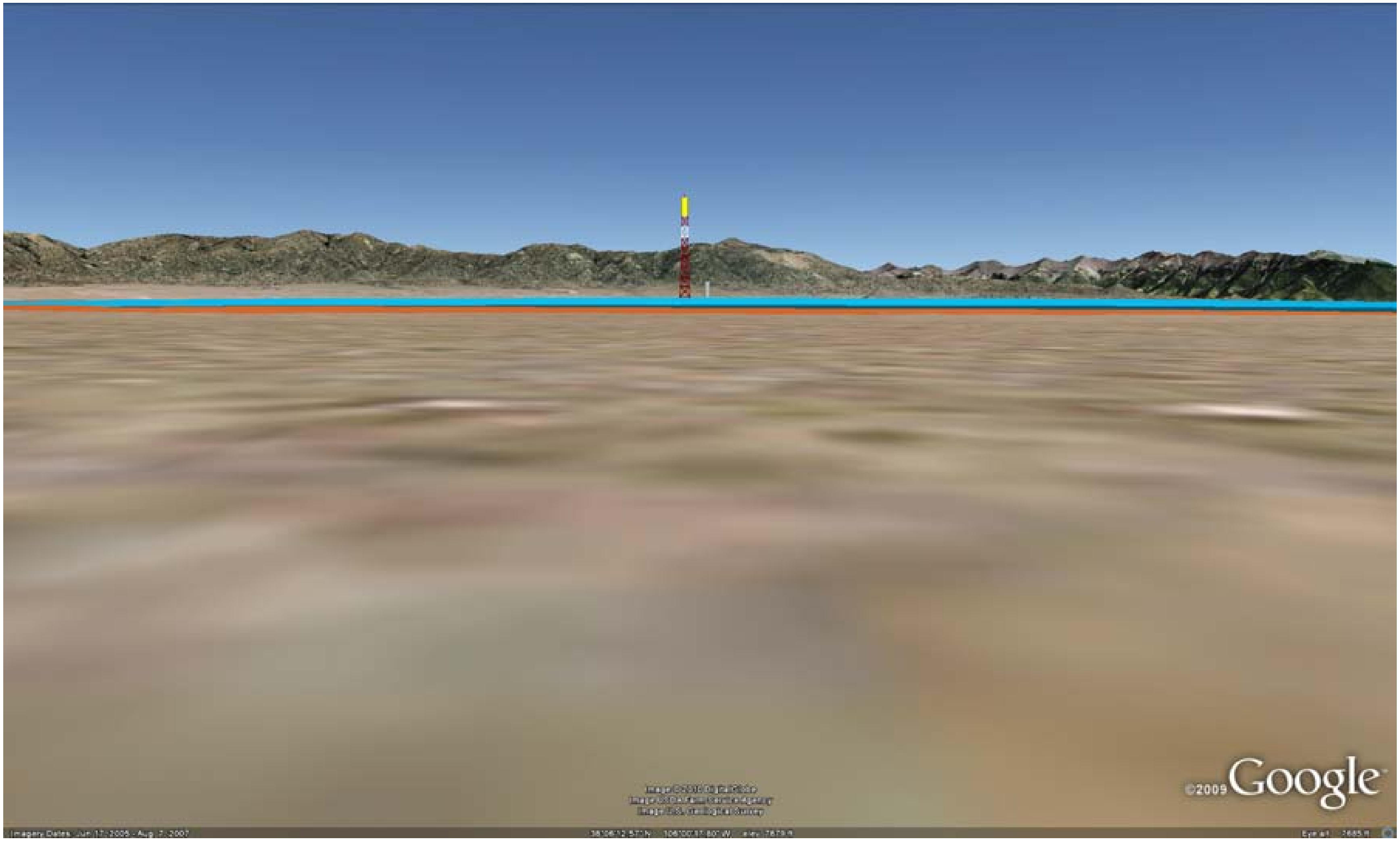

FIGURE 10.2.14.2-4 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Old Spanish National Historic Trail

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.

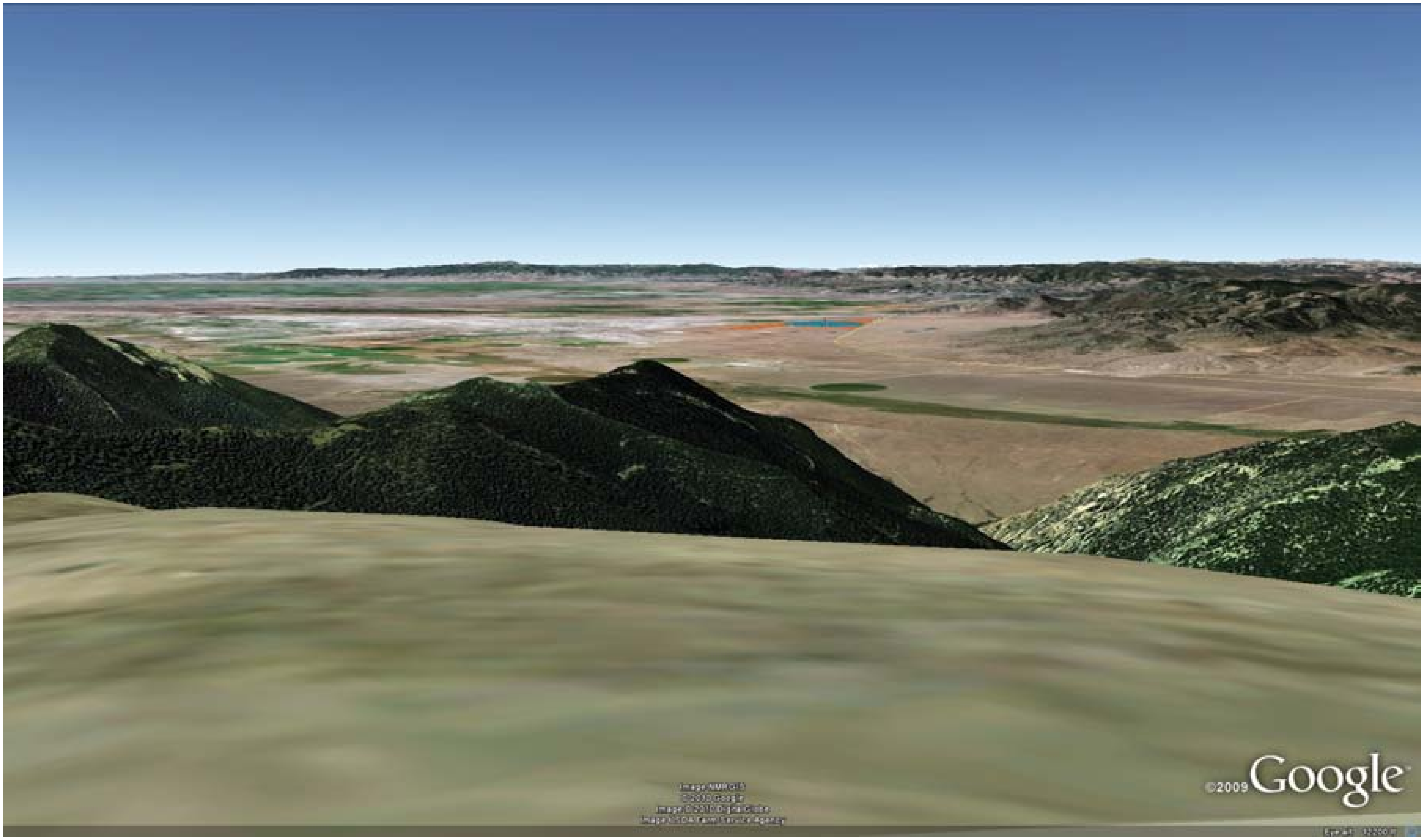

FIGURE 10.2.14.2-5 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the Peak of Nipple Mountain within the Sangre de Cristo WA

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

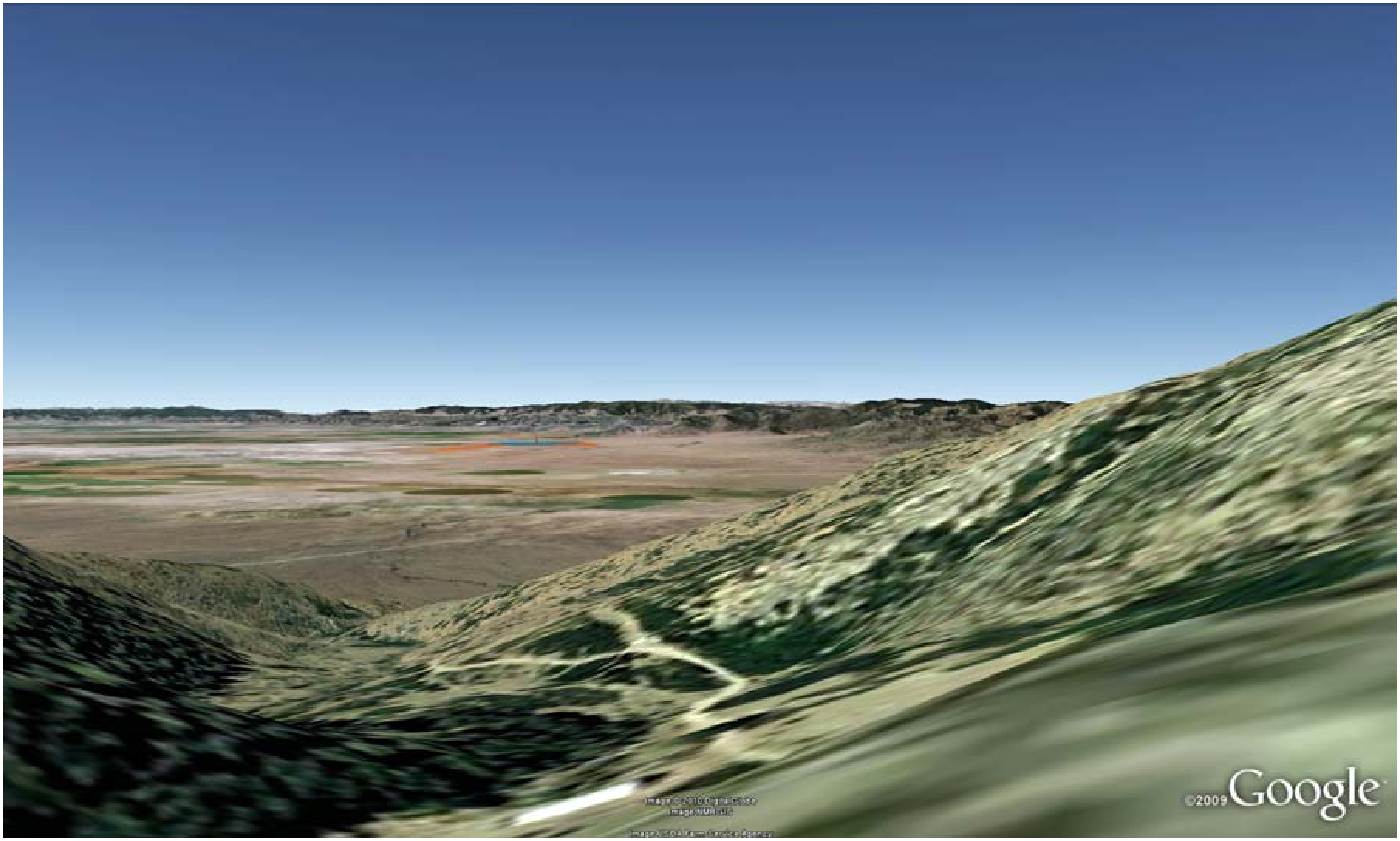

FIGURE 10.2.14.2-6 Google Earth Visualization of the Proposed De Tilla Gulch SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Black Canyon WSA

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

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[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

[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

City	Population 2000	Population 2008	Population Average Annual Growth Rate, 2000–2008 (%)	Median Household Income ($ 2008) 1999	Median Household Income ($ 2008) 2006–2008	Median Household Income ($ 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

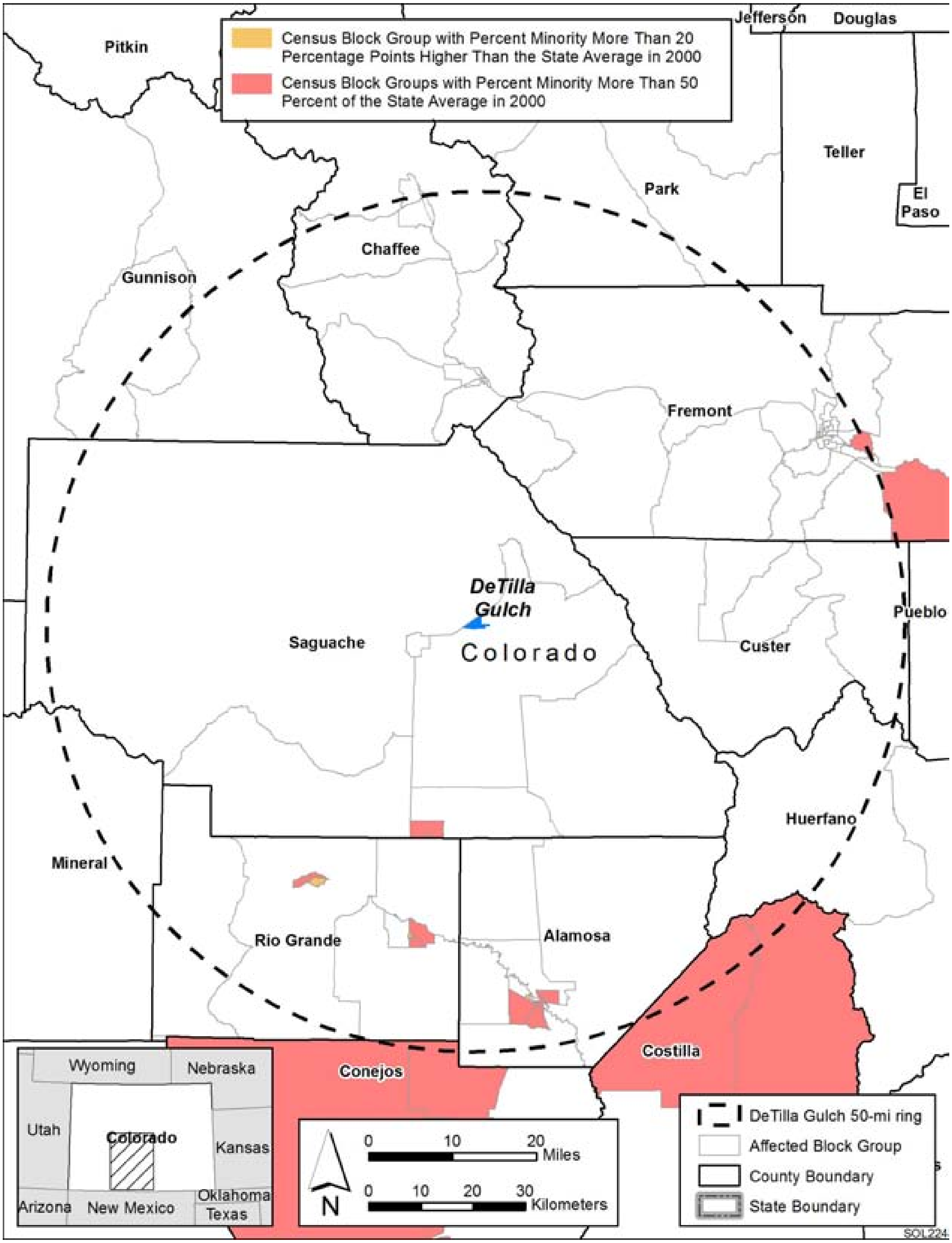

FIGURE 10.2.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed De Tilla Gulch SEZ

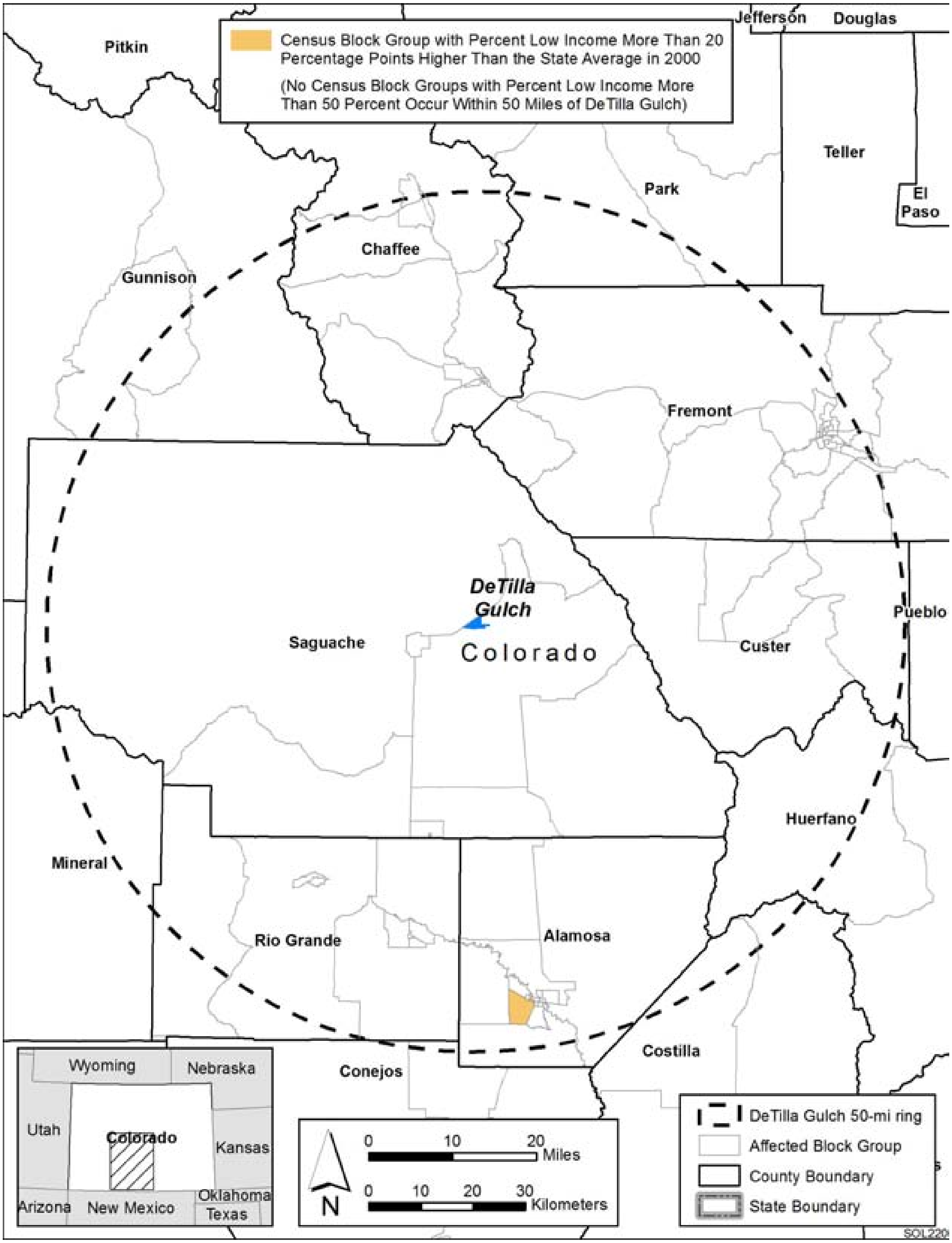

FIGURE 10.2.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed De Tilla Gulch SEZ

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.

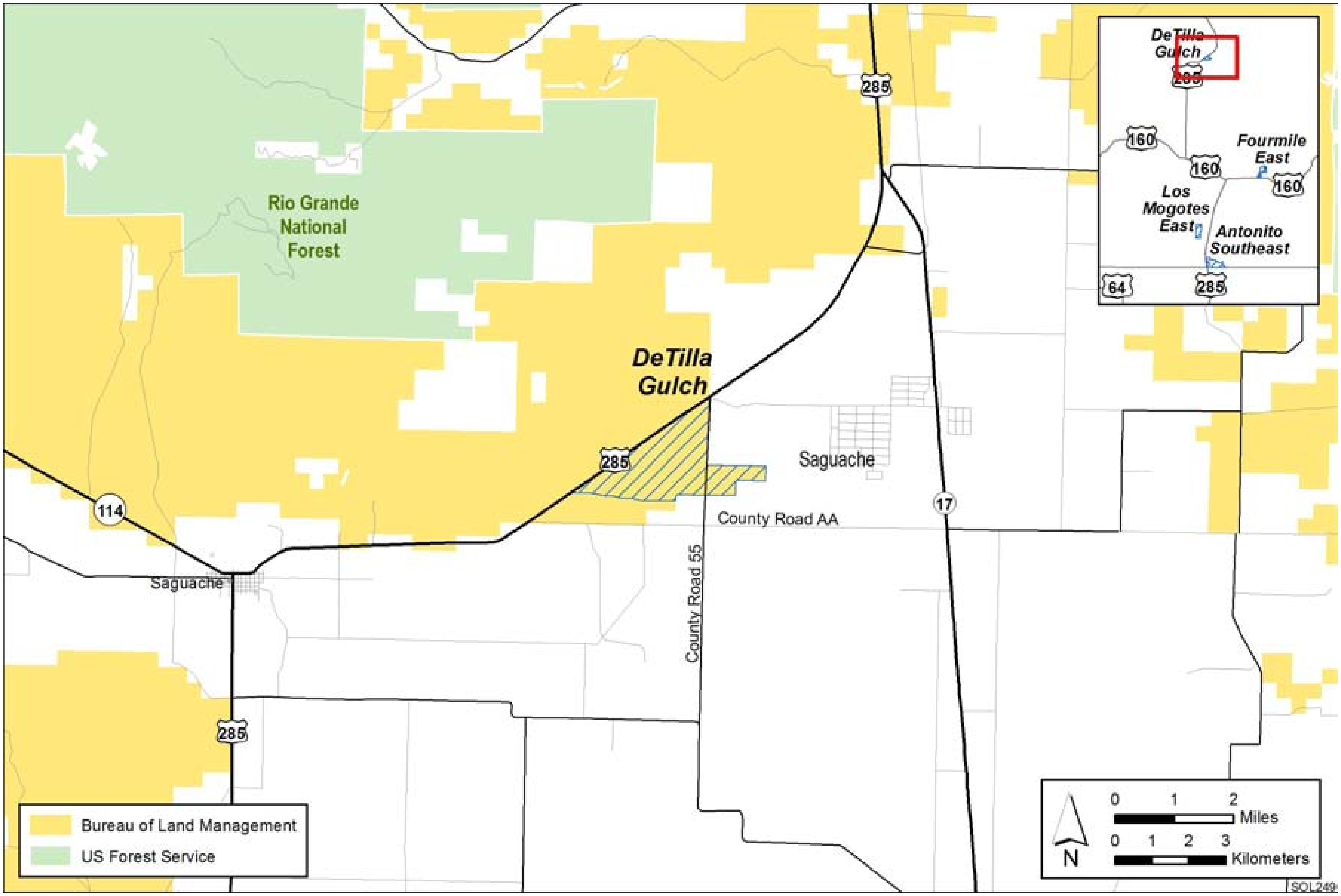

FIGURE 10.2.21.1-1 Local Transportation Network Serving the Proposed De Tilla Gulch SEZ

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

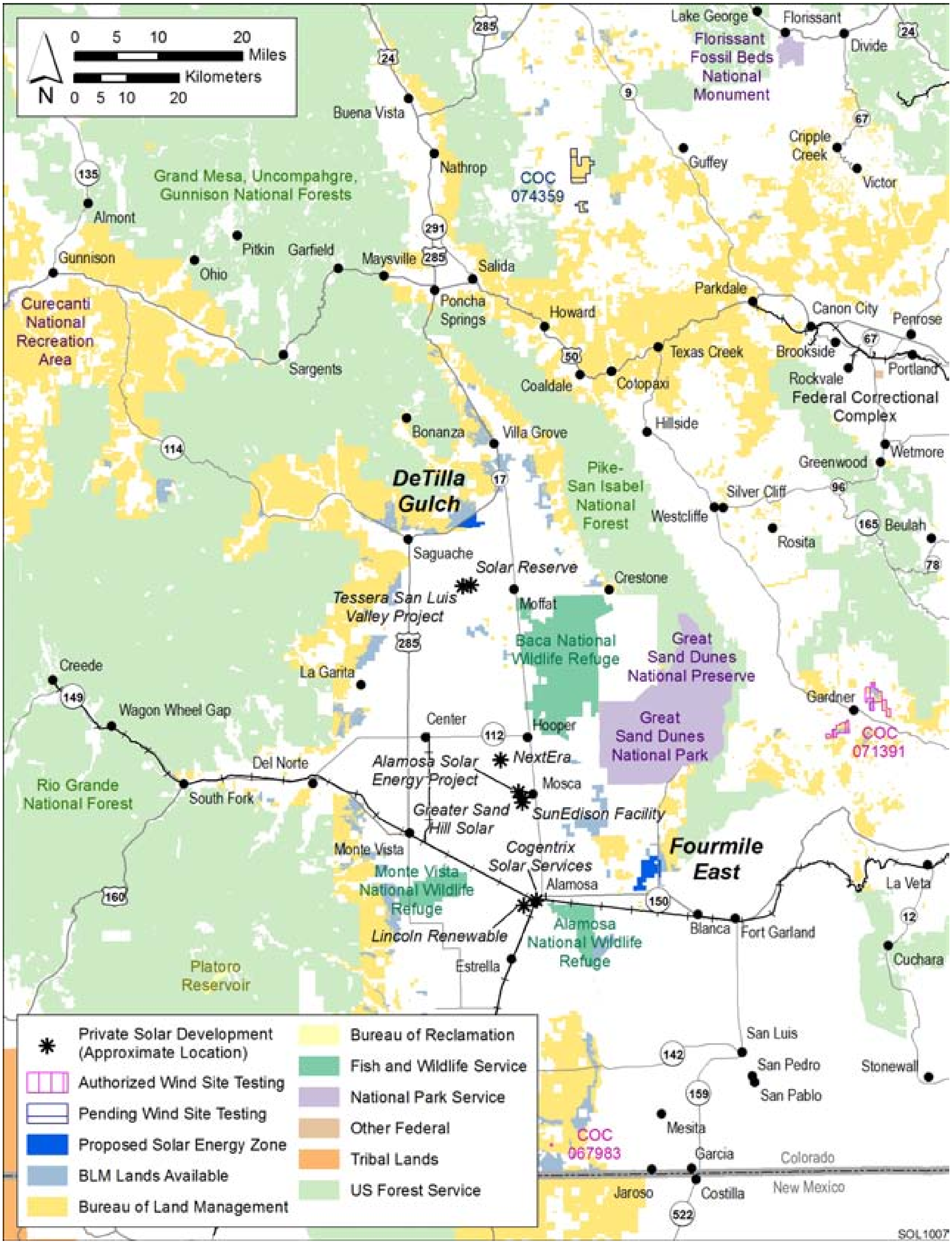

FIGURE 10.2.22.2-1 Existing and Proposed Energy Development Projects within the San Luis Valley

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

[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 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency, or road paving or treatment.

Other planned energy production and distribution activities in the San Luis Valley include construction and operation of two smaller (less than 300 acres [1.2 km^2]) PV facilities near the Fourmile East SEZ, and construction of a power line running east from Alamosa to Walsenburg. Construction of these projects would result in a temporary increase in particulate emissions.

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.

AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project Design Refinements*. Available at http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf. Accessed Sept. 2009.

Alamosa-La Jara Water Users Protection Association v. Gould, 1983, 674 P.2d 914, 931 Colo.

AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the U.S.*, Chicago, Ill. Available at http://www.ama-assn.org/ama/pub/category/2676.html.

Armstrong, H., 2009, "Paleontological Resources in Potential Solar Energy Zones in Colorado," personal communication with attachments from Armstrong (BLM Regional Paleontologist, BLM Colorado State Office, Lakewood, Colo.) to K. Wescott (Argonne National Laboratory, Argonne, Ill.), June 2.

Backlund, P., et al., 2008, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*, Synthesis and Assessment Product 4.3 by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C., May. Available at http://www.sap43.ucar.edu/documents/SAP_4.3_6.18.pdf. Accessed July 2008.

Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*, submitted to the California Energy Commission, March. Available at http://www.energy.ca.gov/sitingcases/beacon/index.html.

Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control Engineering, Washington, D.C.

BLM (Bureau of Land Management), 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal*, Denver, Colo.

BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program,* Colorado State Office, Denver, Colo., Jan.

BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410.2-1, Release 8-28, U.S. Department of the Interior, Jan.

BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Jan.

BLM, 1991, *San Luis Resource Area*, *Proposed Resource Management Plan and Final Environmental Impact Statement,* U.S. Department of the Interior, Sept.

BLM, 1996, *White River Resource Area Proposed Resource Management Plan and Final Environmental Impact Statement*, Colorado State Office, White River Resource Area, Craig District, Colo., June.

BLM, 2001, *Special Status Species Management*, BLM Manual 6840, Release 6-121, U.S. Department of the Interior, Jan. 17.

BLM, 2007a, *Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands*, Instruction Memorandum No. 2008-009, with attachments, Washington, D.C., Oct. 15.

BLM, 2007b*, Proposed Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado, Utah, and Wyoming and Programmatic Environmental Impact Statement,* FES 08-2, Sept.

BLM, 2008a*, Assessment and Mitigation of Potential Impacts to Paleontological Resources*, Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.

BLM, 2008b*, Rangeland Administration System*, Allotment Master, Feb. 7. Available at http://www.blm.gov/ras/index.htm. Accessed Nov. 24, 2009.

BLM, 2008c, *Special Status Species Management*, BLM Manual 6840, Release 6-125, U.S. Department of the Interior, Washington, D.C., Dec. 12.

BLM, 2009, *Proposed Decision Record (CO-500-2005-016-EA) to Amend Off-Highway Vehicle Designations in the San Luis Area Resource Management Plan*, BLM San Luis Valley Public Lands Center, June 4.

BLM, 2010a, *San Luis Valley Resource Area Noxious and Invasive Species Management Environmental Assessment*, DOI-BLM-CO-140-2009-004-EA.

BLM, 2010b, *Solar Energy Interim Rental Policy*, U.S. Department of the Interior. Available at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_ instruction/2010/IM_2010.2-141.html.

BLM, 2010c, *Visual Resource Inventory,* prepared for the U.S. Department of the Interior, BLM Saguache Field Office, Saguache, Colo., Sept.

BLM and USFS (Bureau of Land Management and U.S. Forest Service), 2010, *GeoCommunicator: NILS Interactive Maps*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed Nov. 15, 2009.

Blume, F., and A.F. Sheehan, 2002, *Quantifying Seismic Hazard in the Southern Rocky Mountains through GPS Measurements of Crustal Deformation—Abstract*, Paper No. 227-5, The Geological Society of America, 2002 Annual Meeting, Denver, Colo.

BOR (Bureau of Reclamation), 2009, "San Luis Valley Project, Closed Basin Division, Colorado," prepared by BOR Alamosa Field Division, Alamosa, Colo., for *Geologic Excursions to the Rocky Mountains and Beyond, Field Trip Guidebook*, Geological Society of America-Colorado Geological Survey. Available at http://www.nps.gov/archive/grsa/resources/docs/TOC.PDF. Accessed Nov. 10, 2009.

Brendle, D.L., 2002, *Geophysical Logging to Determine Construction, Contributing Zones, and Appropriate Use of Water Levels Measured in Confined-Aquifer Network Wells, San Luis Valley, Colorado*, *1998–2000*, U.S. Geological Survey, Water Resources Investigations Report 02-4058.

Brister, B.S., and R.R. Gries, 1994, *Tertiary Stratigraphy and Tectonic Development of the Alamosa Basin (Northern San Luis Basin), Rio Grande Rift, South-Central Colorado*, Geological Society of America Special Paper 291.

Brown, J., 2010, personal communication from Brown (Realty Specialist, Colorado Renewable Energy Team, San Luis Public Lands Center, Monte Vista, Colo.) to K. Wescott (Argonne National Laboratory, Argonne, Ill.), Oct. 6.

BTS (Bureau of Transportation Statistics), 2008, *Air Carriers: T-100 Domestic Segment (All Carriers), Research and Innovative Technology Administration*, U.S. Department of Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311. Accessed June 23, 2009.

Burnell, J.R., et al., 2008, *Colorado Mineral and Energy Industry Activities, 2007*, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

Burroughs, R.L., 1974, *Neogene Volcanism in the Southern San Luis Basin*, *New Mexico,* Geological Society Guidebook, 25th Field Conference, Ghost Ranch (Central-Northern New Mexico). Available at http://nmgs.nmt.edu/publications/guidebooks/downloads/25/25_p0291_p0294.pdf. Accessed Jan. 20, 2010.

Burroughs, R.L., 1981, *A Summary of the Geology of the San Luis Basin, Colorado–New Mexico with Emphasis on the Geothermal Potential for the Monte Vista Graben*, Special Publication 17, DOE/ET/28365-10, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

CDA (Colorado Department of Agriculture), 2010, *Colorado Department of Agriculture Noxious Weed Management Program, Noxious Weed List.* Available at http://www.colorado.gov/cs/Satellite?c=Page&cid=1174084048733&pagename=Agriculture-Main%2FCDAGLayout. Accessed Jan. 22, 2010.

CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995, 1999–2007*. Available at http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf.

CDOT (Colorado Department of Transportation), undated, *Traffic Information for Saguache County*. Available at http://www.dot.state.co.us/App_DTD_DataAccess/Traffic/index.cfm?fuseaction=TrafficMain&MenuType=Traffic. Accessed Aug. 10, 2009.

CDOW (Colorado Division of Wildlife), 2008, *Natural Diversity Information Source Data,* Denver, Colo. Available at http://ndis.nrel.colostate.edu/ftp/ftp_response.asp. Accessed Oct. 21, 2009.

CDOW, 2009, *Natural Diversity Information Source, Wildlife Species Page,* Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlife.asp. Accessed Aug. 29, 2009.

CDPHE (Colorado Department of Public Health and Environment), 2008, *Colorado 2007 Air Quality Data Report*, Air Quality Control Division, Denver, Colo., July. Available at http://www.colorado.gov/airquality/documents/2007AnnualDataReport.pdf. Accessed Sept. 2, 2009.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec. Available at http://www.whitehouse.gov/CEQ.

CGS (Colorado Geological Survey), 2001, "When the Ground Lets You Down – Ground Subsidence and Settlement Hazards in Colorado," in *Rock Talk*, Vol. 4, No. 4, Oct.

Chapman, S.S., et al., 2006, *Ecoregions of Colorado* (color poster with map, descriptive text, summary tables, and photographs; map scale 1:1,200,000), U.S. Geological Survey, Reston, Va.

Chick, N., 2009, personal communication from Chick (Colorado Department of Public Health and Environment, Denver, Colo.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), Sept. 4.

CNHP (Colorado Natural Heritage Program), 2009, *Colorado Natural Heritage Program*. Available at http://www.cnhp.colostate.edu. Accessed Sept. 9, 2009.

Colorado District Court, 2004, *Case Number 2004CW24, Concerning the Matter of the Rules Governing New Withdrawals of Ground Water in Water Division No. 3 Affecting the Rate or Direction of Movement of Water in the Confined Aquifer System*, District Court, Water Division No. 3.

Colorado District Court, 2010, *Case Number 06CV64 & 07CW52, In the Matter of the Rio Grande Water Conservation District, in Alamosa County, Colorado and Concerning the Office of the State Engineer's Approval of the Plan of Water Management for Special Improvement District No. 1 of the Rio Grande Water Conservation District*, District Court, Water Division No. 3.

Colorado DWR (Division of Water Resources), 2004, *Preliminary Draft: Rio Grande Decision Support System, Phase 4 Ground Water Model Documentation.*

Colorado DWR, 2005, *Water Well Construction Rules*, 2 CCR 402-2.

Colorado DWR, 2008, *Guide to Colorado Well Permits, Water Rights, and Water Administration*, Jan.

Colorado DWR, 2010a*, Colorado's Decision Support Systems*. Available at http://cdss.state.co.us/DNN/default.aspx.

Colorado DWR, 2010b, *Water Administration*. Available at http://water.state.co.us/wateradmin/waterright.asp.

Colorado DWR, 2010c, *San Luis Advisory Committee*. Available at http://water.state.co.us/wateradmin/SanLuisValleyBasin.asp.

Colorado Governor's Energy Office, 2007, *Connecting Colorado's Renewable Resources to the Markets—Report of the Colorado Senate Bill 07-091 Renewable Resource Generation Development Areas Task Force*, Denver, Colo.

Colorado SHPO (Colorado State Historic Preservation Office), 2009, Data on file at the Colorado State Historic Preservation Office, Denver, Colo.

Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008, U.S. Environmental Protection Agency, Research Triangle, N.C.

Diefenbach, A.K., et al., 2009, *Chronology and References of Volcanic Eruptions and Selected Unrest in the United States, 1980-2008*, U.S. Geological Survey Open File Report 2009-1118.

DOE (Department of Energy), 2009, *Report to Congress, Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation,* Jan. 13.

EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections to 2030*, DOE/EIA-0383, March.

Eldred, K.M., 1982, "Standards and Criteria for Noise Control—An Overview," *Noise Control Engineering* 18(1):16–23.

Emery, P.A., 1979, "Geohydrology of the San Luis Valley, Colorado, USA," IAHS-AISH Publication. No. 128, in *The Hydrology of Areas of Low Precipitation—L'Hydrologie des Régions à Faibles Precipitations*, Proceedings of the Canberra Symposium (Actes du Colloque de Canberra), Dec.

Emery, P.A., 1994, *Hydrogeology of the San Luis Valley, Colorado, An Overview—National Park Service*, Field Trip 20, Section 2, Paper 3. Available at www.nps.gov/archive/grsa/resources/docs/Trip2023.pdf. Accessed June 29, 2009.

Emery, P.A., et al., 1973, *Water in the San Luis Valley, South-Central Colorado,* Colorado Water Conservation Board, Colorado Water Resources Circular 18.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA-550/9-74-004, Washington, D.C., March. Available at http://www.nonoise.org/librarylevels74/levels74.htm. Accessed Nov. 17, 2008.

EPA, 2009a, *Energy CO_2 Emissions by State*. Available at http://www.epa.gov/climatechange/emissions/state_energyco2inv.html, last updated June 12, 2009. Accessed June 23, 2009.

EPA, 2009b, *AirData: Access to Air Pollution Data*. Available at http://www.epa.gov/oar/data/. Accessed Sept. 12, 2009.

EPA, 2009c, *Preferred/Recommended Models - AERMOD Modeling System*. Available at http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.

EPA, 2009d, *eGRID.* Available at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, last updated Oct. 16, 2008. Accessed Jan. 12, 2009.

EPA, 2010, *National Ambient Air Quality Standards (NAAQS)*. Available at http://www.epa.gov/air/criteria.html, last updated June 3, 2010. Accessed June 4, 2010.

FAA (U.S. Federal Aviation Administration), 2009, *Airport Data (5010) & Contact Information, Information Current as of July 2, 2009*. Available at http://www.faa.gov/airports/airport_safety/airportdata_5010. Accessed Aug. 13, 2009.

FEMA (Federal Emergency Management Agency), 2009, FEMA Map Service Center. Available at http://www.fema.gov. Accessed Nov. 20.

Fire Departments Network, 2009, *Fire Departments by State*. Available at http://www.firedepartments.net.

GAO (Government Accountability Office), 2007, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, Report to Congressional Requesters, GAO-07-863, Aug.

Gibson, M., 2010, personal communication from Gibson (San Luis Valley Water Conservancy District, Alamosa, Colo.) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., May. Available at http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.

Heide, R., 2009, *National Heritage Area in the Works*. Available at http://www.coloradopreservation.org/news/articles/Heritage_Area_04.doc. Accessed Oct. 19, 2009.

Hildner, M., 2009a, "Plan to Reduce Groundwater Pumping Could Cost $125.8 Million," in the *Pueblo Chieftain*, Feb. 14.

Hildner, M., 2009b, "Court Hearing Next for Valley Water Project—State Engineer Signs Off on Amendments to a Groundwater Management Proposal," in the *Pueblo Chieftain*, May 20.

Hinderlider, M.C., et al., 1939, *Rio Grande Compact, with Amendments,* adopted Dec. 19. Available at http://wrri.nmsu.edu/wrdis/compacts/Rio-Grande-Compact.pdf. Accessed Nov. 10, 2009.

Joe, T., 2008, personal communication regarding tribal consultation request for solar energy development on BLM lands from Joe (Program Manager for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to Ms. S. Sierra (State Director, Bureau of Land Management, Salt Lake City, Utah), July 3.

Joe, T.H., Jr., 2009, personal communication regarding joint BLM and DOE PEIS for solar energy development, from Joe (Supervisory Anthropologist for the Navajo Nation Historic Preservation Department – Traditional Cultural Program, Window Rock, Ariz.) to S. Borchard (California Desert District Manager, Bureau of Land Management, Riverside, Calif.), July 3.

Kenny, J.F., et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological Survey, Circular 1344. Available at http://pubs.usgs.gov/circ/1344. County data accessed Jan. 4, 2010.

Kirkham, R.M. (compiler), 1998a, "Fault Number 2320, Mineral Hot Springs Fault (Class A)," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Kirkham, R.M. (compiler), 1998b, "Fault Number 2315, Faults near Monte Vista," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Kirkham, R.M. (compiler), 1998c, "Fault Number 2319, Villa Grove Fault Zone," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Kirkham, R.M., and W.P. Rogers, 1981, *Earthquake Potential in Colorado,* Colorado Geological Survey Bulletin 43.

Laney, P., and J. Brizzee, 2005, *Colorado Geothermal Resources*, INEEL/MIS-2002-1614, Rev. 1, prepared for U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Geothermal Technologies Program, Nov.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

Leith, B., 2010, *EHP Earthquake Question – LgGS Magnitude*, e-mail transmittal from Leith (Earthquake Hazards Program, U.S. Geological Survey) to T. Patton (Argonne National Laboratory, Argonne, IL), Aug. 8.

Leonard, G.J., and K.R. Watts, 1989, *Hydrogeology and Simulated Effects of Ground-Water Development on an Unconfined Aquifer in the Closed Basin Division, San Luis Valley*, *Colorado*, U.S. Geological Survey Water Resources Investigations Report 87-4284, Denver, Colo.

Lipman, P.W., and H.H. Mehnert, 1979, "The Taos Plateau Volcanic Field, Northern Rio Grande Rift, New Mexico," in *Rio Grande Rift: Tectonics and Magmatism*, R.E. Riecker (editor), American Geophysical Union.

Lipman, P.W., et al., 1970, *Volcanic History of the San Juan Mountains, Colorado, as Indicated by Potassium-Argon Dating*, Geological Society of America Bulletin, Vol. 81.

Livo, K.E., et al., 2001, *Distribution of Altered Rock Material in the Kerber Creek Drainage Basin, Saguache County, Colorado,* U.S. Geological Survey Open File Report 99-12.

Mayo, A.L., et al., 2007, "Groundwater Flow Patterns in the San Luis Valley, Colorado, USA, Revisited: An Evaluation of Solute and Isotopic Data," *Hydrogeology Journal* 15:383-408.

McDermott, P., 2010, personal communication from McDermott (Engineer, Colorado Division of Water Resources, Division 3) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

MIG (Minnesota IMPLAN Group), Inc., 2009, *State Data Files*, Stillwater, Minn.

Miller, N.P., 2002, "Transportation Noise and Recreational Lands," *Proceedings of Inter-Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at http://www.hmmh.com/cmsdocuments/N011.pdf. Accessed Aug. 30, 2007.

Molenar, C.M., 1988, *Petroleum Geology and Hydrocarbon Plays of the Albuquerque-San Luis Rift Basin, New Mexico and Colorado*, U.S. Geological Survey Open-File Report 87-450-S.

National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding, Water Science and Technology Board, and Commission on Geosciences, Environment, and Resources, National Academy Press, Washington D.C.

NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life*. Available at http://www.natureserve.org/explorer. Accessed Sept. 9, 2009.

NCDC (National Climatic Data Center), 2009a, *2008 Local Climatological Data Annual Summary with Comparative Data, Alamosa, Colorado (KALS)*, National Oceanic and Atmospheric Administration. Available at http://www7.ncdc.noaa.gov/IPS/lcd/lcd.html. Accessed Aug. 26, 2009.

NCDC, 2009b, *Integrated Surface Data (ISD), DS3505 format*, database, Asheville, N.C. Available at ftp://ftp3.ncdc.noaa.gov/pub/data/noaa. Accessed Aug. 26, 2009.

NCDC, 2009c, *Climates of the States (CLIM60): Climate of Colorado*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl. Accessed Aug. 26, 2009.

NCDC, 2010, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms. Accessed Oct. 8, 2010.

NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*, U.S. Department of Education. Available at http://www.nces.ed.gov/ccd/districtsearch.

NMDGF (New Mexico Department of Game and Fish), 2009, *Biota Information System of New Mexico Database Query,* Santa Fe, N.M. Available at http://www.bison-m.org/databasequery.aspx. Accessed Oct. 9, 2009.

NPS (National Park Service), 2009, *Sangre de Cristo National Heritage Area*. Available at http://www.nps.gov/grsa/parknews/sangre-de-cristo-nha.htm. Accessed Nov. 10, 2009.

NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO) Database for Alamosa County, Colorado*. Available at http://SoilDataMart.nrcs.usds.gov.

NRCS, 2009, *Custom Soil Resource Report for Conejos County, Colorado*, U.S. Department of Agriculture, Washington, D.C., Aug. 21.

NSTC (National Science and Technology Council), 2008, *Scientific Assessment of the Effects of Global Change on the United States*, a report of the Committee on Environment and Natural Resources, May.

Pew Center on Global Climate Change, 2009*, Renewable and Alternative Energy Portfolio Standards (with reference to Colorado House Bill 07-1281)*. Available at http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm. Accessed Nov. 4, 2009.

Ray, A.J., et al., 2008, *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation*, a report by the Western Water Assessment for the Colorado Water Conservation Board. Available at http://cwcb.state.co.us/NR/rdonlyres/B37476F5-BE76-4E99-AB01-6D37E352D09E/0/ClimateChange_FULL_Web.pdf. Accessed Nov. 2, 2009.

RGWCD (Rio Grande Water Conservation District), 2009, *Draft: Proposed Plan of Water Management—Special Improvement District 1 (aka Closed Basin Subdistrict)*, May 11. Available at http://www.rgwcd.org/Pages/Subdistricts/Subdistrict1_1.htm. Accessed Nov. 9, 2009.

RGWCD, 2010, *Draft: San Luis Valley Well and Water-Level Database.* Available at http://www.rgwcd.org/wl/. Accessed Aug. 4, 2010.

Ritter, B., Jr., 2007, *Colorado Climate Action Plan: A Strategy to Address Global Warming*, Nov.

Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah,* U.S. Geological Survey, HA 730-C.

Ruleman, C., and M. Machette, 2007, "An Overview of the Sangre de Cristo Fault System and New Insights to Interactions between Quaternary Faults in the Northern Rio Grande Rift," Chapter J in *2007 Rocky Mountain Section Friends of the Pleistocene Field Trip—Quaternary Geology of the San Luis Basin of Colorado and New Mexico, September 7–9, 2007*, M.N. Machette et al. (editors), U.S. Geological Survey Open-File Report 2007-1193.

SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies, U.S. Department of Health and Human Services. Available at http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage.

SES (Sterling Energy Systems) Solar Two, LLC, 2008, *Application for Certification,* submitted to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission, Sacramento, Calif., June. Available at http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php. Accessed Oct. 2008.

SLRG (San Luis & Rio Grande) Railroad, 2009, *San Luis & Rio Grande Railroad.* Available at http://www.sanluisandriogranderailroad.com. Accessed June 25, 2009.

SLV (San Luis Valley) Development Resources Group, 2007, *Comprehensive Economic Development Strategy*, prepared with support from Planning and Assistance Grant 05-83-04371, Alamosa, Colo. Available at http://www.slvdrg.org/ceds.php. Accessed Nov. 3, 2009.

SLV Development Resources Group, 2009, *SLV TIGER Discretionary Grant Application with Appendices (Appendix 1—SLVRMI Map Showing the Sangre de Cristo NHA).* Available at http://slvdrg.org/tigergrant.php. Accessed Nov. 10, 2009.

Smith, M.D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425-450.

Solar Reserve, 2010, *Saguache Solar Energy Project, Preliminary 1041 Permit Application for Saguache County, Colorado*, July 20.

State Demography Office, 2009, *Preliminary Population Forecasts for Colorado Counties, 2000–2010*. Available at http://dola.colorado.gov/dlg/demog/population/forecasts/counties1yr.xls.

Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians,* Houghton Mifflin Company, Boston, Mass.

Stoeser, D.B., et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States: Central States – Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Iowa, Missouri, Arkansas, and Louisiana, Version 1.2*, U.S. Geological Survey Open File Report 2005-1351, updated Dec. 2007.

Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen (Bureau of Land Management, Washington, D.C.), and L. Resseguie (Bureau of Land Management, Washington, D.C.), Sept. 14, 2009.

Strait, R., et al., 2007, *Colorado Greenhouse Gas Inventory and Reference Case Projections 1990–2020*, prepared by Center for Climate Strategies, Washington, D.C., for Colorado Department of Public Health and Environment, Denver, Colo., Jan. Available at http://www.cdphe.state.co.us/ap/down/GHGEIJan07.pdf. Accessed Sept. 11, 2009.

Texas v. Colorado, 1968, 391 U.S. 901, 88 S. Ct. 1649, 20 L. Ed.2d 416.

Thompson, K., 2002, *Dealing with Drought: Part Two*, prepared for Agro Engineering, Inc. Available at http://www.agro.com/WaterResources/Dealingwithdrought2.PDF. Accessed Nov. 9, 2009.

Thompson, R.A., et al. 1991, "Oligocene Basaltic Volcanism of the Northern Rio Grande Rift: San Luis Hills, Colorado," *Journal of Geophysical Research,* Vol. 96, No. B8, July 30.

Topper, R., et al., 2003, *Ground Water Atlas of Colorado,* Special Publication 53, Colorado Geological Survey. Available at http://geosurvey.state.co.us/wateratlas.

Tri-State Generation and Transmission Association, Inc., 2008, *San Luis Valley Electric System Improvement Project Alternative Evaluation and Macro Corridor Study*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State Generation and Transmission Association, Inc., 2009, *San Luis Valley–Calumet-Comanche Transmission Project Alternative Evaluation*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State and Public Service Company of Colorado, 2009, *Southern Colorado Transmission Improvements—Renewable Energy Development.* Available at http://www.socotransmission.com/Purpose/renewables.cfm. Accessed Nov. 4, 2009.

TSNA (Tessera Solar North America), 2010, *San Luis Valley Solar Project Tessera Solar North America 1041 Final Application to Saguache County, Colorado*, June.

Tweto, O., 1979, *Geologic Map of Colorado* (Scale 1:500,000), U.S. Geological Survey, prepared in cooperation with the Geological Survey of Colorado.

USACE (U.S. Army Corps of Engineers), 2007, *Upper Rio Grande Basin Water Operations Review—Final Environmental Impact Statement Summary*, with the U.S. Department of the Interior, Bureau of Reclamation, and the New Mexico Interstate Stream Commission, FES-07-05, April.

U.S. Bureau of the Census, 2009a, *County Business Patterns, 2006*, Washington, D.C. Available at http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html.

U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and Families: 2000. Census 2000 Summary File (SF 3) – Sample Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009d, *S1901. Income in the Past 12 Months. 2006-2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009e, *GCT-PH1. Population, Housing Units, Area, and Density: 2000. Census 2000 Summary File (SF 1) – 100-Percent Data.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009f, *T1. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied Housing Units (Dollars). 2006-2008 American Community Survey 3-Year Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000. Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied Housing Units 2006-2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3) – Sample Data.* Available at http://factfinder.census.gov/.

USDA (U.S. Department of Agriculture), 1984, *Soil Survey of Saguache County Area, Colorado*, Soil Conservation Service, Washington, D.C.

USDA, 2004*, Understanding Soil Risks and Hazards—Using Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel (editor).

USDA, 2009, *2007 Census of Agriculture: Colorado State and County Data, Volume 1, Geographic Area Series,* National Agricultural Statistics Service, Washington, DC. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Colorado/index.asp.

USDA 2010, *United States Department of Agriculture Plants Database*. Available at http://plants.usda.gov/index.html. Accessed Jan. 25, 2010.

U.S. Department of Commerce, 2009, *Local Area Personal Income*, Bureau of Economic Analysis. Available at http://www.bea.doc.gov/bea/regional/reis.

U.S. Department of the Interior, 2010. *Native American Consultation Database,* National NAGPRA Online Databases, National Park Service. Available at http://grants.cr.nps.gov/nacd/index.cfm.

U.S. Department of Justice, 2008, *Crime in the United States: 2007*. Available at http://www.fbi.gov/ucr/cius2006/about/table_title.html.

U.S. Department of Justice, 2009a, "Table 8: Offences Known to Law Enforcement, by State and City," *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Justice, 2009b, "Table 10: Offences Known to Law Enforcement, by State and by Metropolitan and Non-metropolitan Counties," *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual Averages*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau/staadata.txt.

U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates by State*, Bureau of Labor Statistics. Available at http://www.bls.gov/web/laumstrk.htm.

U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau.

U.S. Department of Labor, 2009d, *Consumer Price Index, All Urban Consumers—(CPI-U) U.S. City Average, All Items*, Bureau of Labor Statistics. Available at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt.

USFS (U.S. Forest Service), 2005, *Rio Grande Chub (Gila Pandora): A Technical Conservation Assessment*, prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project, Fort Collins, Colo.

USFWS (U.S. Fish and Wildlife Service), 2009, *National Wetlands Inventory,* U.S. Department of the Interior, Washington, D.C. Available at http://www.fws.gov/wetlands.

USFWS, 2010, *Environmental Conservation Online System (ECOS)*. Available at http://www.fws.gov/ecos/ajax/ecos/indexPublic.do. Accessed May 28, 2010.

USGS (U.S. Geological Survey), 2000, *Estimated Use of Water in the United States, County Level Data for 2000*. Available at http://water.usgs.gov/watuse/data/2000. Accessed Oct. 22, 2009.

USGS, 2004, *National Gap Analysis Program, Provisional Digital Land Cover Map for the Southwestern United States*, Version 1.0, RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2005, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—Land Cover Descriptions,* RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2007, *National Gap Analysis Program*, *Digital Animal-Habitat Models for the Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm. Accessed Jan. 22, 2010.

USGS, 2008, *National Seismic Hazard Maps – Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 Years (Interactive Map)*. Available at http://gldims.cr.usgs.gov/nshmp2008/viewer.htm. Accessed Aug. 4, 2010.

USGS, 2010a, *National Earthquake Information Center (NEIC) – Circular Area Database Search (within 100-km of the center of the proposed Fourmile East SEZ)*. Available at http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php. Accessed Aug. 5, 2010.

USGS, 2010b, *Glossary of Terms in Earthquake Maps – Magnitude*. Available at http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude. Accessed Aug. 8, 2010.

USGS, 2010c, *Water Resources of the United States—Hydrologic Unit Maps*. Available at http://water.usgs.gov/GIS/huc.html. Accessed April 12, 2010.

USGS, 2010d, *National Water Information System.* Available at http://wdr.water.usgs.gov/nwisgmap. Accessed Aug. 3, 2010.

USGS and CGS (U.S. Geological Survey and Colorado Geological Survey), 2009, *Quaternary Fault and Fold Database for the United States*. Available at http://earthquake.usgs.gov/regional/qfaults/. Accessed Sept. 11, 2009.

Westerling, A.L., et al., 2006, "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity," *Science* 313:940–943.

Widman, B.L. (compiler), 1997a, "Fault Number 2313, Western Boundary Fault," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Widman, B.L. (compiler), 1997b, "Fault Number 2314, Lucky Boy Fault," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Wolfe, D., 2008, *Order Establishing Advisory Committee for Rules and Regulations Governing the Diversion and Use of Underground Waters in Water Division 3*, Colorado Division of Water Resources, Dec. 31. Available at http://water.state.co.us/SurfaceWater/RulemakingAndAdvising/SLVAC/Pages/SLVNews.aspx.

WRCC (Western Regional Climate Center), 2009, *Western U.S. Climate Historical Summaries.* Available at http://www.wrcc.dri.edu/Climsum.html. Accessed Aug. 21, 2009.

WRCC 2010a, *Monthly Climate Summary, Blanca, Colorado (050776).* Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co0776. Accessed July 22, 2010.

WRCC 2010b, *Monthly Climate Summary, La Vetta Pass, Colorado (054870).* Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co4870. Accessed July 22, 2010.

WRCC, 2010c, *Average Pan Evaporation Data by State*. Available at http://www.wrcc.dri.edu/htmlfiles/westevap.final.html. Accessed Jan. 19, 2010.

WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System (EDMS)*. Available at http://www.wrapedms.org/default.aspx. Accessed June 4, 2009.

10.3 FOURMILE EAST

10.3.1 Background and Summary of Impacts

10.3.1.1 General Information

The proposed Fourmile East SEZ has a total area of 3,882 acres (15.7 km^2) and is located in Alamosa County in south-central Colorado (Figure 10.3.1.1-1). In 2008, the county population was 15,783, while the four-county region surrounding the SEZ—Alamosa, Conejos, Costilla, and Rio Grande Counties—had a total population of 39,759. The largest nearby town is Alamosa, with an estimated 2008 population of 8,745, which is located about 13 mi (21 km) to the west on U.S. 160. This highway lies about 0.6 mi (1 km) south of the SEZ, while CO 150 runs north-south through the eastern portion of the SEZ; Great Sands Dunes National Park is located about 9 mi (14 km) north of the SEZ on CO 150. The SLRG Railroad serves the area. The nearest public airport is San Luis Valley Regional Airport located 12 mi (19 km) west of the SEZ in Alamosa. Santa Fe, New Mexico, lies about 120 mi (193 km) to the south, and Denver, Colorado, lies about 170 mi (31 km) to the northeast.

An existing 69-kV transmission line lies about 2 mi (3 km) to the south, and a 230-kV line lies about 8 mi (13 km) to the north of the SEZ. It is assumed that a new transmission line would be needed to provide access from the SEZ to the transmission grid (see Section 10.3.1.2). As of February 2010, there were no pending solar project applications on the SEZ.

The proposed Fourmile East SEZ lies in the eastern San Luis Valley, part of the San Luis Basin, a high-elevation (approximately 8,000 ft [2,440 m]) basin between two large mountain ranges. The San Juan Mountains to the west and the Sangre de Cristo Range to the east form the rim of the basin. The proposed SEZ lies on a flat alluvial fan formed in the basin. There are no developments 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 some agricultural areas lie to the southeast.

The proposed Fourmile East SEZ and other relevant information are shown in Figure 10.3.1.1-1. 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 Fourmile East SEZ, other restrictions may be appropriate. The analyses in the following sections address the affected environment and potential impacts associated with utility-scale solar energy development in the proposed SEZ for important environmental, cultural, and socioeconomic resources.

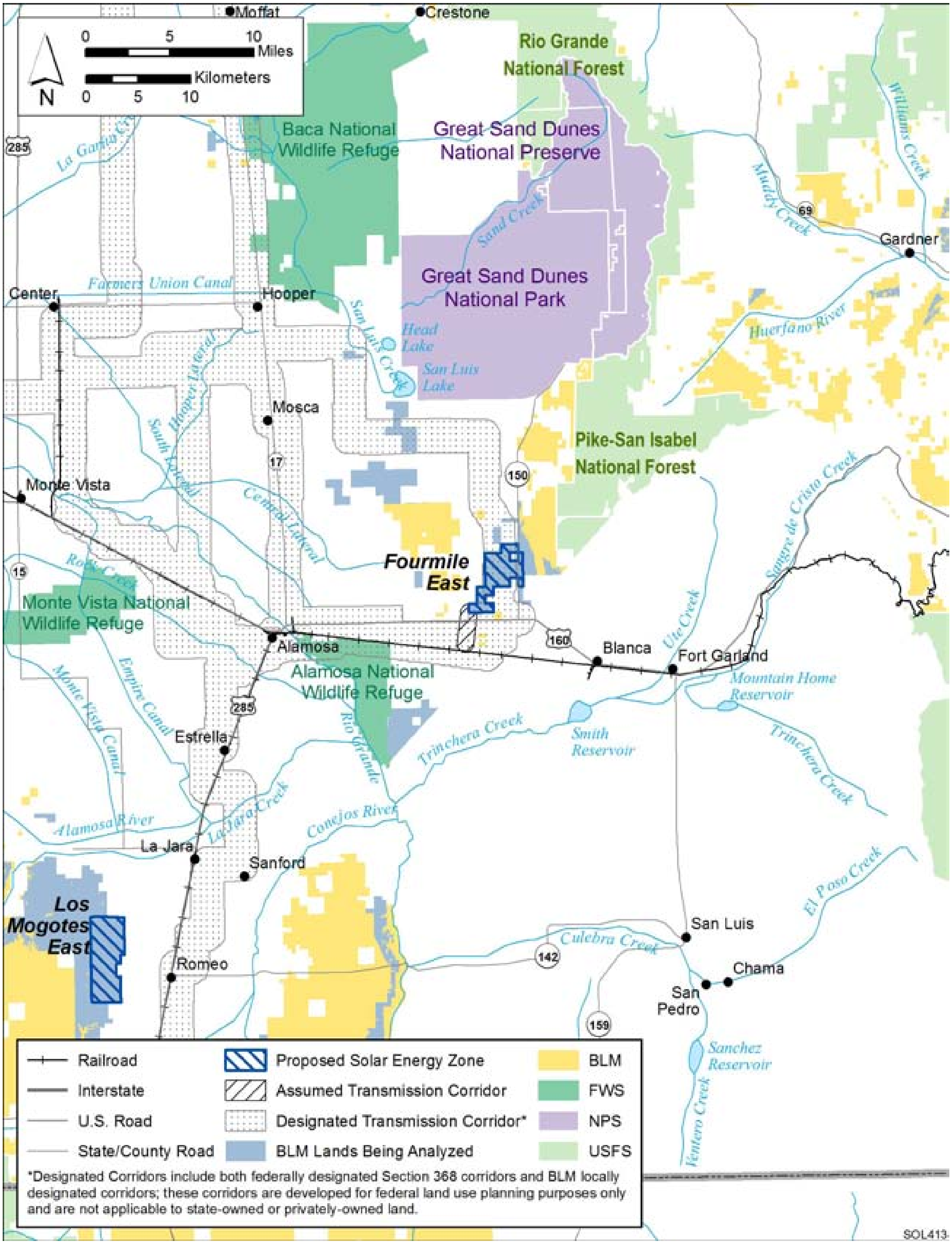

FIGURE 10.3.1.1-1 Proposed Fourmile East SEZ

10.3.1.2 Development Assumptions for the Impact Analysis

Maximum development of the proposed Fourmile East SEZ was assumed to be 80% of the total SEZ area over a period of 20 years, a maximum of 3,105 acres (12.6 km^2). These values are shown in Table 10.3.1.2-1, along with other development assumptions. Full development of the Fourmile East SEZ would allow development of facilities with an estimated total of 345 MW of electrical power capacity if power tower, dish engine, or PV technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 621 MW of power if solar trough technologies were used, assuming 5 acres/MW (0.02 km^2/MW) of land required.

Availability of electric transmission facilities from SEZs to load centers will be an important consideration for future development in SEZs. For the proposed Fourmile East SEZ, the nearest existing transmission line is a 69-kV line 2 mi (3.2 km) of the SEZ. It is possible that a new transmission line could be constructed from the SEZ to this existing line, but the 69-kV capacity of that line would be inadequate for 345 to 621 MW of new capacity (note: a 500-kV line can approximately accommodate the load of one 700-MW facility). At full build-out capacity, it is clear that substantial new transmission and/or upgrades of existing transmission lines would be required to bring electricity from the proposed Fourmile East SEZ to load centers; however, at this time the location and size of such new transmission facilities are unknown. Generic impacts of transmission and associated infrastructure construction and of line upgrades on various resources are discussed in Chapter 5. Project-specific analyses would need

TABLE 10.3.1.2-1 Proposed Fourmile East SEZ—Assumed Development Acreages, Maximum Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S., or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line ROW and Road ROW	Distance to Nearest BLM-Designated Transmission Corridor[e]
3,882 acres and 3,105 acres[a]	345 MW[b] 621 MW[c]	Adjacent (CO 150)	2 mi[d] and 69 kV	61 acres and 0 acres	Adjacent/ Through[f]

[a] To convert acres to km^2, multiply by 0.004047.

[b] Maximum power output if the SEZ were fully developed using power tower, dish engine, or PV technologies, assuming 9 acres/MW (0.04 km^2/MW) of land required.

[c] Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW MW (0.02 km^2/MW) of land required.

[d] To convert mi to km, multiply by 1.609.

[e] BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

[f] A BLM locally designated corridor covers the entire proposed Fourmile East SEZ.

to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

To provide as complete an analysis of impacts of solar development in the SEZ as possible, it was assumed that, at a minimum, a transmission line segment would be constructed from the proposed Fourmile East SEZ to the nearest existing transmission line in order to connect the SEZ to the transmission grid. This assumption was made without information on whether the nearest existing transmission line would actually be available for connection of future solar facilities, and without assumptions about upgrades of the line. Establishing a connection to the line closest to the Fourmile East SEZ would involve the construction of about 2 mi (3.2 km) of new transmission line outside of the SEZ. The ROW for this transmission line would occupy approximately 61 acres (0.25 km^2) of land, assuming a 250-ft (76-m) wide ROW, a typical width for such a ROW. If a connecting transmission line were constructed to a different location in the future, 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 Fourmile East SEZ should be adequate to support construction and operation of solar facilities, because CO 150 runs within the eastern boundary and U.S. 160 runs less than 1 mi (2 km) to the south of the SEZ. Thus, no additional road construction outside of the SEZ is assumed to be required to support solar development, as summarized in Table 10.3.1.2-1.

10.3.1.3 Summary of Major Impacts and Proposed SEZ-Specific Design Features

In this section, the impacts and proposed SEZ-specific design features assessed in Sections 10.3.2 through 10.3.21 for the proposed Fourmile East SEZ are summarized in tabular form. Table 10.3.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the applicable sections for detailed support of the impact assessment. Section 10.3.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features that are specific to the Fourmile East SEZ are included in Sections 10.3.2 through 10.3.21 and in the summary table. The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in this and other SEZs.

TABLE 10.3.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Fourmile East SEZ and Proposed SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ could disturb up to 3,105 acres (13 km^2), utility-scale solar energy development would be a new and discordant land use to the area. There is also potential to create a more fragmented land management pattern. Solar development would exclude most traditional uses of the public lands from the SEZ. Possible non-mitigable impacts are related to induced changes to existing land uses on nearby state and private lands. Any transmission lines constructed to connect to the regional power grid would likely be constructed on private land A BLM locally designated corridor covers almost all 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 Lands with Wilderness Characteristics	The Blanca Wetlands ACEC/SRMA is within 0.5 to 6 mi (0.8 to 10 km) of the SEZ, and development within the SEZ would have a significant impact on recreation visitors in the ACEC/SRMA. Additional factors, such as noise, glare, aerial hazards, and added human presence would also disturb the use of the area by wildlife and may reduce the value of the area to wildlife. The SEZ is within view of the Sangre de Cristo Wilderness, and it is likely there would be an adverse effect on wilderness characteristics in about 1,378 acres (5.6 km^2) of the WA.	Solar technologies in the SEZ should be restricted to those with the lowest profile to minimize the visual impact on nearby specially designated areas. Additionally, lighting within the SEZ should be carefully designed to minimize visual impacts on surrounding specially designated areas.

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TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Specially Designated Areas and Lands with Wilderness Characteristics *(Cont.)*	There is potential for adverse effects on the night sky viewing experience in the Great Sand Dunes National Park and other specially designated areas.	None.
	Portions of the route of the Old Spanish National Historic Trail pass within 1 mi (1.6 km) of the SEZ, and the historic setting of the trail would be adversely affected by SEZ development along at least 12 mi (19 km) of the trail. It is likely that this level of impact would affect future management of the trail.	Pending outcome of a study of the significance of potentially affected segments of the Old Spanish National Historic Trail, restrictions on solar facility development that might adversely impact trail resources should be put in place.
	The Los Caminos Antiguos Scenic Byway passes through the east side of the SEZ, and about 14 mi (22.5 km) of the highway is within the most visually sensitive zone from 1 to 5 mi (1.6 to 8 km). Solar development within the SEZ would be visible to visitors along about 50 mi (80 km) of the scenic byway. Potential impact on the use of the scenic byway is not known but may be significant.	Solar development on the east side of the scenic byway should not be approved, in order to reduce the negative visual effect on visitors from traveling on the road. This also would reduce the adverse impact on the scenic view from the highway looking to the east toward Blanca Peak and the WA. It could also reduce the potential impacts to the Old Spanish National Historic Trail.
	There may be an adverse effect on Native American religious values associated with Blanca Peak, which is within full view of the SEZ.	Consultation would be conducted to determine whether there would be adverse impacts on Native American religious values, and if so, what mitigation measures might be possible to reduce or eliminate such impacts.
	The SEZ is located within the recently (2009) designated Sangre de Cristo NHA, and it appears that solar development could be inconsistent with the designation.	Early consultation should be initiated with the entity responsible for developing the management plan for the Sangre de Cristo NHA to understand how development of the SEZ could be consistent with NHA plans/goals.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Specially Designated Areas and Lands with Wilderness Characteristics *(Cont.)*		Adoption of visual design features described in Appendix A, Section A.2.2, would reduce visual impacts on wilderness, historic, and scenic values and should be considered as part of any solar project analysis.
Rangeland Resources: Livestock Grazing	One seasonal grazing allotment likely would be cancelled and 139 AUMs would be lost. One grazing permittee would be displaced and would incur economic and possible social impacts.	None.
Rangeland Resources: Wild Horses and Burros	None.	None.
Recreation	Recreational users would be displaced from the SEZ but impacts would be minor.	None.
	Development of the SEZ would be a dominating factor in the viewshed of the scenic byway that runs through the SEZ for about 14 mi (22.5 km) of its length and for about 5 mi (8 km) of the Rio Grande scenic railroad route. The potential impact on recreation visitors to the area is difficult to determine and would likely vary by individual and solar technology employed.	The portion of the SEZ on the east side of the scenic byway should be eliminated to reduce the negative visual effect on visitors traveling on the scenic byway and to reduce the visual impacts looking to the east toward Blanca Peak and the Sangre de Cristo Mountains.
	Because of the density of specially designated areas, scenic resources, and visually sensitive recreation resources, it is likely there would be unmitigated impacts to recreation use associated with development of the SEZ.	Solar technologies in the SEZ should be restricted to those with the lowest profile to minimize the visual impact and the accompanying adverse effect on recreational visitors.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Military and Civilian Aviation	The SEZ is located in an area under 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 would 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).	The need for a study to evaluate the potential impacts of building a solar facility in close proximity to the Great Sand Dunes should be determined.
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 964 ac-ft of (1.2 million m^3) of water during peak construction year. Construction activities would generate as high as 74 ac-ft (91,300 m^3) of sanitary wastewater. With full development of the SEZ, normal operations would use the following amounts of water: • For parabolic trough facilities (621-MW capacity), 444 to 941 ac-ft/yr (0.5 million to 1.2 million m^3/yr) for dry-	Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures. Land disturbance activities should avoid impacts to the extent possible in the wetland areas on the western boundary of the site. 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.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	cooled systems and 3,115 to 9,325 ac-ft/yr (3.8 million to 11.5 million m^3/yr) for wet-cooled systems; • For power tower facilities (345-MW capacity), 246 to 522 ac-ft/yr (0.3 million to 0.6 million m^3/yr) for dry-cooled systems and 1,730 to 5,180 ac-ft/yr (2.1 million to 6.4 million m^3/yr) for wet-cooled systems; • For dish engine facilities (345-MW capacity), 177 ac-ft/yr (218,300 m^3/yr).; and For PV facilities (345-MW capacity), 17 ac-ft/yr (21,000 m^3/yr). With full development of the SEZ, normal operations would generate up to 9 ac-ft/yr (11,100 m^3/yr) of sanitary wastewater. With full development of the SEZ, operation of solar energy facilities using wet-cooling systems (e.g., some parabolic trough and power tower facilities) would generate 98 to 176 ac-ft/yr (0.1 million to 0.2 million m^3/yr) of cooling system blowdown wastewater.	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.
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 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	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 semidesert shrub steppe and greasewood flat habitats and minimize the potential for the spread of invasive species. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*	impacts on wetlands both within and outside 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.	All wetland, sand dune and sand transport areas, playa, and dry wash habitats within the SEZ and assumed transmission line corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around wetlands and dry washes to reduce the potential for impacts on these habitats on or near the SEZ. Appropriate engineering controls should be used to minimize impacts on wetland, playa, dry wash, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation. Transmission line towers should be sited and constructed to minimize impacts on wetlands and span them whenever practicable. Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetlands or springs on or near the SEZ associated with groundwater discharge, such as the Blanca wetlands.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Wildlife: Amphibians and Reptiles[b]	Small impacts on amphibians and reptiles could occur from development on the SEZ. Few amphibian species are expected to occur on the SEZ.	Wetland habitats within the SEZ should be avoided to the extent practicable. Appropriate engineering controls should be used to minimize impacts on the washes that drain off of the Sangre de Cristo Mountains and on Smith Reservoir resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats. Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas (if present within the finalized ROW location) and span them whenever practicable.
Wildlife: Birds[b]	Unmitigated direct impacts on land birds from habitat disturbance and long-term habitat reduction/fragmentation would be small. 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. Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition. 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.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Wildlife: Birds[b] *(Cont.)*		Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas (if present within the finalized ROW location) and span them whenever practicable. If present, prairie dog colonies (which could provide habitat or a food source for some bird species) should be avoided to the extent practicable.
Wildlife: Mammals[b]	Unmitigated direct impacts on small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/ fragmentation would be small. Impacts on American black bear and cougar are expected to be small. No impacts are expected for bighorn sheep The SEZ occurs within the overall range and summer range of elk, overall range of mule deer, and overall range and winter range of pronghorn; however, impacts on them is expected to be small.	Prairie dog colonies should be avoided to the extent practicable to reduce impacts on species such as the desert cottontail and thirteen-lined ground squirrel. To the extent practicable, construction activities should be avoided while pronghorn are on their winter range within the immediate area of the SEZ. Development in the 213-acre (0.9 km^2) portion of the SEZ that overlaps elk summer range should be avoided.
Aquatic Biota[b]	Direct alteration of aquatic habitat would result if either construction activities or the placement of facilities occurred directly in the small emergent wetlands located primarily in the western portion of the SEZ. Removal of vegetation and disturbance of surface soils to construct solar energy facilities would likely increase the amount of sediment in wetland areas, thus negatively affecting aquatic biota. Withdrawing water from the Smith Reservoir, Rio Grande, or other perennial surface water features could affect water levels and aquatic organisms within those water bodies.	Undisturbed buffer areas and sediment and erosion controls should be maintained around wetlands on the SEZ. The use of heavy machinery and pesticides should be avoided in the immediate catchment basin for those wetlands.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Aquatic Biota[b] *(Cont.)*	Contaminants such as fuels, lubricants, or pesticides/herbicides that directly enter the wetlands on the SEZ site or near its boundary 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.	
Special Status Species[b]	Potentially suitable habitat for 59 special status species occurs in the affected area of the Fourmile East SEZ. For all special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effect.	Pre-disturbance surveys should be conducted within the SEZ and access road corridor to determine the presence and abundance of special status species; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effect (where appropriate); 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 in the transmission corridor could reduce impacts on three special status species. Coordination with the USFWS and CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog, a candidate species for listing under the ESA. Coordination would identify an appropriate survey protocol, avoidance measures,

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		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.
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 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, about 9 mi [14 km] north of the proposed SEZ); the potential impacts, however, would be moderate and temporary. In addition, construction emissions from the engine exhaust of heavy equipment and vehicles could affect AQRV (e.g., visibility and acid deposition) at nearby Class I areas. *Operations:* Positive impact due to avoided emission of air pollutants from combustion-related power generation: 1.3 to 2.3% of total SO_2, NO_x, Hg, and CO_2 emissions from electric power systems in Colorado (up to 1,439 tons SO_2, 1,659 tons NO_x, 0.009 tons Hg, and 1,075,000 tons CO_2).	None.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
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 and/or outside the SEZ. The SEZ is located 2.8 mi (4.5 km) from Sangre de Cristo WA at the point of closest approach. Because of the short distance and elevated viewpoints, weak to strong visual contrasts could be observed by WA visitors near the point of closest approach. About 50 mi (80 km) of the Old Spanish NHT, including 25 mi (40 km) of a high-potential segment fall within the SEZ 25-mi (40-km) viewshed. Trail users would be expected to observe strong visual contrasts from solar energy development within the SEZ at some points on the trail. Strong visual contrast levels would be expected for some viewpoints in the Blanca Wetlands SRMA/ACEC, located approximately 0.5 mi (0.8 km) from the western edge of the SEZ. Moderate visual contrast levels would be expected for some viewpoints in the Zapata Falls SRMA, located approximately 4.6 mi (7.4 km) northeast of the SEZ. Almost 71 mi (114 km) of Los Caminos Antiguos Scenic Byway are within the Fourmile East SEZ viewshed. Travelers on the byway would be likely to observe strong visual contrasts from solar energy development within the SEZ at some locations on the byway.	The development of power tower facilities should be prohibited within the SEZ. Within the SEZ, in areas visible from and within 0.25 mi (0.4 km) of the Los Caminos Antiguos Scenic Byway, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives, as experienced from key observation points on the byway. Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the centerline of the high-potential segment of the Old Spanish National Historic Trail, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives, as experienced from key observation points on the high-potential segment of the Old Spanish National Historic Trail. Within the SEZ, in areas visible from and between 3 mi (4.8 km) and 5 mi (8 km) of the centerline of the high-potential segment of the Old Spanish National Historic Trail, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives, as experienced from key observation points on the high-potential segment of the Old Spanish National Historic Trail. Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the Sangre de Cristo WA, visual impacts associated with solar energy project operation should be consistent with VRM Class II management

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	The SEZ is located 7 mi (11 km) from Blanca Peak (a culturally significant mountain and recreation resource) at the point of closest approach. Because of the short distance and elevated viewpoint, moderate visual contrasts could be observed by visitors. Portions of the Rio Grande Scenic Railway are within the SEZ viewshed. Railroad passengers would be likely to observe strong visual contrasts from solar energy development within the SEZ at some points on the railroad. The communities of Alamosa, Blanca, and Mosca are located within the viewshed of the SEZ, although slight variations in topography and vegetation provide some screening. Weak visual contrast levels would be expected for these communities. 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, including CO 150 and U.S. 160. Strong contrast levels could potentially be observed from some locations. 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.	objectives, as experienced from key observation points within the WA. Within the SEZ, in areas visible from and between 3 mi (4.8 km) and 5 mi (8 km) of the Sangre de Cristo WA, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives, as experienced from key observation points within the WA.
Acoustic Environment	*Construction:* For construction of a solar facility located near the southwestern SEZ boundary, estimated noise levels at the nearest residence located about 0.8 mi (1.3 km) from the SEZ boundary would be about 44 dBA, which is somewhat higher than the typical daytime mean rural background level of 40 dBA. However, an estimated 43 dBA L_{dn} at this residence is well below the EPA guidance 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 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Acoustic Environment *(Cont.)*	*Operations:* For operation of a parabolic trough or power tower facility located near the southwestern SEZ boundary, the predicted noise level would be about 42 dBA at the nearest residence, which is slightly higher than 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 43 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 52 dBA, which is higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 53 dBA L_{dn}, which is a slightly lower than the EPA guideline of 55 dBA L_{dn} for residential areas. If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residence would be about 44 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 43 dBA L_{dn} at this residence would be well below the EPA guideline of 55 dBA L_{dn} for residential areas.	Dish engine facilities within the proposed Fourmile East SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearest residence located southwest of the SEZ (i.e., the facilities should be located in the central or northern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.
Paleontological Resources	There could be impacts on significant paleontological resources in the proposed Fourmile East SEZ. A more detailed look at the geological deposits of the SEZ and their depth and a paleontological survey may be needed.	The depth to the Alamosa Formation within the SEZ should be determined to identify what design features might be needed in that area if solar energy development occurs.
Cultural Resources	Direct impacts on significant cultural resources (potentially including Native American burials) could occur and are likely within the SEZ and within the ROW for new transmission. However, a cultural resource survey would need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and to see if any are eligible for listing in the NRHP.	A PA may need to be developed among the BLM, DOE, Colorado SHPO, ACHP, and the Trail Administration for the Old Spanish Trail to consistently address impacts on significant cultural resources from solar energy development within the San Luis Valley.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Cultural Resources *(Cont.)*	Further evaluation is needed to determine the effects of solar energy development on a high-potential segment of the Old Spanish National Historic Trail. There will be an adverse effect on the scenic integrity of the high-potential segment. Culturally unevaluated segments of the trail should be evaluated for significance.	Because of the possibility of encountering Native American human remains in the vicinity of the proposed Fourmile East SEZ, it is recommended that, for surveys conducted in the SEZ, consideration be given to include Native American participation in the development of survey designs and historic property treatment and monitoring plans. Ongoing consultation with the Colorado SHPO and the appropriate Native American governments should be continued so that most adverse effects on significant resources in the valley could be mitigated to some degree. Some impacts may not be mitigable.
Native American Concerns	It is possible that there will be Native American concerns about culturally significant archaeological sites, the potential for Native American human remains and associated cultural items to be present within the proposed SEZ, and the potential visual and noise effects of solar energy development 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 20 jobs and $0.3 million in income, loss of $35 annually in grazing fees. *Transmission line construction:* 9 total jobs; $0.4 million income.	None.
	Construction: 212 to 2,804 total jobs; $11.5 million to $152.6 million income in ROI. *Operations:* 9 to 203 annual jobs; $0.3 to $6.6 million annual income in ROI.	None.

TABLE 10.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Fourmile East SEZ	SEZ-Specific Design Features
Environmental Justice	Minority populations identified within the New Mexico portion of the 50-mi (80-km) radius around the proposed SEZ could be disproportionately affected by the construction and operation of solar facilities. Potential adverse impacts could result from noise and dust during construction; increased traffic related to construction; operations noise; visual impacts of generation and auxiliary facilities to areas of traditional or cultural significance; restricted access to animals and vegetation on developed lands; curtailed mineral, energy, and forestry development in the region; and property value impacts.	None.
Transportation	U.S. 160 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). Some parts of U.S. 160 could experience approximately a 50% increase in the daily traffic load. Local road improvements would be necessary in any portion of the SEZ along U.S. 160 that might be developed so as not to overwhelm the local roads near any site access point(s). The amount of traffic currently using CO 150 could increase approximately threefold. CO 150 and any other access roads connected to it would require road improvements to handle the additional traffic.	None.

Footnotes on next page.

TABLE 10.3.1.3-1 (Cont.)

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; CEQ = Council on Environmental Quality; CO = Colorado State Highway; CO_2 = carbon dioxide; 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; 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 to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in the proposed Fourmile East SEZ.

[b] The scientific names of all plants, wildlife, and aquatic biota are provided in Sections 10.3.10 through 10.3.12.

10.3.2 Lands and Realty

10.3.2.1 Affected Environment

The proposed Fourmile East SEZ is located within an area of mixed land ownership and is surrounded mainly by private lands, but there are also a number of BLM- and USFS-managed lands nearby. Private lands are sparsely developed, yet there are home sites scattered throughout the area. It appears that the private lands to both the east and south have been subdivided, and there are numerous roads throughout these areas. Easy access to the SEZ is available from State Highway 150 that passes through the east side of the area. Three county roads also provide good access to portions of the site. Only two existing ROWs are located in the SEZ and both are for short segments of roads. There is a transmission corridor that passes through most of the SEZ but, currently, it does not contain any transmission facilities. The overall character of the land in the SEZ and the surrounding lands is rural.

There are currently no applications for ROWs for solar facilities within the Fourmile East SEZ; however, there is one solar facility operating in the San Luis Valley on private land near Mosca, about 12 mi (19 km) northwest of the SEZ. There is ongoing interest in developing additional solar energy facilities on private lands in the valley.

10.3.2.2 Impacts

10.3.2.2.1 Construction and Operations

This analysis assumes that 3,105 acres (13 km^2), or 80%, of the proposed Fourmile East SEZ could be developed for utility-scale solar energy production over a 20-year period. This area is small when compared with many proposed SEZs; however, it would establish an industrial area that would exclude most other existing and potential uses from the site. Because the character of the area is currently rural, utility-scale solar energy development would introduce a new and discordant land use. If solar development occurred, the existing and traditional uses of the public lands in the SEZ would be foregone, perhaps in perpetuity. Additional private lands near the SEZ also could be developed, with landowner approval, 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 proposed SEZ be identified as an SEZ in the ROD for this PEIS, the BLM would still have discretion to authorize additional ROWs in the area until solar energy development was authorized, and then future ROWs would be subject to the rights granted for solar energy development. Because the area currently has so few ROWs, it is not anticipated that approval of solar energy development would have a significant impact on ROW availability in the area.

The SEZ has an odd shape and is somewhat isolated from other public lands by the presence of State Highway 150. Depending on how the SEZ is developed, it would be possible to create a more fragmented public land pattern that would be difficult to manage.

10.3.2.2.2 Transmission Facilities and Other Off-Site Impacts

A BLM locally designated transmission corridor fully covers 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 was fully developed with solar production facilities, future expansion of transmission facilities would be located outside of the area on private lands.

To connect solar energy production facilities in the SEZ with the regional grid, approximately 2 mi (3.2 km) of new transmission line would be required. This new transmission line and its ROW would result in about 61 acres (0.25 km^2) of surface disturbance. Because of the relative scarcity of BLM-administered land in the area, it is likely that a new transmission line would be constructed on private land. No new roads would need to be constructed outside of the SEZ to support solar development, although existing county roads might need to be upgraded to support construction of solar facilities.

10.3.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required to address 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 Lands and Realty Program.

10.3.3 Specially Designated Areas and Lands with Wilderness Characteristics

10.3.3.1 Affected Environment

There are no specially designated areas within the proposed Fourmile East 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. Many of these are elevated above the SEZ, and some are in close proximity to the SEZ (see Figure 10.3.3.2-1). These areas are discussed below. No lands with wilderness characteristics have been identified within 25 mi (40 km) of the SEZ.

The BLM-administered Zapata Falls SRMA is located northeast of the SEZ, and the SEZ is visible from portions of the area. The SRMA currently is a day-use area that provides picnic and restroom facilities and an interpretive area. The area also provides overnight parking facilities for visitors to the Sangre de Cristo WA. Activities and attractions include viewing Zapata Falls and surrounding scenery, hiking, mountain biking, and horseback riding. The BLM has plans for construction of a campground within the SRMA that would include 24 single camping units, 1 group camping unit, 1 host site, and 2 accessible double vault toilets. The campground will be located along the eastern edge of the RMA (BLM 2009b).

The BLM-administered Blanca Wetlands SRMA/ACEC, which is composed of two separate units, is located within 0.5 mi (0.8 km) of the SEZ. The SRMA/ACEC was designated to protect both wildlife and recreation resources. The area that is a designated Watchable Wildlife Area contains wetland habitats that are important for waterfowl, shorebirds, and other wildlife; a day use recreation area with restroom facilities and an interpretive loop trail; and, is seasonally open to fishing and waterfowl hunting.

The Sangre de Cristo Wilderness is located on the ridgeline east of the SEZ and continues northwest for about 70 mi (113 km).

Great Sand Dunes National Park and Preserve is located north and northeast of the SEZ. Much of the park is at a higher elevation than the SEZ.

Portions of State Highways 17, 150, and 159 and Alamosa County Road 6N have been designated by the state and the BLM as part of the Los Caminos Antiguos Scenic Byway. The scenic byway provides one of the major access routes to Great Sand Dunes National Park.

The route of the Old Spanish National Historic Trail passes about 1 mi (1.6 km) east of the SEZ, and nearly 50 mi (80.5 km) of the trail is within the viewshed of the SEZ, including a 25-mi (40-km) length of a high-potential segment of the trail. The high-potential portion of the trail that is considered to be most significant (see discussion in Section 10.3.17)

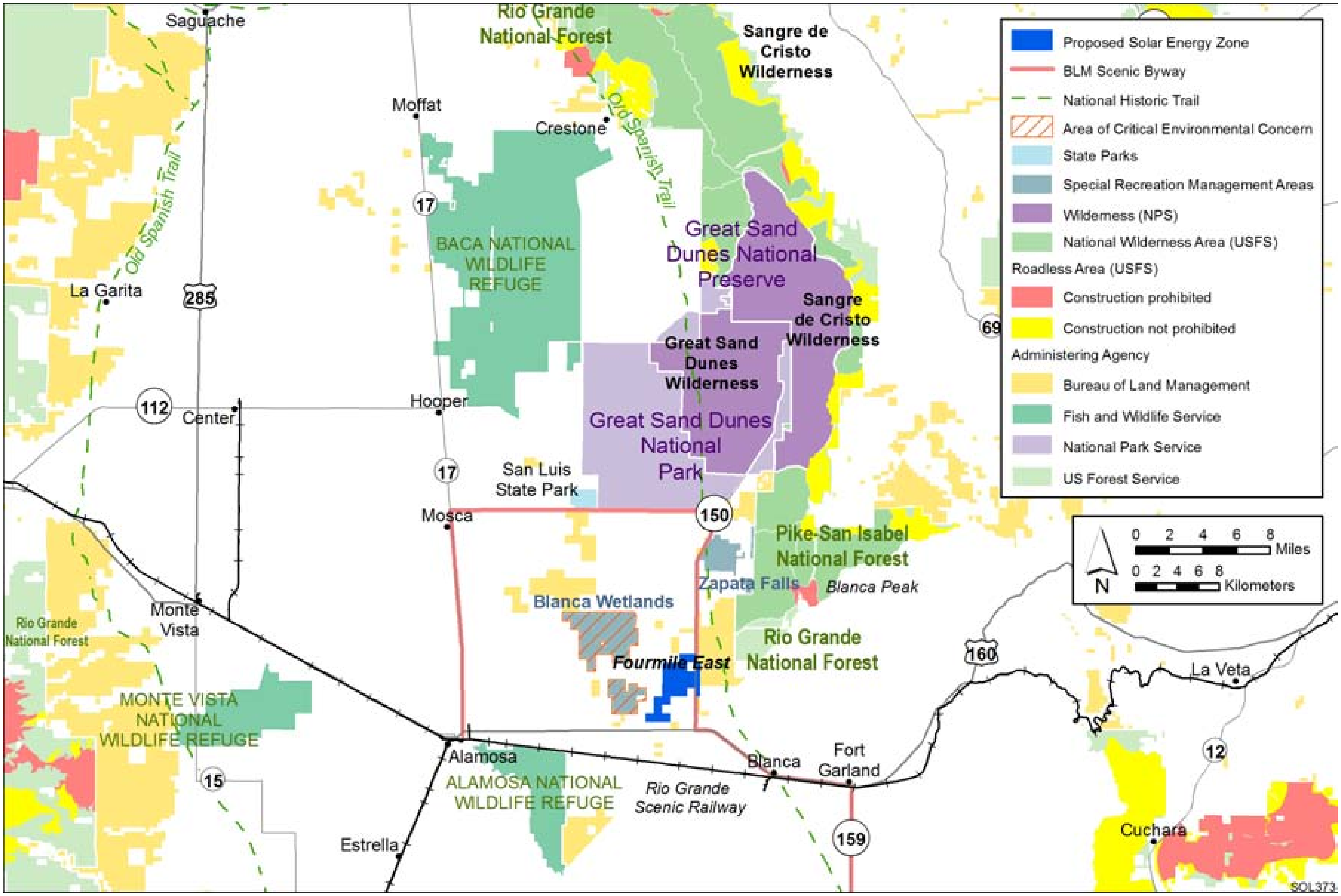

FIGURE 10.3.3.2-1 Specially Designated Areas in the Vicinity of the Proposed Fourmile East SEZ

begins about 1.5 mi (2.4 km) northeast of the corner of the SEZ (see discussion in Section 10.3.17).

San Luis Lakes State Park is located adjacent to and west of Great Sand Dunes National Park and is northwest of the SEZ.

Blanca Peak is a 14,000+-ft (4,267+-m) peak that dominates much of the San Luis Valley and is located northeast of the SEZ. The area possesses special significance to Native Americans.

The SEZ is located within the boundaries of the recently (2009) designated Sangre de Cristo NHA. The NHA includes three Colorado counties—Alamosa, Conejos, and Costilla.

10.3.3.2 Impacts

10.3.3.2.1 Construction and Operations

Potential impacts on specially designated areas from solar development within the SEZ are difficult to determine and would likely vary by solar technology employed, the specific area being impacted, and the experience of individuals. Development of the SEZ, especially full development, would be a dominating factor in the viewshed from large portions of some of these specially designated areas. Figure 10.3.3.2-1 shows the locations of the areas discussed below.

SRMAs/ACECs

- The Zapata Falls SRMA is about 5 mi (8 km) from the SEZ. On the basis of visual landscape analysis, recreational visitors traveling along portions of the access road and at the parking area in the SRMA would be able to see development in the SEZ. The SEZ would not be visible from the falls. Based on the distance to the SEZ, and the limited visibility of the SEZ, there would be minimal impact on recreational users of the SRMA due to development within the SEZ. Taller facilities within the SEZ, such as a power tower, would increase the overall visibility in the SRMA and could increase the level of impact on users.

- The Blanca Wetlands ACEC/SRMA is from 0.5 to 6 mi (0.8 to 9.7 km) from the SEZ and is at approximately the same elevation. The ACEC/SRMA is within the most visually sensitive 1- to 5-mi (0.6- to 8-km) visual zone, and development within the SEZ, especially full development, would likely have a significant impact on recreational visitors in the ACEC/SRMA. Most of this impact would be caused by the industrial nature of a solar development and its conflict with the purposes for which most visitors utilize the ACEC/SRMA. In addition, solar facilities may introduce factors such as noise, glare, aerial hazards, and added human presence that would disturb use of the area by wildlife (see Section 10.3.11 for more information on wildlife impacts). Because the function of these areas is dependent upon the presence of surface water, depending on the technology employed and the source and amount of water used, there may be potential for impact on the ACEC/SRMA (see Section 10.3.9 for more discussion of water resource issues).

Sangre de Cristo Wilderness

The USFS-administered wilderness covers the ridgeline on the east side of the San Luis Valley, and areas within the wilderness on the west side of the ridge have dominating, though relatively small views of the SEZ. Within the zone from 3 to 5 mi (5 to 8 km), about 1,378 acres (5.6 km^2) or about 0.8% of the designated wilderness would have a clear view of development in the SEZ. It is likely there would be adverse impacts on wilderness characteristics and on visitor experience in this area. In the 5- to15-mi (8- to 24-km) zone, about 2,330 additional acres would have a view of development in the SEZ bringing the total percentage of the WA potentially affected to about 2.2%. While the SEZ would be visible in this second zone, the level of visual impact on wilderness characteristics and visitor experience would be reduced but could still be significant. Views of the SEZ from farther away in the wilderness would have a much reduced impact because of the distance and additional visual distractions within the viewshed. Because of the small percentage of the wilderness that would be affected and other human structures that are also visible from the designated wilderness, the overall impact on the WA is anticipated to be small.

Great Sand Dunes National Park and Preserve

The park is a very large area (150,000 acres [604 km^2]) that stretches from about 9 to 23 mi (14 to 37 km) from the SEZ. The nearer portions of the park are at or only slightly above the elevation of the SEZ and therefore do not have a good view of the SEZ. The higher elevations within the park are about 15 mi (24 km) distant, and development within the SEZ, although visible, would be far enough away to have little effect. It is anticipated that the overall visual effect of development of the SEZ would likely be low and would have minimal impact on park visitors.

The NPS has indicated a concern for potential impact on night sky viewing in the park that could be caused by lighting installed for any solar facilities.

Los Caminos Antiguos Scenic Byway

Travelers along approximately 50 mi (80 km) of the scenic byway would have visibility of solar development within the SEZ. A portion of the byway passes through the SEZ and about 14 mi (23 km) of the highway is within the most visually sensitive zone from 0 to 5 mi (0 to 8 km). The potential impact of development of the SEZ on byway users is not known, but solar development would be a very dominant visual feature within the 0 to 5 mi (0 to 8 km) zone. From longer distances, the development in the SEZ would still be visible but, depending on the technology employed, would have less visual impact. Taller solar facilities would create more visual impacts.

A portion of the byway serves as a major access road to Great Sand Dunes National Park and Preserve, and visitors traveling to the park via this route may find the industrial look of a solar facility in stark contrast to the views anticipated within the park. Whether this would be an issue of concern for park visitors is not known.

Old Spanish National Historic Trail

The route of the Old Spanish National Historic Trail is within 1 to 2 mi (1.6 to 3.2 km) of the eastern border of the SEZ, and portions of the trail, including a high-potential segment, would have clear views of development within the SEZ. The high-potential segment would be adversely affected by solar energy development resulting from visual impacts to the historic setting of the trail. If additional portions of the trail south of the high-potential segment are also determined to be significant as a result of future survey, these portions would also be adversely affected, with possible reductions in level of impact the farther the significant portions of the trail are from the SEZ. Potential impacts on the trail from solar energy development will be both site and technology specific and will require further analysis prior to approval of solar facilities.

San Luis Lakes State Park

The State Park is about 10 mi (16 km) north of the SEZ and is at about the same elevation as the SEZ. Because of the distance to the SEZ and the low viewing angle of facilities in the SEZ, it is not likely that there would be any significant impact on recreation users at the State Park. Taller solar facilities would create more visual impacts. Night sky viewing from the park could be adversely affected by lighting installed at the SEZ.

Blanca Peak

There would be a commanding view of the SEZ from the peak. Since the distance would be about 7 mi (11.3 km), it is not within the most sensitive zone, but the SEZ would be a major component of the western viewshed from the peak. The impact on visitors to the peak would likely vary depending on the individual and the solar technology employed, but a clear determination of impact has not been made. There is potential for impact on Native American religious values associated with Blanca Peak (see Section 10.3.17 for discussion of these potential impacts).

Sangre de Cristo NHA

The SEZ is included within the NHA, and planning for the NHA is not yet complete; thus it is difficult to assess the impact that solar development in the SEZ might have. However, an NHA is described as a place where natural, cultural, historic, and scenic resources combine to form a cohesive, nationally important landscape arising from patterns of human activity shaped by geography (NPS 2008). This definition implies that visual impacts from solar energy development could be of concern.

10.3.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

The nearest transmission line to the SEZ is about 2 mi (3.2 km) away, and construction of a transmission line to connect to that line would disturb about 61 acres (0.333 km^2). New transmission lines and associated construction and service roads would add to the visual impact associated with the SEZ facilities, including to the Old Spanish National Historic Trail. Because of the scarcity of BLM land in the vicinity, the transmission line would likely be built on private lands.

10.3.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts. However, without reducing the size of the SEZ there would be unmitigated impacts on a large portion of the Blanca Wetlands ACEC/SRMA; on the wilderness characteristics of the portion of the Sangre de Cristo WA within 5 mi (8 km) of the SEZ; on the Old Spanish National Historic Trail; and on visitors using the Los Caminos Antiguos Scenic Byway.

Proposed design features specific to the proposed Fourmile East SEZ include:

- Solar technologies in the SEZ should be restricted to those with the lowest profile to minimize the visual impact on nearby specially designated areas. Additionally, lighting within the SEZ should be carefully designed to minimize visual impacts on surrounding specially designated areas.

- Pending outcome of a study of the significance of potentially affected segments of the Old Spanish National Historic Trail, restrictions on solar facility development that might adversely impact trail resources should be put in place.

- Solar development on the east side of the scenic byway should not be approved, in order to reduce the negative visual effect on visitors from traveling on the road. This also would reduce the adverse impact on the scenic view from the highway looking to the east toward Blanca Peak and the WA. It could also reduce the potential impacts on the Old Spanish National Historic Trail.

- Consultation would be conducted to determine whether there would be adverse impacts on Native American religious values, and if so, what mitigation measures might be possible to reduce or eliminate such impacts.

- Early consultation should be initiated with the entity responsible for developing the management plan for the Sangre de Cristo NHA to understand how development of the SEZ could be consistent with NHA plans/goals.

Adoption of visual design features described in Appendix A, Section A.2.2, would reduce visual impacts on wilderness, historic, and scenic values and should be considered as part of any solar project analysis.

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10.3.4 Rangeland Resources

Rangeland resources include livestock grazing and wild horse and burros, both of which are managed by the BLM. Discussion of these resources and possible impacts of solar development within the proposed Fourmile East SEZ on these resources is presented in Sections 10.3.4.1 and 10.3.4.2.

10.3.4.1 Livestock Grazing

10.3.4.1.1 Affected Environment

The SEZ includes portions of two seasonal grazing allotments: Tobin Creek (#14117) and Foothills (#14107), which are run by separate permittees. These allotments are currently permitted to graze a total of 489 animal unit months (AUMs) per season. Table 10.3.4.1-1 summarizes key data for the allotments.

10.3.4.1.2 Impacts

Construction and Operations

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 for any range improvements in the area removed from the grazing allotment. The impact of this change in the grazing permits would depend on several factors, including (1) how much of an allotment the permittee might lose to development, (2) how important the specific land lost is to the permittee's overall operation, and (3) the amount of actual forage production that would be lost by the permittee.

TABLE 10.3.4.1-1 Grazing Allotments within the Proposed Fourmile East SEZ[a]

Allotment	Total Acres	% Total in SEZ[b]	Private Acres	Total Permitted AUMs	No. of Permittees
Tobin Creek	6,488	58	360	139	1
Foothills	5,340	5	640	350	1

[a] Total acres, including public and private land, are from the BLM Rangeland Administration System report (BLM 2009a).

[b] Represents the percentage of public land in the allotment within the SEZ.

If full solar development occurred in the SEZ, it is assumed that the federal grazing permit for the Tobin Creek allotment would be cancelled because all of the consolidated federal lands in that allotment would be developed. It is anticipated that all 139 AUMs currently authorized on the allotment would be lost. Because only a very small percentage of the Foothills allotment is included in the SEZ, there would be no impact on that allotment**,** although the permit would be modified to exclude the 240 acres (0.99 km^2) of the allotment in the SEZ.

The impact from modifying the Tobin Creek allotment on the permittee would depend on how much the loss would affect the permittee's overall operation. If the permittee depends solely on the Tobin Creek allotment, the loss of the use of grazing permit would be a major impact. If the allotment represents a small portion of the permittee's overall operation, the impact would be less. Section 10.3.19.2.1 provides more information on the economic impact of the loss of the 139 AUMs of grazing capacity in the allotment.

Although the impact on the Tobin Creek permittee would depend on the specific situation, there would be an adverse economic impact and possibly an adverse social impact, since for many permittees, having grazing allotments on public lands has been a longstanding tradition. It is possible that solar development proponents could purchase all or portions of the existing allotment both to facilitate solar operations and to reduce the adverse economic impact on the permittee from the loss of the grazing permit.

Transmission Facilities and Other Off-Site Infrastructure

A new transmission line and associated construction and service road would add about 61 acres (0.25 km^2) of surface disturbance to the impact associated with the SEZ facilities. This disturbance would not add a significant additional impact to grazing operations.

10.3.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, could minimize disruption of grazing operations; however, it may not be possible to fully mitigate the economic loss to the holders of grazing permits and the social impacts from loss of grazing rights.

10.3.4.2 Wild Horses and Burros

10.3.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. No wild or feral horses occur within the proposed Fourmile East SEZ or in proximity to it.

10.3.4.2.2 Impacts

Solar energy development of the proposed Fourmile East SEZ would not affect wild horses and burros.

10.3.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary to avoid or minimize impacts on wild horses and burros.

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10.3.5 Recreation

10.3.5.1 Affected Environment

The proposed Fourmile East SEZ is flat, and it has no unique recreation or other resource values that would attract recreation users from distant locations. Although there are no recreation data specific to the area, the area is likely used by local residents for general outdoor recreation, including horseback riding, OHV and backcountry driving, and small game hunting. Good access to the area is available via State Highway 150 and County Roads 4S, 4.4S, and 6S that go through the area. The area has been designated in the San Luis Valley Travel Management Plan as Limited, Designated Roads and Trails. There are several road/trail segments within the SEZ identified as Open Motorized Road that are available for OHV or vehicular travel. There are also several low-quality dirt roads that wind through portions of the area but that are not designated for motorized use. Recreational use of the SEZ area is likely minimal.

CO 150, which passes directly through the SEZ, is a portion of the Los Caminos de Antiguos Scenic Byway, a state- and BLM-designated scenic byway. This highway is also a major access route to Great Sand Dunes National Park, located about 10 mi (16 km) north of the SEZ. Part of the scenic attraction of the highway is the view of Blanca Peak, located northeast of the SEZ, and the Sangre de Cristo Mountains and USFS-administered wilderness lands about 3 mi (5 km) northeast of the SEZ.

The Rio Grande Scenic Railroad runs scenic train tours between Alamosa and La Veta seven days a week between Memorial Day and October 31. Saturday-only trips are available from January 2 through the spring. During the main summer season, visitors have the option of leaving the train at Blanca to travel to Great Sand Dunes National Park for a brief visit (RGSR 2009). The train route passes about 2.5 mi (4 km) south of the SEZ, and most of the SEZ is within 5 mi (8 km) of the railroad. The side trip to Great Sand Dunes National Park travels along the Los Caminos de Antiguos Scenic Byway, which passes through the SEZ on the way to the park.

10.3.5.2 Impacts

10.3.5.2.1 Construction and Operations

Recreational users would be excluded from any portions of the proposed Fourmile East SEZ developed for solar energy production, and recreation opportunities within the area would be lost. Because of the low level of recreation use on the site, impacts from the loss of the area would be minimal. Users displaced from the SEZ would have similar opportunities on nearby public lands.

Should the SEZ be developed, the resulting industrial area would straddle about 2.5 mi (4 km) of the scenic byway that provides access for many recreation visitors to other important recreation attractions in the area, especially the Great Sand Dunes National Park and Preserve. Development of the portion of the SEZ on the east side of the highway also would interfere with views of Blanca Peak and the Sangre de Cristo Mountains. Development of the SEZ would be a dominating factor in the viewshed of the scenic byway for about 14 mi (23 km) of its length and for about 5 mi (8 km) of the scenic railroad route. The potential impact on recreation visitors to the area is difficult to determine and would likely vary by individual and solar technology employed. Some people could find the solar development very distracting from the primary purpose of their trip while others might find it an interesting addition.

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If such routes were identified during project-specific analyses, they would be re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

10.3.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

The nearest transmission line to the SEZ is about 2 mi (3.2 km) away, and construction of a transmission line to connect to that line would disturb about 61 acres (0.25 km^2). New transmission lines and associated construction and service roads would add to the visual impact associated with the SEZ facilities. This, however, would contribute only a minor amount to the direct impact on recreation resources relative to that caused by development within the SEZ.

10.3.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would minimize impacts on recreational use. However, because of the density of specially designated areas, scenic resources, and visually sensitive recreation resources, it is likely there would be unmitigated impacts associated with development of the SEZ.

Proposed design features specific to the proposed Fourmile East SEZ include:

- The portion of the SEZ on the east side of the scenic byway should be eliminated to reduce the negative visual effect on visitors traveling on the scenic byway and to reduce the visual impacts looking to the east toward Blanca Peak and the Sangre de Cristo Mountains.

- Solar technologies in the SEZ should be restricted to those with the lowest profile to minimize the visual impact and the effect on recreation visitors.

10.3.6 Military and Civilian Aviation

10.3.6.1 Affected Environment

The proposed Fourmile East SEZ is located under an MTR and is identified as being in a consultation area for the DoD. The San Luis Valley Regional Airport is located near Alamosa, about 12 mi (19 km) west-southwest of the SEZ.

10.3.6.2 Impacts

Development of any solar or transmission facilities that impinge into airspace used by the military would be of concern to the military and could interfere with military training activities. Preliminary input from the DoD, however, has indicated that it has no concerns about potential impacts on its activities from development

There would be no impacts on regional airport operations from solar energy development, but FAA regulations might require special marking of certain types of solar facilities.

10.3.6.3 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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10.3.7 Geologic Setting and Soil Resources

10.3.7.1 Affected Environment

10.3.7.1.1 Geologic Setting

Regional Geology

The proposed Fourmile East 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 10.3.7.1-1). 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 10.3.7.1-2). The proposed Fourmile East SEZ is located along the eastern edge of the Alamosa Basin near the base of the Sangre de Cristo Range. 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 10.3.7.1-3) (Leonard and Watts 1989).

The proposed Fourmile East SEZ sits above the Baca graben, the deepest part of the Alamosa Basin, where basin fill sediments are estimated to be up to 19,000 ft (5,800 m) deep (Figure 10.3.7.1-3) (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 up to 2,050 ft (610 m) thick above the Baca 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 interbedded buff to pink clays and silty sands of the Santa Fe Group (Miocene to Pliocene). These sediments are intertongued with the alluvial sediments of the Los Pinos Formation to the west and crop out near the eastern edge of the basin along the Northern Sangre de Cristo fault zone. The Los Pinos Formation (Oligocene to Pliocene) consists of eastward-thickening sandy gravels interbedded with volcanic rocks (tuffs and tuffaceous siltstones and conglomerates). Below the Santa Fe Formation are Tertiary and Cretaceous sedimentary rocks that predate the Vallejo Formation. These rocks overlie a basement complex of Precambrian igneous and metamorphic rocks (Brister and Gries 1994; Burroughs 1974, 1981; Leonard and Watts 1989; Molenar 1988).

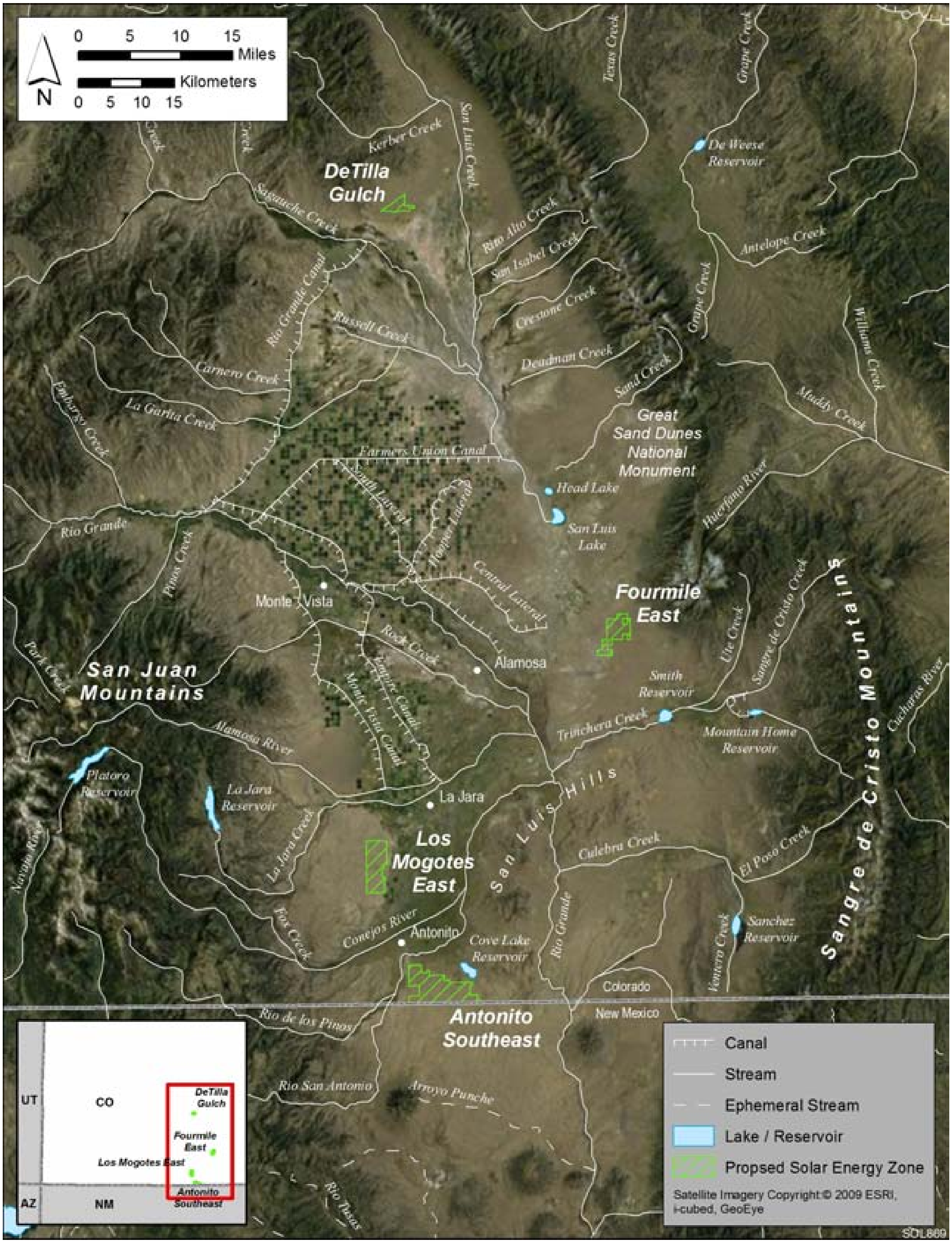

FIGURE 10.3.7.1-1 Physiographic Features of the San Luis Valley

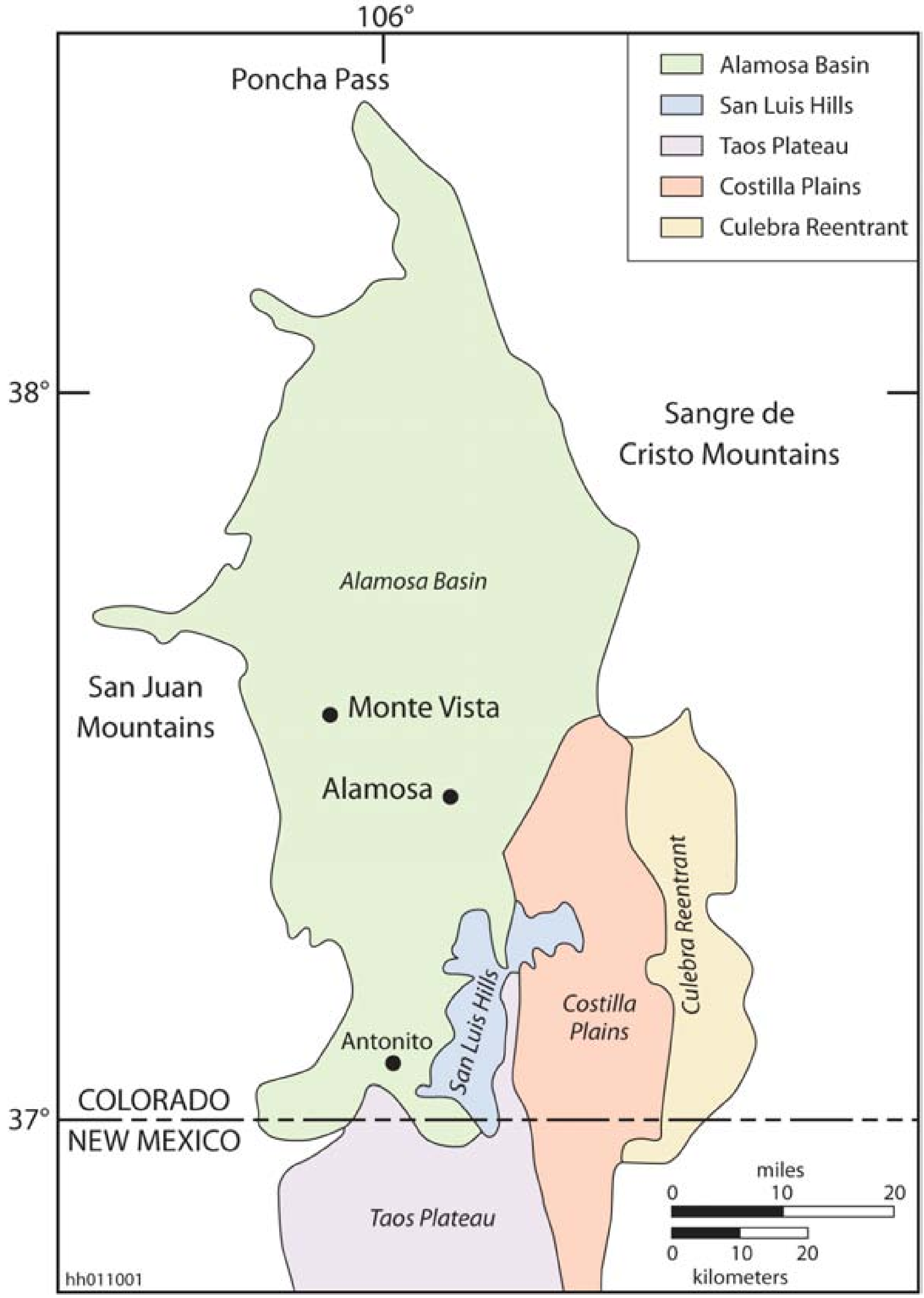

FIGURE 10.3.7.1-2 Physiographic Subdivisions within the San Luis Basin (modified from Burroughs 1981)

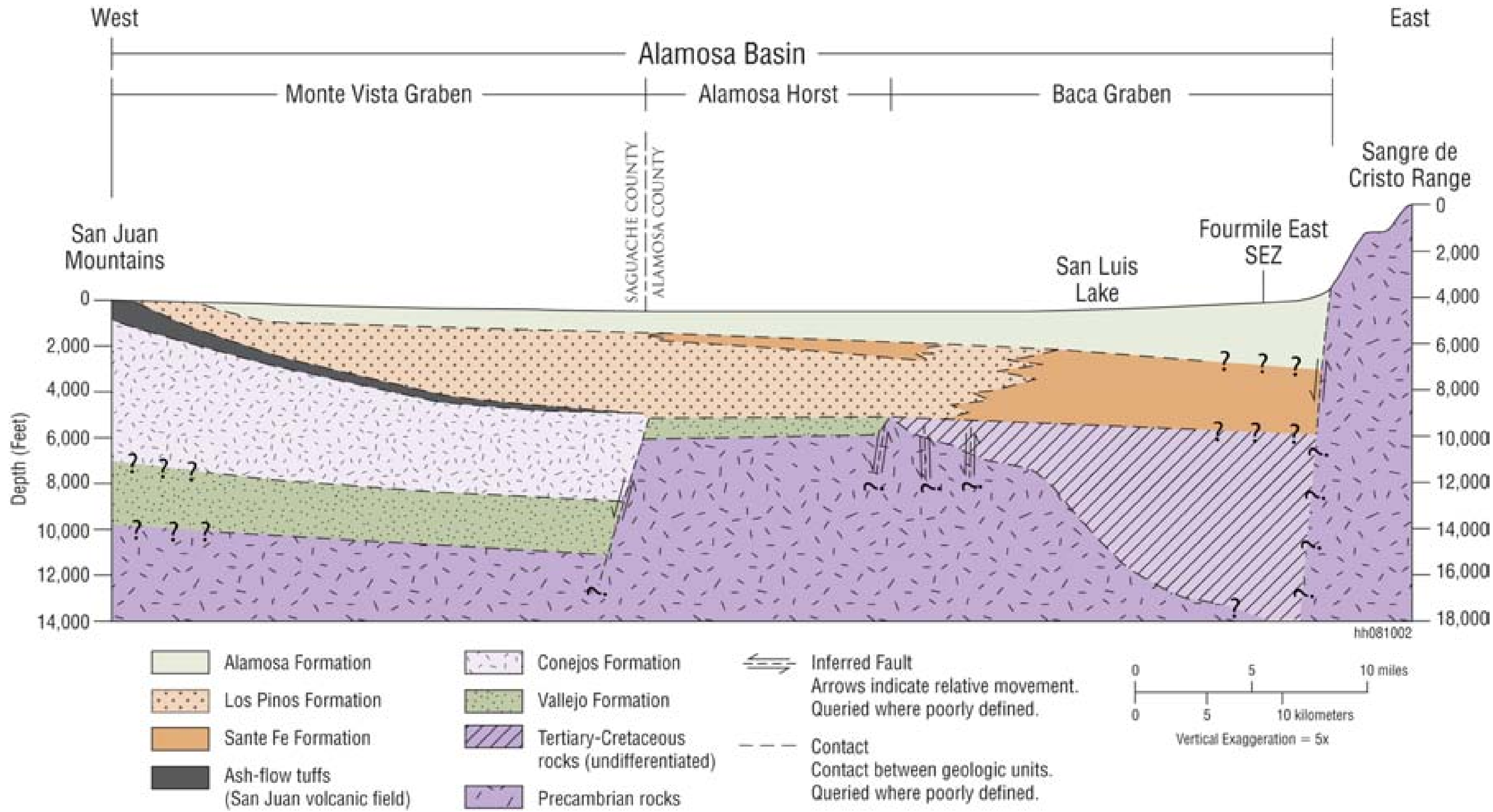

FIGURE 10.3.7.1-3 Generalized Geologic Cross Section (west to east) across the Northern Part of the Alamosa Basin (modified from Leonard and Watts 1989)

Exposed sediments in the San Luis Valley consist mainly of modern alluvial deposits and the fluviolacustrine clays and sands of the Alamosa Formation (Figure 10.3.7.1-4). 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 (Emery 1979; Leonard and Watts 1989).

The proposed Fourmile East SEZ is located in a topographic depression, known as the closed basin, about 10 mi (17 km) southeast of San Luis Lake in Alamosa County (Figure 10.3.7.1-1). Its terrain is relatively flat with a very gentle dip to the west and northwest (Figure 10.3.7.1-5). Elevations range from about 7,680 ft (2,341 m) near the northeastern corner of the site to less than 7,600 ft (2,316 m) along its western boundary.

Geologic Hazards

The types of geologic hazards that could potentially affect solar project sites and the potentially applicable mitigation measures to address them are discussed in Sections 5.7.3 and 5.7.4. The following sections provide a preliminary assessment of these hazards at the proposed Fourmile East SEZ. Solar project developers may need to conduct a geotechnical investigation to assess geologic hazards locally to better identify facility design criteria and site-specific design features to minimize their risk.

Seismicity. Seismic activity associated with earthquakes in Colorado is low to moderate, with a slightly higher risk in and around the Rio Grande rift zone (Kirkham and Rogers 1981). The rift zone is an extensional stress regime and consists of a series of grabens (fault-bounded basins) that extend along the northeast-oriented rift axis. It is currently dormant; however, earthquakes could potentially occur as a result of movement along existing normal faults within and along the boundaries of the San Luis Basin (Blume and Sheehan 2002).

No known Quaternary faults occur within the proposed Fourmile East SEZ. The closest Quaternary fault is the Northern Sangre de Cristo fault system that lies about 3 mi (4.8 km)

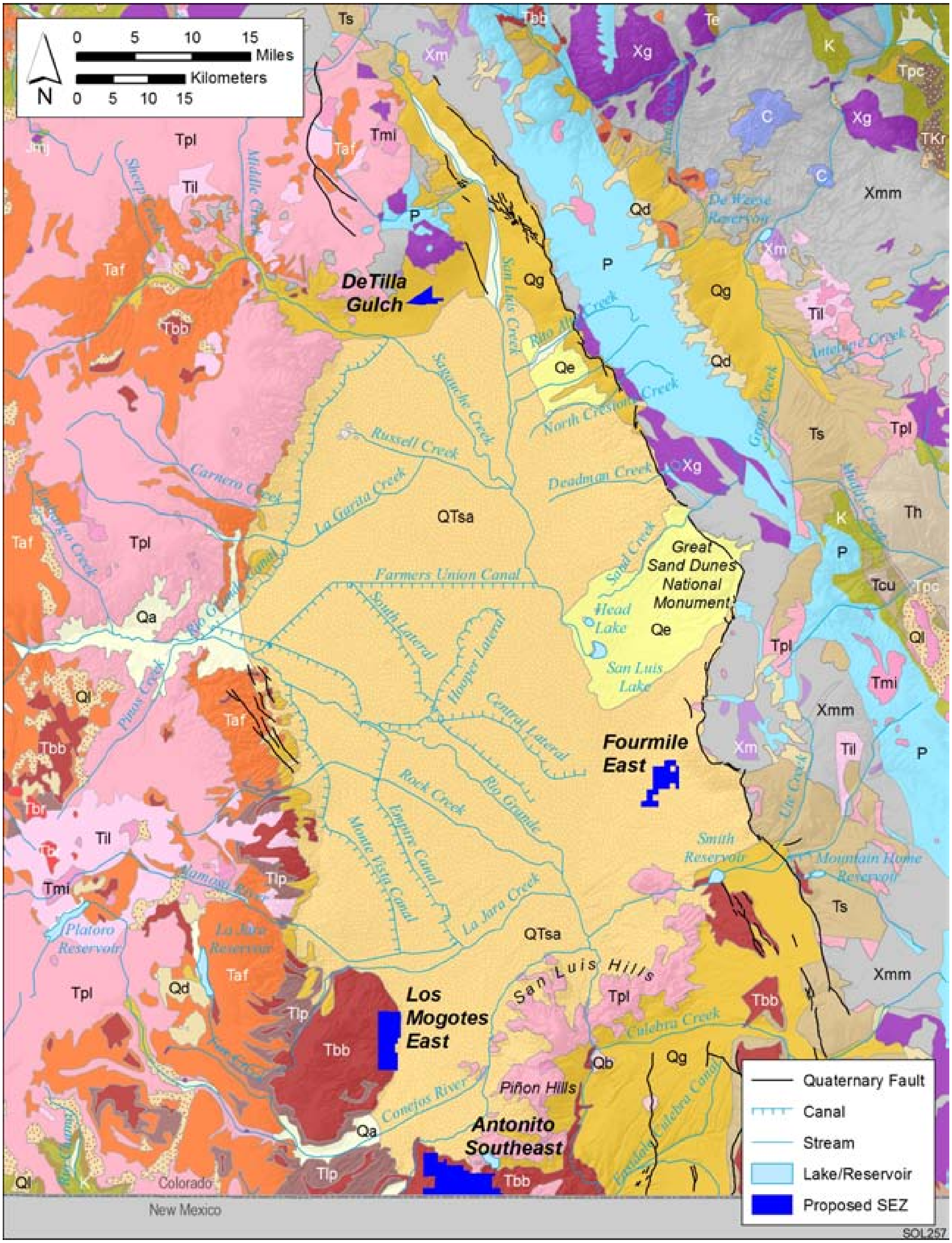

FIGURE 10.3.7.1-4 Geologic Map of the San Luis Valley and Vicinity (Stoeser et al. 2007 and Tweto 1979)

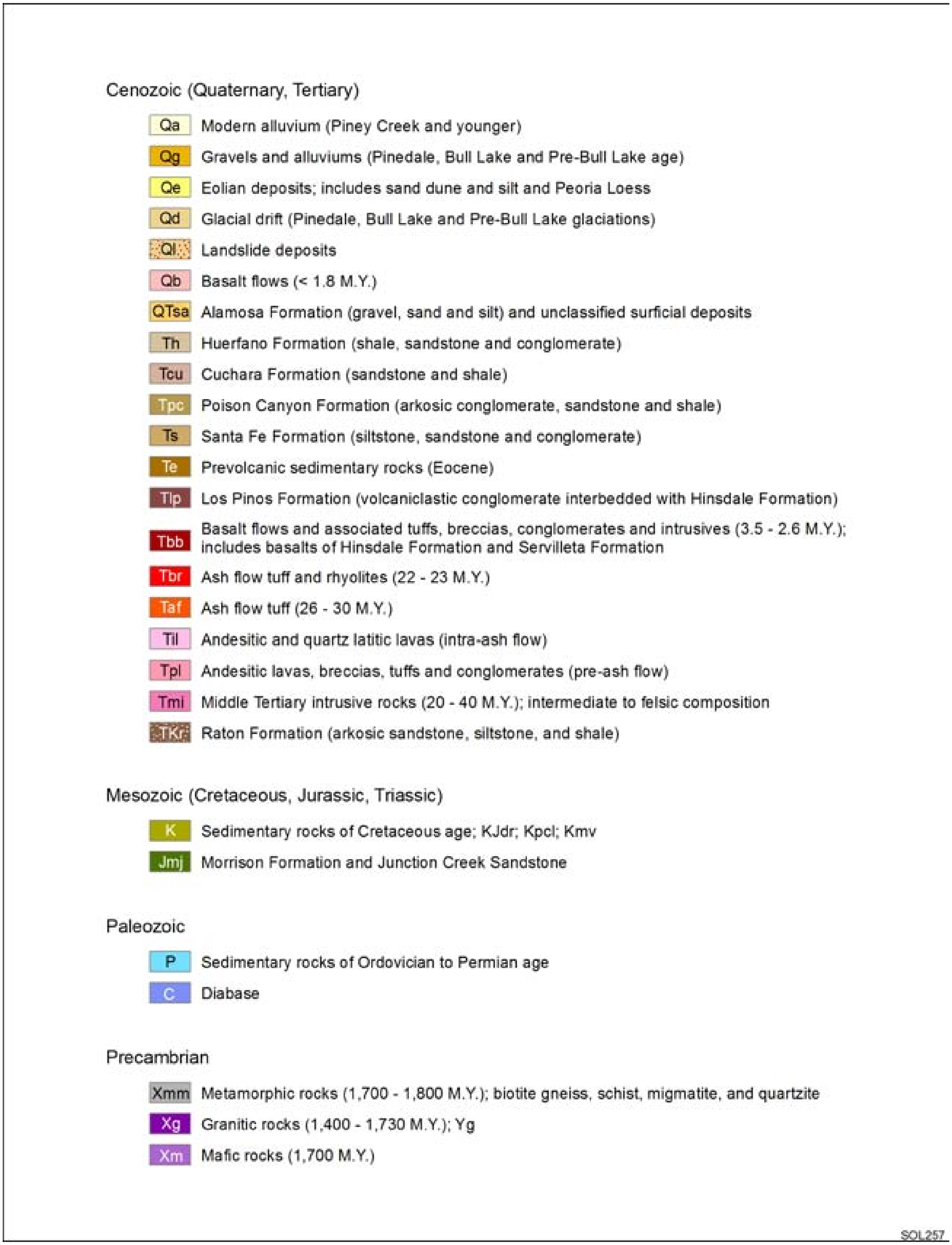

FIGURE 10.3.7.1-4 (Cont.)

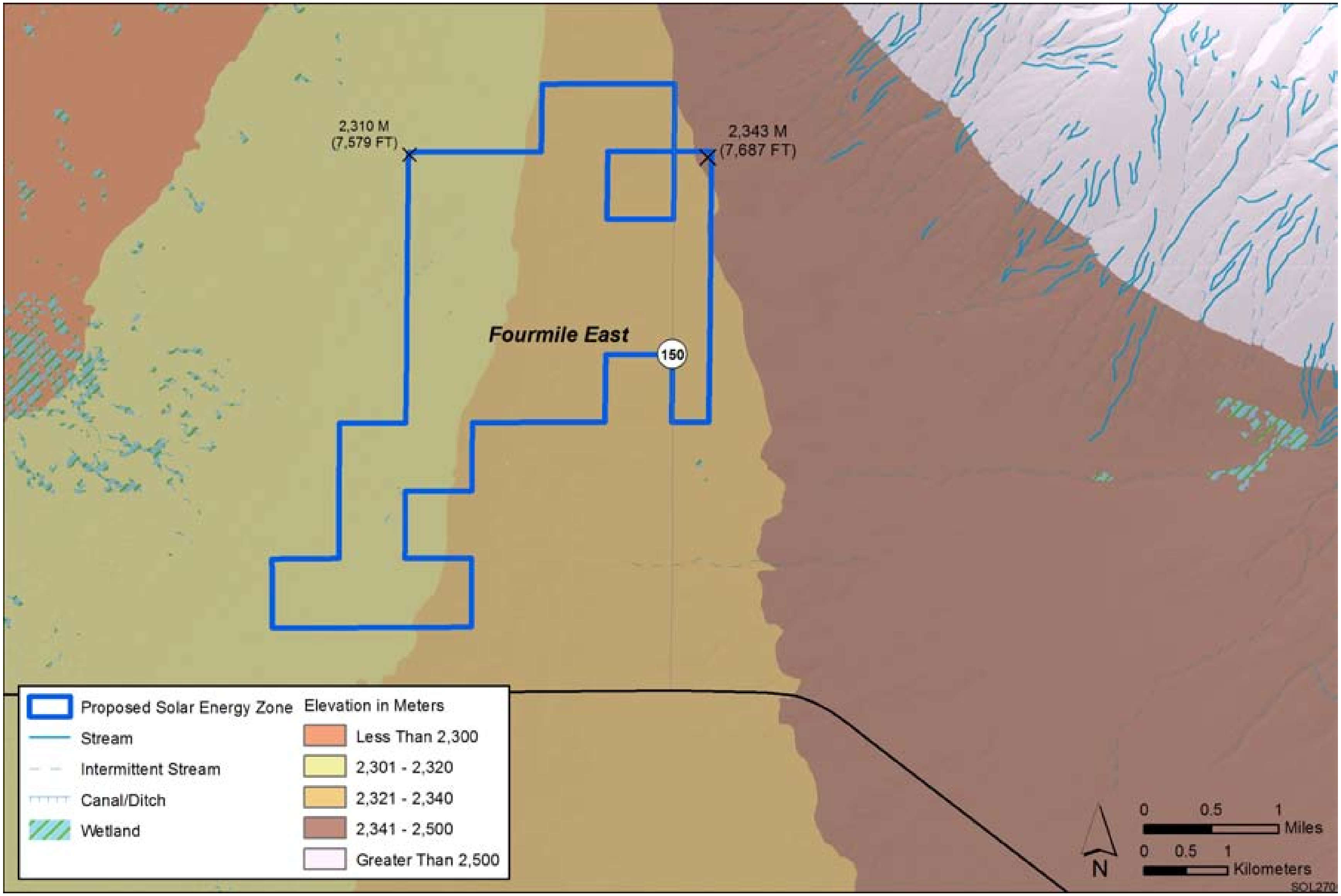

FIGURE 10.3.7.1-5 General Terrain of the Proposed Fourmile East SEZ

northeast of the SEZ (Figure 10.3.7.1-6). 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 1998).

From June 1, 2000, to May 31, 2010, 95 earthquakes were recorded within a 61-mi (100-km) radius of the proposed Fourmile East SEZ. The largest earthquake during that period occurred on August 10, 2005 (it is also the largest recorded earthquake since 1987). It was located about 60 mi (95 km) southeast of the SEZ in the Canadian River Valley (New Mexico) and registered a moment magnitude (Mw)[1] of 5.0 (Figure 10.2.7.1-6). During this period, 59 (62%) of the recorded earthquakes within a 61-mi (100-km) radius of the SEZ had magnitudes greater than 3.0 (USGS 2010a).

Liquefaction. The proposed Fourmile East SEZ lies within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.05 and 0.06 g. Shaking associated with this level of acceleration is generally perceived as moderate; however, the potential for damage to structures is very light (USGS 2008). Given the low intensity of ground shaking and the low incidence of historic seismicity in the San Luis Valley, the potential for liquefaction in valley sediments is also likely to be low.

Volcanic Hazards. The San Juan Mountains west of the San Luis Valley 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 along the western edge of the San Luis Valley and in the San Luis Hills, and the younger basalt flows (e.g., the Servilleta Basalt) of the Taos Plateau in the southern part of the valley (Brister and Gries 1994; Lipman 2006; Lipman and Mehnert 1979; Lipman et al. 1970; Thompson et al. 1991).

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[1] Moment magnitude (Mw) is used for earthquakes with magnitudes greater than 3.5 and is based on the moment of the earthquake, equal to the rigidity of the earth times the average amount of slip on the fault times the amount of fault area that slipped (USGS 2010b).

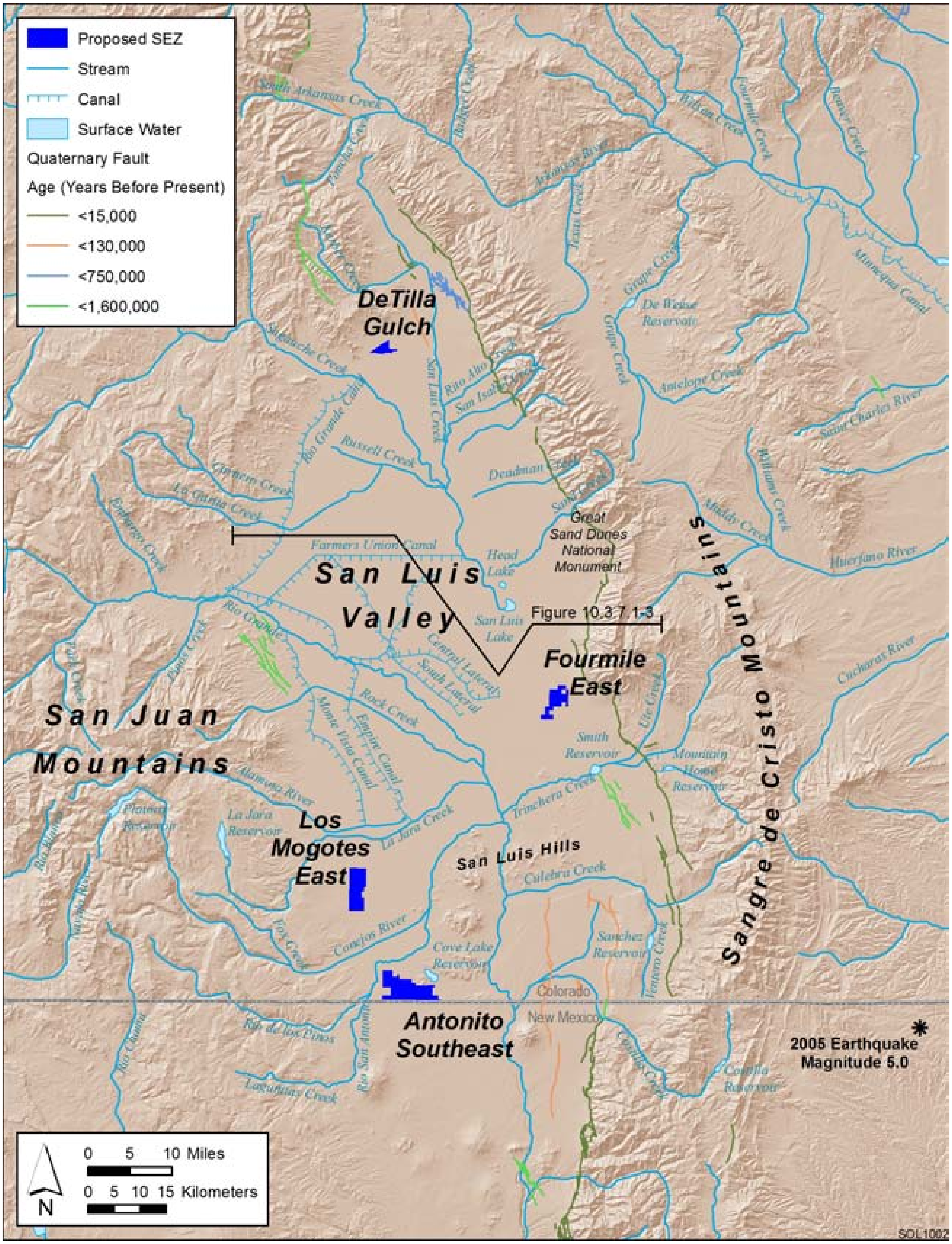

FIGURE 10.3.7.1-6 Quaternary Faults in the San Luis Valley (USGS and CGS 2009; USGS 2010a)

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 Fourmile East 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 10.3.9.1.1 provides further discussion of flood risks within the Fourmile East SEZ.

10.3.7.1.2 Soil Resources

Soils within the proposed Fourmile East SEZ are predominantly loamy fine sands and loamy sands of the Space City, Hooper, and Mosca Series, which together make up about 73% of the soil coverage at the site (Figure 10.3.7.1-7). Soil map units within the Fourmile East SEZ are described in Table 10.3.7.1-1. Parent material consists of alluvium and eolian sands derived from igneous rock. Soils are characterized as deep and well to somewhat excessively well drained. Most soils on the site have moderate to high surface runoff potential and slow to rapid permeability. Except for dune land soils that cover less than 1% of the site, the natural soil

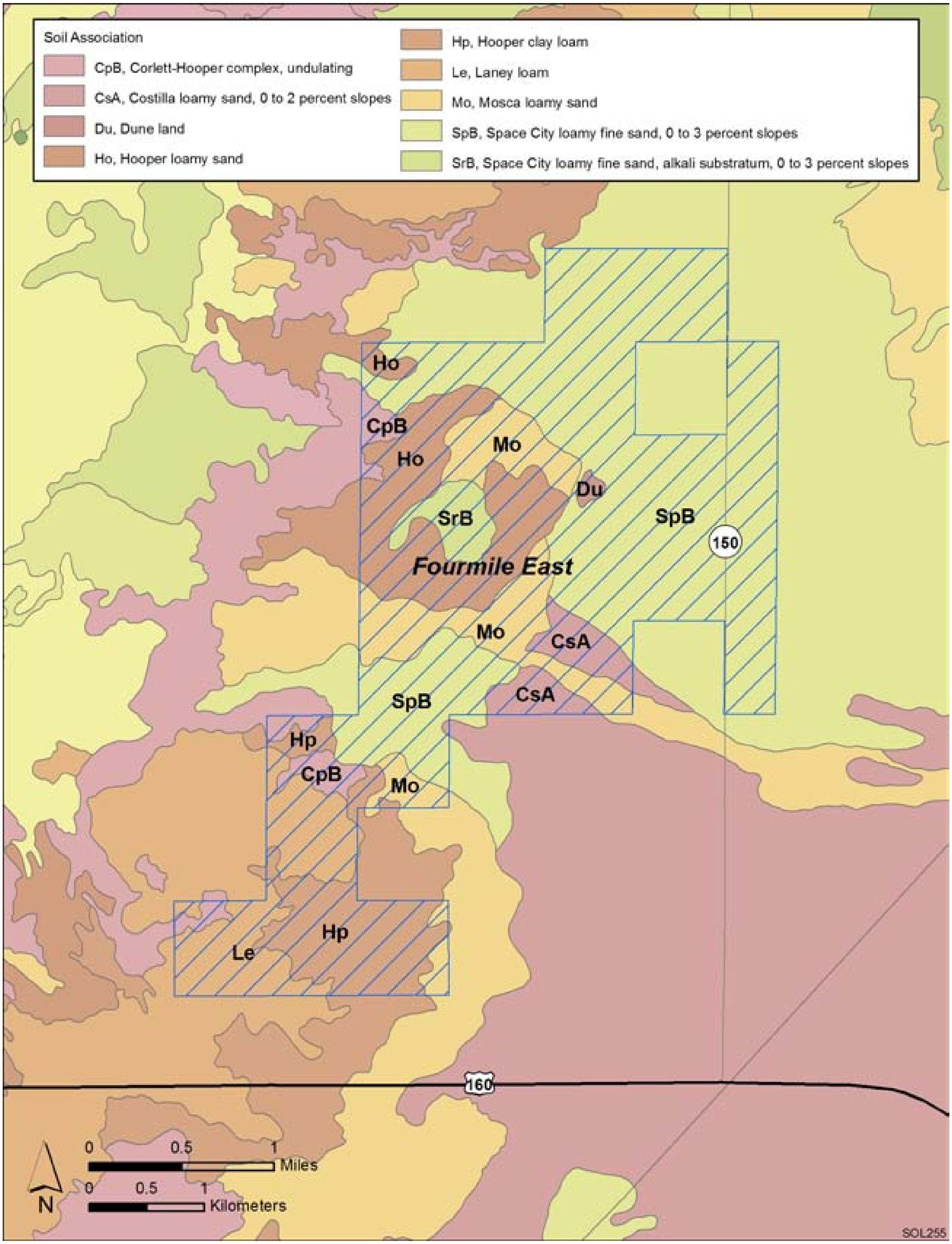

FIGURE 10.3.7.1-7 Soil Map for the Proposed Fourmile East SEZ (NRCS 2008)

TABLE 10.3.7.1-1 Summary of Soil Map Units within the Proposed Fourmile East SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area, in Acres[b] (% of SEZ)
SpB	Space City loamy fine sand (0 to 3% slope)	Slight	High (WEG 2)[c]	Level to nearly level soils along isolated low ridges on the valley floor. Parent material consists of eolian sands derived from igneous rock. Somewhat excessively drained with high surface runoff potential (low infiltration rate) and rapid permeability. Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used mainly as rangeland.	1,886 (49)
Mo	Mosca loamy sand	Slight	High (WEG 2)	Nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained with moderate surface runoff potential and moderate permeability; moderately to strongly alkaline. Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used locally for irrigated crops and pastureland. Farmland of unique importance.[d]	466 (12)
Ho	Hooper loamy sand	Slight	High (WEG 2)	Level to nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained with high surface runoff potential (low infiltration rate) and slow permeability; strongly alkaline. Shrink-swell potential is low to moderate. Available water capacity is low. Moderate rutting hazard. Used mainly as rangeland.	463 (12)
Hp	Hooper clay loam	Slight	High (WEG 1)	Level to nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained with high surface runoff potential (low infiltration rate) and slow permeability; strongly alkaline. Most areas are without vegetation; provides some cover for wildlife. Shrink-swell potential is moderate to high. Available water capacity is very low. Severe rutting hazard. Used mainly as rangeland.	354 (9)

TABLE 10.3.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area, in Acres[b] (% of SEZ)
Le	Laney loam	Slight	Moderate (WEG 4) [c]	Nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low to moderate. Available water capacity is moderate. Severe rutting hazard. Used mainly as rangeland.	341 (9)
CsA	Costilla loamy sand (0 to 2%)	Slight	High (WEG 1)	Level to nearly level soils on floodplains. Parent material consists of wind-worked alluvium. Deep and somewhat excessively drained with low runoff potential (high infiltration rate) and rapid permeability. Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used locally for irrigated cropland.	150 (4)
CpB	Corlett-Hooper complex, undulating	Slight	High (WEG 1)	Composed of 45% Corlett sand and loamy sand, 40% Hooper loamy sand and sandy loam, and 15% minor components. Parent material consists of eolian deposits; soils occur on and between sand dunes. Undulating, deep and moderately well drained with low surface runoff potential (high infiltration rate) and rapid permeability. Shrink-swell potential is low. Available water capacity is very low. Severe rutting hazard.	115 (3)
SrB	Space City loamy fine sand, alkali substratum (0 to 3% slope)	Slight	High (WEG 2)	Level to nearly level soils along isolated low ridges on the valley floor. Parent material consists of eolian sands derived from igneous rock. Somewhat excessively drained, with low surface runoff potential (high infiltration rate) and rapid permeability. Strongly alkaline below 24 in.[e] Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used mainly as rangeland.	94 (2)

TABLE 10.3.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area, in Acres[b] (% of SEZ)
Du	Dune land	Very severe	High (WEG 1)	Constantly shifting medium-grained sand deposited by wind blowing across the valley. Parent material consists of eolian sands. Little or no vegetation; low surface runoff potential (high infiltration rate) and very rapid permeability. Shrink-swell potential is low. Available water capacity is very low. Severe rutting hazard.	13 (<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. A rating of “very severe” indicates that significant erosion is expected; loss of soil productivity and damage are likely and erosion control measures are costly and generally impractical.

[b] To convert acres to km^2, multiply by 0.004047.

[c] WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and 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: WEGs 1 and 2, 134 tons per acre per year; and WEG 4, 86 tons per acre per year.

[d] Farmland is of unique importance for the production of food, feed, fiber, forage, or oilseed crops.

[e] To convert from in. to cm, multiply by 2.54.

Sources: NRCS (2009); USDA (1968).

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 but the dune land soils, which have a very severe risk of erosion if disturbed. Depending on the vegetative cover, the susceptibility to wind erosion is high, with as much as 134 tons (122 metric tons) of soil eroded by wind per acre each year (NRCS 2009).

The soils of the Corlett-Hooper complex occur on and between sand dunes and cover about 3% of the site. Soils in this complex as well as the Hooper clay loam, covering about 9% of the site, are 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 (NRCS 2009).

10.3.7.2 Impacts

Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase of a solar project. These impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. Such impacts are common to all utility-scale solar energy developments in varying degrees and are described in more detail for the four phases of development in Section 5.7.1.

Because impacts on soil resources would 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.

It is not known whether construction within the proposed Fourmile East SEZ would affect the eolian processes that maintain the Great Sand Dunes north of the site. Because the area is a designated National Monument and Preserve, the developer may be required to conduct a study to evaluate the impacts of building a solar facility close to the landform and to develop specific mitigation measures to avoid or minimize those impacts.

10.3.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

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.

[2] A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding (NRCS 2009).

A proposed design feature specific to the proposed Fourmile East SEZ is as follows:

- The need for a study to evaluate the potential impacts of building a solar facility in close proximity to the Great Sand Dunes should be determined.

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10.3.8 Minerals (Fluids, Solids, and Geothermal Resources)

10.3.8.1 Affected Environment

The San Luis Basin is identified as an oil and gas producing region (Burnell et al. 2008), although there is no current production. Nevertheless, 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. Currently, there are no oil and gas leases in the proposed Fourmile East SEZ, although almost all of the area was leased for oil and gas at one time (BLM and USFS 2010b). No oil or gas is currently produced in Alamosa County (Burnell et al. 2008). The area is still open for discretionary mineral leasing, including leasing for oil and gas.

Currently, there are no mining claims in the SEZ (BLM and USFS 2010a). Lands in the SEZ were closed to locatable mineral entry in June 2009 pending the outcome of this PEIS (74 FR 31308–31309).

The San Luis Basin is also a region of known and potential geothermal resources. Several geothermal springs and wells have been developed in the northern part of the basin, the nearest at Alamosa, about 21 mi (34 km) west of the proposed Fourmile East SEZ (Laney and Brizzee 2005). No geothermal development has occurred within or adjacent to the SEZ (BLM and USFS 2010b).

10.3.8.2 Impacts

If the BLM identifies the proposed Fourmile East SEZ 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 existing mining claims, it is assumed that valuable locatable minerals are not present on the site and 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. Additionally, oil and gas development utilizing directional drilling to access resources under the area (should any be found) could be allowed.

Solar energy development of the SEZ would preclude future surface use of the site to produce geothermal energy but would not preclude the possibility of accessing any geothermal resources, should any be found, through directional drilling. Because of this option and the lack of current geothermal development within the SEZ, solar development of the SEZ would have no impact on development of geothermal resources.

If the area is identified as an SEZ, some mineral uses might be allowed. For example, oil and gas development that uses directional drilling to access resources under the area (should any be found) could be allowed. 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.

10.3.8.3 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 to mineral leasing.

10.3.9 Water Resources

10.3.9.1 Affected Environment

The proposed Fourmile East SEZ is located in the San Luis Valley, which is in the Rio Grande Headwaters subbasin of the Rio Grande hydrologic region (USGS 2010a). The San Luis Valley covers approximately 2 million acres (8,094 km^2) and is bounded by the San Juan Mountains to the west and the Sangre de Cristo Mountains to the east. The northern portion of the San Luis Valley is internally drained toward San Luis Lake and is referred to as the "closed basin" (see inset of Figure 10.3.9.1-1), while the southern portion of the valley drains to the Rio Grande (Mayo et al. 2007; Topper et al. 2003). The proposed Fourmile East SEZ is located in the eastern portion of the San Luis Valley and has surface elevations ranging from 7,585 to 7,675 ft (2,312 to 2,339 m) with a general east-to-west 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 eastern San Luis Valley are on the order of 8.5 and 24 in. (22 and 61 cm), respectively (WRCC 2010a). Precipitation and snowfall amounts are much greater in the surrounding mountains and are on the order of 22 and 150 in. (56 and 381 cm), respectively, at elevations greater than 9,000 ft (2,743 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) (Emery 1994; Leonard and Watts 1989; Mayo et al. 2007).

10.3.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)

No permanent surface water bodies occur on the proposed Fourmile East SEZ. Several ephemeral washes drain off the Sangre de Cristo Mountains, but they all end about 1 mi (1.5 km) east of the SEZ. Smith Reservoir is located about 5 mi (8 km) southeast of the SEZ and is fed by Sangre de Cristo Creek and Ute Creek. The Rio Grande is about 8 mi (13 km) southeast of the proposed SEZ, flowing from northwest to southeast through the Alamosa National Wildlife Refuge (Figure 10.3.9.1-1). Additionally, two laterals that originate about 6 mi (10 km) west of the proposed SEZ deliver groundwater from the closed basin portion of the San Luis Valley to the Rio Grande as a part of the closed basin project (operated by the U.S. Bureau of Reclamation) to help support Rio Grande Compact obligations (see Section 10.3.9.1.3 for further details on the Rio Grande Compact).

Flood hazards have not been identified (Zone D) for the area surrounding the proposed Fourmile East SEZ (FEMA 2009). However, shallow ponding and runoff in ephemeral washes can occur during rain events.

The NWI identified several small palustrine wetlands with emergent vegetation along the western boundary of the proposed Fourmile East SEZ (USFWS 2009). The Alamosa National Wildlife Refuge is located 6 mi (10 km) southwest of the proposed SEZ and contains several wetlands consisting of wet meadows, oxbow lakes, and riparian floodplain regions of the Rio Grande. These wetlands are described in more detail in Section 10.3.10.1 and are

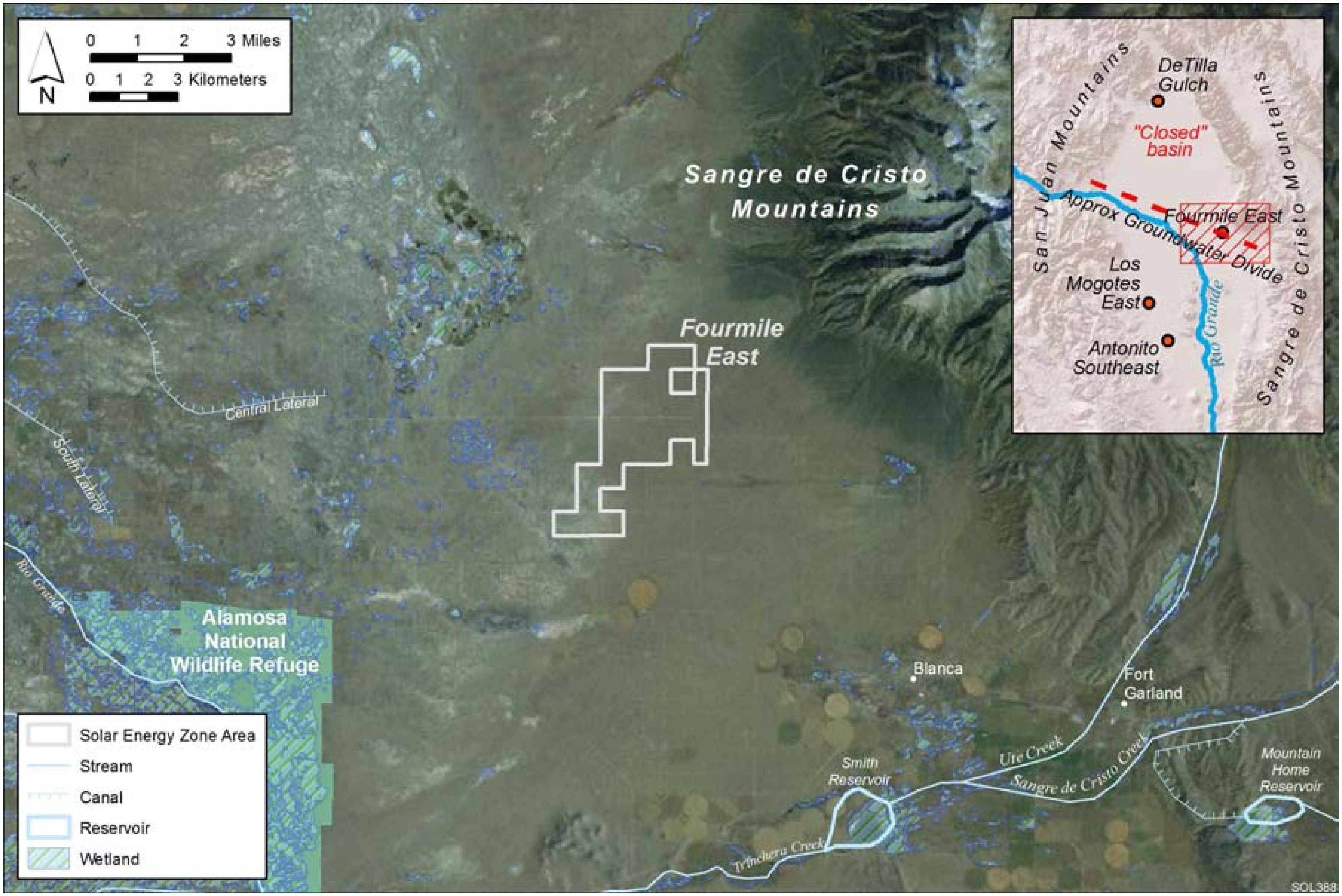

FIGURE 10.3.9.1-1 Surface Water Features near the Proposed Fourmile East SEZ

characterized as being intermittently flooded, which suggests that surface water is present for variable periods of time throughout the year.

10.3.9.1.2 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) thick 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. Flow, however, 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 Fourmile East SEZ is situated atop the distal area of an alluvial fan above the Baca Graben where the basin fill material can be as much as 19,000 ft (5,800 m) thick (Mackelprang 1983). The unconfined aquifer in this region of the San Luis Valley is about 125 ft (38 m) thick, below which lies the confining clay layer that is on the order of 100 ft (30 m) thick separating the unconfined and confined aquifers (Colorado DWR 2010a; RGWCD 2010). The unconfined aquifer is the primary source of groundwater withdrawals in the San Louis Valley (Colorado District Court 2004). Three monitoring wells with well depths ranging from 50 to 169 ft (15 to 52 m) in the unconfined aquifer are located within the proposed SEZ. Depth to groundwater in these wells is between 32 and 52 ft (10 and 16 m) below the surface, and all wells have shown declines in groundwater surface elevations at a rate of approximately 0.4 ft/yr (0.1 m/yr) over the past couple decades (USGS 2010b; well numbers 372923105383501, 372948105385202, 373106105363401). The overall groundwater flow path in the unconfined aquifer is from east to west in this portion of the San Luis Valley (RGWCD 2010). Monitoring wells in the confined aquifer are located 4 mi (6 km) northwest and 6 mi (10 km) southwest of the proposed SEZ, and all indicate that the confined aquifer is under artesian conditions (RGWCD 2010; well numbers ALA04, ALA11, and ALA 15).

Mayo et al. (2007) summarized the TDS of groundwater in the unconfined and upper confined aquifers. The TDS in the unconfined aquifer water is estimated to be less than 250 mg/L. The upper confined aquifer water has TDS concentrations between 20 and 100 mg/L. Water collected at a depth of 5,500 ft (1,674 m) in the Baca Graben showed TDS concentrations of about 4,000 mg/L (Burroughs 1981).

10.3.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals in Alamosa County were estimated to be 305,017 ac-ft/yr (376 million m^3/yr), of which about 14% was from surface water sources (streams, springs, and irrigation canals and laterals) and 86% was from groundwater. The largest water use category was irrigation, composing 98% of the water use in that year, and groundwater withdrawals for irrigation totaled 300,130 ac-ft/yr (370 million m^3/yr). Other water use categories for groundwater were for public supply at 2,836 ac-ft/yr (3.5 million m^3/yr), aquaculture at 1,894 ac-ft/yr (2.3 million m^3/yr), livestock at 123 ac-ft/yr (152,000 m^3/yr), and mining at 11 ac-ft/yr (14,000 m^3/yr) (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 Fourmile East 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 to 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 depletions in terms of timing, location, amount, and quality (Colorado DWR 2008).

A major element of water management in the San Luis Valley is the Rio Grande Compact of 1938, which obligates Colorado to deliver a specified quantity of water (dependent on natural supply) in the Rio Grande as it crosses the Colorado–New Mexico state line (Colorado District Court 2004). Since its inception, several U.S. Supreme Court and Colorado Supreme Court decisions (e.g., *Alamosa-La Jara Water Users Protection Association v. Gould* 1983; *Texas v. Colorado* 1968) have imposed that the Colorado Division of Water Resources develop rules and regulations regarding surface water and groundwater appropriations within the Rio Grande Basin. The process of modifying and adopting new rules and regulations regarding surface water and groundwater rights is still ongoing. 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 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 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

[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)).

regarding groundwater management in the San Luis Valley that are expected in the near future (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 about 1,000 ac-ft/yr (1.2 million m^3/yr) to be successful in obtaining needed water rights (McDermott 2010).

10.3.9.2 Impacts

Potential impacts on water resources related to utility-scale solar energy development include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at the place of origin and at the time of the proposed activity, while indirect impacts occur away from the place of origin or later in time. Impacts on water resources considered in this analysis are the result of land disturbance activities (construction, final developed site plan, as well as off-site activities such as road and transmission line construction) and water use requirements for solar energy technologies that take place during the four project phases: site characterization, construction, 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).

10.3.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy facilities, which are described in more detail for the four phases of development in Section 5.9.1; these impacts would be minimized through the implementation of the programmatic design features described in Appendix A, Section A.2.2. The proposed Fourmile East SEZ contains several small palustrine wetlands along the western boundary. Siting of utility-scale solar energy facilities should not interfere with these wetland regions as they serve as local recharge zones for the unconfined aquifer. In addition, stormwater management plans need to address the potential impacts of increased runoff and sedimentation in the region of these wetlands, as well as off the proposed SEZ toward the Alamosa National Wildlife Refuge and the manmade laterals that feed into the Rio Grande (see Section 10.3.9.1.1).

10.3.9.2.2 Water Use Requirements for Solar Energy Technologies

Analysis Assumptions. A detailed description of the water use assumptions for the four utility-scale solar energy technologies (parabolic trough, power tower, dish engine, and PV systems) is presented in Appendix M. Assumptions regarding water use calculations specific to the proposed Fourmile East 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 77% of the SEZ total area during the peak construction year; and

- Water use requirements for hybrid cooling systems are assumed to be on the same order of magnitude as those using dry cooling (see Section 5.9.2.1).

Site Characterization. During site characterization, water would be used mainly for dust suppression and the workforce potable water supply. Impacts on water resources during this phase of development are expected to be negligible 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 Fourmile East 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 10.3.9.2-1 and could be as high as 964 ac-ft (1.2 million m^3). In addition, the generation of up to 74 ac-ft (91,300 m^3) of sanitary wastewater would need to be treated either on-site or sent to an off-site facility.

Groundwater wells would have to yield an estimated 425 to 597 gpm (1,609 to 2,260 L/min) to meet the estimated construction water requirements. In the San Luis Valley, current well yields for large production wells are as high as 2,000 gpm (7,571 L/min); however, the majority of well yields are 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 10.3.9.2-2). At full build-out capacity, water needs for mirror/panel washing are estimated to range from 17 to 311 ac-ft/yr (2,100 to 383,600 m^3/yr). As much as 9 ac-ft/yr (11,100 m^3/yr) would be needed for the potable water supply.

TABLE 10.3.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Fourmile East SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	612	919	919	919
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	686	964	938	928
Wastewater generated				
Sanitary wastewater (ac-ft)	74	45	19	9

[a] Assumptions of water use for fugitive dust control, potable supply for the 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.

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 10.3.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per MW. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

The maximum total water usage during one year of normal operations would be greatest for those technologies using the wet-cooling option and is estimated to be as high as 9,325 ac-ft/yr (11.5 million m^3/yr) (Table 10.3.9.2-2). Water usage for dry-cooling systems would be as high as 941 ac-ft/yr (1.2 million m^3/yr), about 10 times less than 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 10.3.9.1.2 and 10.3.9.1.3). For example, a dish engine facility would require about 177 ac-ft/yr (218,300 m^3/yr), including water needed for mirror washing and the workforce potable water supply. This quantity of water could be obtained from a groundwater well with a pump rate of about 110 gpm (420 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 5,780 gpm (21,880 L/min) would be needed This value is about a factor of two to three times larger than the largest production wells in the San Luis Valley (RGWCD 2010). Based on water use requirements, wet-cooling technologies would not be feasible given their high water needs.

TABLE 10.3.9.2-2 Estimated Water Requirements during Normal Operations at the Proposed Fourmile East SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	621	345	345	345
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	311	173	173	17
Potable supply for workforce (ac-ft/yr)	9	4	4	<1
Dry cooling (ac-ft/yr)[e]	124–621	69–345	NA[f]	NA
Wet cooling (ac-ft/yr)[e]	2,795–9,005	1,553–5,003	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	177	17
Dry-cooled technologies (ac-ft/yr)	444–941	246–522	NA	NA
Wet-cooled technologies (ac-ft/yr)	3,115–9,325	1,730–5,180	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[g]	176	98	NA	NA
Sanitary wastewater (ac-ft/yr)	9	4	4	<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.

The availability of water rights and the impacts associate 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 Fourmile East SEZ would produce up to 9 ac-ft/yr (11,100 m^3/yr) of sanitary wastewater (Table 10.3.9.2-2) 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 98 to 176 ac-ft/yr (12,090 to 217,090 m^3/yr) (Table 10.3.9.2-2). 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.

10.3.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed Fourmile East SEZ is located adjacent to State Highway 150 and U.S. 160, and existing transmission lines are within 2 mi (3 km) of the SEZ as described in Section 10.3.1.2. 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 to 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 impacts due to water use 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.

10.3.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources from development of solar energy at the proposed Fourmile East SEZ would be 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 alter groundwater recharge and discharge processes. The proposed SEZ contains several small wetlands along the western boundary, and surface drainage off the site could potentially affect laterals that connect to the Rio Grande and Alamosa National Wildlife Refuge. 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 and clogging of groundwater recharge areas.

Water in the Rio Grande Basin is managed strictly because of its scarcity, treaty obligations, and its necessity for supporting agriculture in the San Luis Valley. Both surface water and groundwater rights are over appropriated, so water requirements for solar energy development would have to be met through the purchase of senior water rights. Water withdrawals in the basin are managed to control discharge to the Rio Grande system, in accordance with the Rio Grande Compact, so water withdrawals under purchased water rights would need to result in no net impact on the basin. In addition, applications for new points of groundwater diversion would have to demonstrate no impact on adjacent surface and groundwater rights holders. Since current water rights are used primarily for irrigation, the purchase and diversion of groundwater rights for solar energy 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 10.3.9.1.3), then the water requirements for full build-out assuming dry-cooled parabolic trough technology would need to fallow 588 acres (2.4 km^2) of agricultural fields, where as PV technology would only need to fallow 11 acres (0.04 km^2). This is a hypothetical example only, and it does not take into account securing water rights needed for an augmentation plan either. 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 to be 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 10.3.9.2-2, technologies using wet cooling are not feasible given that associated water requirements are from 1,730 to 9,325 ac-ft/yr (2.1 million to 11.5 million m^3/yr). Dry-cooling technologies would need to incorporate 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 10.3.9.1.3). Securing water rights in the Rio Grande Basin is a complex and expensive process, so dish engine and PV technologies are the preferable solar energy technologies for the proposed Fourmile East SEZ because of their low water use requirements.

10.3.9.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features given in Appendix A, Section A.2.2 will mitigate some impacts on water resources. Programmatic design features would focus on coordination with federal, state, and local agencies that regulate the use of water resources to meet the requirements of permits and approvals needed to obtain water for development, and on hydrological studies to characterize the aquifer from which groundwater would be obtained (including drawdown effects, if a new point of diversion is created). The greatest consideration for mitigating water impacts would be in the selection of solar technologies. The mitigation of impacts would be best achieved by selecting technologies with low water demands.

Proposed design features specific to the proposed Fourmile East SEZ include:

- Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures;

- Land disturbance activities should avoid impacts to the extent possible in the wetland areas on the western boundary of the site;

- During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as being within a 100-year floodplain;

- 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 2008b); 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.

10.3.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Fourmile East SEZ. The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 250-ft (76-m) wide portion of an assumed transmission line corridor. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. No area of direct or indirect effects was assumed for new access roads because they are not expected to be needed for developments on the Fourmile East SEZ due to the proximity of an existing state highway.

Indirect effects considered in the assessment included effects from surface runoff, dust, and accidental spills from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. Because there is some overlap between the area of indirect effect of the SEZ and the area affected by the transmission corridor, the size of the affected area is somewhat less than the sum of the areas of direct and indirect effects. These areas are defined, and the impact assessment approach is described in Appendix M.

10.3.10.1 Affected Environment

The proposed Fourmile East SEZ is located within the Salt Flats Level IV ecoregion, which supports sparse shrubland plant communities (Chapman et al. 2006). The dominant species in this ecoregion are greasewood (*Sarcobatus vermiculatus*), fourwing saltbush (*Atriplex canescens*), shadscale (*Atriplex confertifolia*), horsebrush (*Tetradymia* sp.), spiny hopsage (*Grayia spinosa*), rubber rabbitbrush (*Ericameria nauseosa*), saltgrass (*Distichlis spicata*), and alkali sacaton (*Sporobolus airoides*). This ecoregion is located within the Arizona/New Mexico Plateau Level III ecoregion, which is described in Appendix I.

Level IV ecoregions within 5 mi (8 km) of the SEZ include the Sand Dunes and Sand Sheets ecoregion, northwest of the SEZ, which supports scrub communities on sand sheets and sparse vegetation on sand dunes, which are mostly barren. To the northeast, with increasing elevation, lie the Foothill Shrublands ecoregion, which supports shrubland and woodland habitats with interspersed grasslands; the Crystalline Subalpine Forests ecoregion, which supports mostly coniferous forest along with aspen groves and subalpine meadows; and the Alpine Zone ecoregion, which supports alpine meadows with sparse stunted trees near the tree line. To the southeast lies the San Luis Alluvial Flats and Wetlands ecoregion, which is mostly irrigated cropland with some remaining shrubland communities. The Foothill Shrublands ecoregion, Crystalline Subalpine Forests ecoregion, and the Alpine Zone ecoregion are located within the Southern Rockies Level III ecoregion, which is described in Appendix I. The Salt Flats ecoregion, Sand Dunes and Sand Sheets ecoregion, and San Luis Alluvial Flats and Wetlands ecoregion are located in the Arizona/New Mexico Plateau Level III ecoregion, which is also described in Appendix I. Annual precipitation in the vicinity of the SEZ is low, averaging 7.1 in. (18.1 cm) at Alamosa (see Section 10.3.13).

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 Fourmile East SEZ are shown in Figure 10.3.10.1-1. Table 10.3.10.1-1 provides the surface area of each cover type within the potentially affected area.

Lands within the proposed Fourmile East SEZ are classified primarily as two cover types—Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Greasewood Flat. Additional cover types within the SEZ include Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Active and Stabilized Dune, and Inter-Mountain Basins Playa.

Greene's rabbitbrush (*Chrysothamnus greenei*) and bottlebrush squirreltail (*Elymus elymoides*) were observed to be the dominant species in some areas of the SEZ in July 2009. Large areas of the SEZ supported a shrub steppe community with an abundance of grasses. Other areas of the SEZ support a shrub-dominated community, with few associated grasses. Prickly pear (*Opuntia* sp.) was abundant in some shrub steppe areas. Sensitive habitats on the SEZ include wetlands, sand dunes, ephemeral washes, and playas. The area has had a long history of livestock grazing, and the plant communities present within the SEZ have likely been affected by grazing.

Lands within the transmission line corridor include seven cover types. Inter-Mountain Basins Greasewood Flat is the predominant cover type in the corridor. Additional cover types include a wide variety of woodland, shrubland, and grassland types (Table 10.3.10.1-1).

The area surrounding the SEZ, within 5 mi (8 km), includes 35 cover types, which are listed in Table 10.3.10.1-1. The predominant cover types are Inter-Mountain Basins Semi-Desert Shrub Steppe and Inter-Mountain Basins Greasewood Flat.

The NWI identifies a number of small wetlands within and immediately outside of the western portion of the SEZ (Figure 10.3.10.1-2). The NWI maps are produced from high altitude imagery and are subject to uncertainties inherent in image interpretation (USFWS 2009). Most of these wetlands occur within the Inter-Mountain Basins Greasewood Flat cover type with a small number within Inter-Mountain Basins Semi-Desert Shrub Steppe.

Twelve of these wetlands, totaling 2.1 acres (0.0085 km^2), occur within the SEZ. They range in size from 0.1 to 0.6 acres (0.0004 to 0.002 km^2). These wetlands are classified as palustrine wetlands with emergent plant communities that are intermittently flooded, indicating

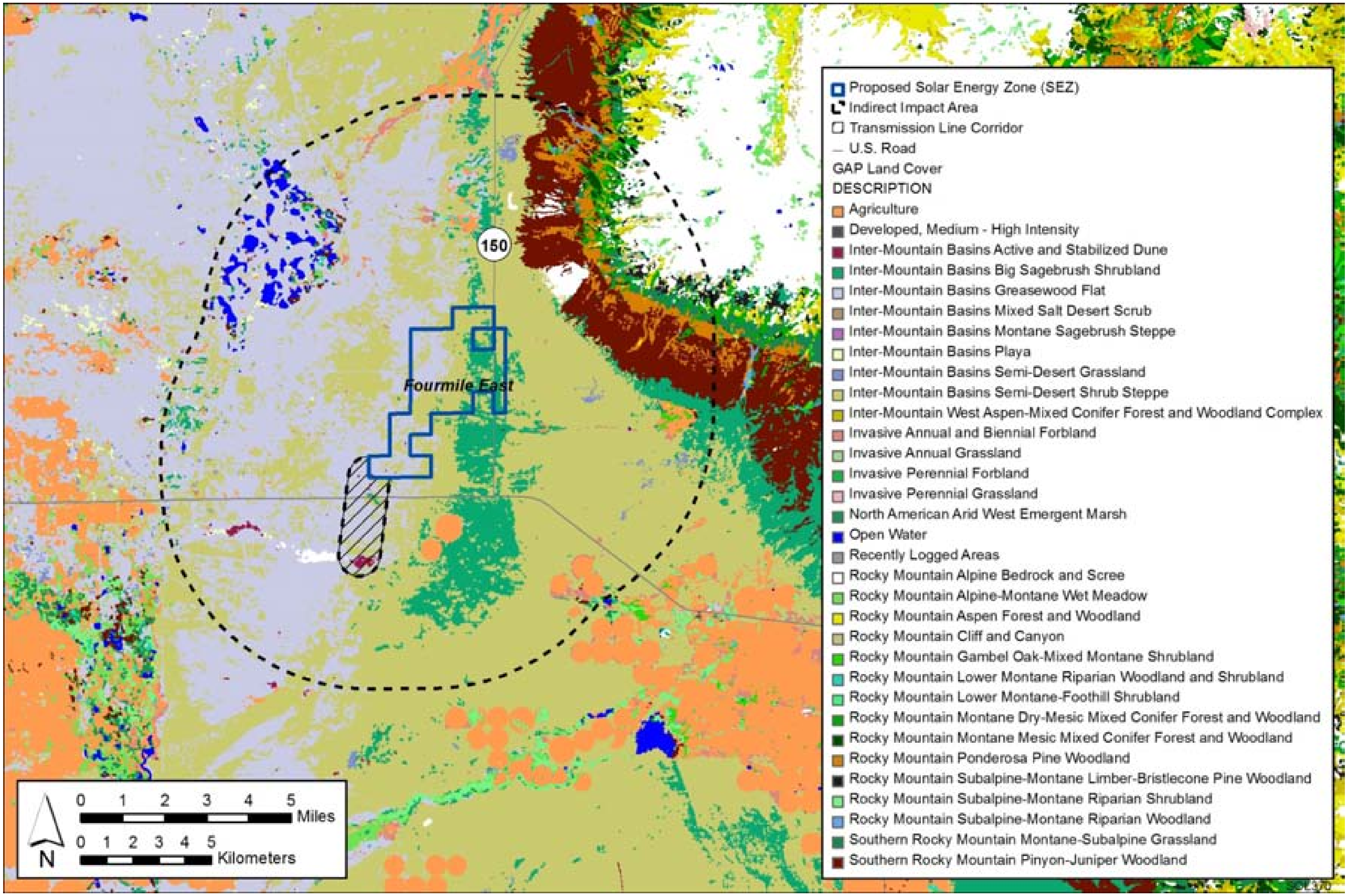

FIGURE 10.3.10.1-1 Land Cover Types within the Proposed Fourmile East SEZ (Source: USGS 2004)

TABLE 10.3.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Fourmile East SEZ and Potential Impacts

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S079 Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	2,013 acres[g] (0.2%, 0.8%)	39,268 acres (4.8%)	15 acres (<0.1%)	Small
S096 Inter-Mountain Basins Greasewood Flat: Dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*) and generally occurring in areas with saline soils, a shallow water table, and intermittent flooding, although remaining dry for most growing seasons. This community type generally occurs near drainages or around playas. These areas may include, or may be co-dominated by, other shrubs, and may include a graminoid herbaceous layer.	1,266 acres (0.4%, 6.1%)	28,705 acres (8.7%)	45 acres (<0.1%)	Small
S054 Inter-Mountain Basins Big Sagebrush Shrubland: Dominated by basin big sagebrush (*Artemisia tridentata tridentata*), Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), or both. Other shrubs may be present. Perennial herbaceous plants are present but not abundant.	589 acres (0.2%, 1.2%)	6,828 acres (2.4%)	1 acre (<0.1%)	Small
S012 Inter-Mountain Basins Active and Stabilized Dune: Includes Dune and sandsheet areas that are unvegetated or sparsely vegetated, with up to 30% plant cover, but generally less than 10%. Plant communities consist of patchy or open grassland, shrubland, or shrub steppe, with species often adapted to the shifting sandy substrate.	7 acres (<0.1%, 2.2%)	232 acres (0.5%)	3 acres (<0.1%)	Small

TABLE 10.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
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.	<1 acre (<0.1%, 0.2%)	167 acres (1.5%)	<1 acre (<0.1%)	Small
D03 Recently Mined or Quarried: Includes open pit mines and quarries.	0 acres	194 acres (17%)	<1 acre (<0.1%)	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.	0 acres	389 acres (0.6%)	<1 acre (<0.1%)	Small
S038 Southern Rocky Mountain Pinyon-Juniper Woodland: Occurs on dry mountains and foothills. The dominant trees are twoneedle pinyon (*Pinus edulis*) or oneseed juniper (*Juniperus monosperma*), or both. Rocky Mountain juniper (*Juniperus scopulorum*) may be a dominant in higher elevation occurrences. An understory may be absent or dominated by shrubs or graminoids.	0 acres	5,476 acres (1.3%)	0 acres	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	2,004 acres (0.6%)	0 acres	Small
N80 Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	0 acres	1,479 acres (0.2%)	0 acres	Small

TABLE 10.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
N11 Open Water: Plant or soil cover is generally less than 25%.	0 acres	1,166 acres (8.7%)	0 acres	Small
S032 Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland: Occurs on mountain slopes, canyon sideslopes, and ridgetops. Shrub and graminoid species are generally present.	0 acres	932 acres (0.6%)	0 acres	Small
S002 Rocky Mountain Alpine Bedrock and Scree: Occurs at high elevations, usually on outcrops and scree slopes, and consists of barren and sparsely vegetated substrates. Plant communities are dominated by lichens. Plant growth is generally limited. A sparse cover of forbs, grasses, lichens, and low shrubs may be present.	0 acres	787 acres (1.7%)	0 acres	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	646 acres (0.5%)	0 acres	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	642 acres (0.2%)	0 acres	Small
D09 Invasive Annual and Biennial Forbland: Areas dominated by annual and biennial non-native forb species.	0 acres	531 acres (1.0%)	0 acres	Small

TABLE 10.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
D11 Recently Chained Pinyon-Juniper Areas: Areas that have recently been chained to remove Pinyon-Juniper (*Pinus edulis-Juniperus* sp.).	0 acres	523 acres (17.4%)	0 acres	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	330 acres (1.1%)	0 acres	Small
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	311 acres (0.2%)	0 acres	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	282 acres (2.3%)	0 acres	Small
S034 Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland: Occurs in lower and middle ravine slopes, along stream terraces, and on north- and east-facing slopes. The dominant trees are conifers, sometimes mixed with aspen. Shrubs and herbaceous species are generally present.	0 acres	265 acres (0.2%)	0 acres	Small

TABLE 10.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
S081 Rocky Mountain Dry Tundra: Occurs in alpine areas on slopes, flat ridges, valleys, and basins with a constant water supply. The dense cover of low-growing, perennial graminoids and forbs is typically dominated by sod-forming sedges and prostrate and mat-forming forbs.	0 acres	167 acres (0.4%)	0 acres	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	165 acres (1.4%)	0 acres	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	161 acres (0.2%)	0 acres	Small
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	152 acres (0.1%)	0 acres	Small
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	137 acres (3.1%)	0 acres	Small

TABLE 10.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b]: Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	Overall Impact Magnitude[f]
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	136 acres (0.2%)	0 acres	Small
S091 Rocky Mountain Subalpine-Montane Riparian Shrubland: Occurs along low-gradient streams, alluvial terraces, and floodplains; around seeps, fens, and isolated springs on hillslopes; and in above–tree-line snowmelt-fed basins. This cover type often occurs as a mosaic of shrub and herbaceous communities.	0 acres	125 acres (0.3%)	0 acres	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	109 acres (0.1%)	0 acres	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	87 acres (0.6%)	0 acres	Small
S093 Rocky Mountain Lower Montane Riparian Woodland and Shrubland: Occurs on streambanks, islands, and bars, in areas of annual or episodic flooding, and often occurs as a mosaic of tree-dominated communities with diverse shrubs.	0 acres	82 acres (0.4%)	0 acres	Small

TABLE 10.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b]			Overall Impact Magnitude[f]
	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Transmission Line (Direct Effects)[e]	
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 graminoids.	0 acres	73 acres (0.3%)	0 acres	Small
N22 Developed, Medium–High Intensity: Includes housing and commercial/industrial development. Impervious surfaces compose 50 to 100% of the total land cover.	0 acres	55 acres (1.7%)	0 acres	Small
S004 Rocky Mountain Alpine Fell-Field: Occurs on windy ridgetops and exposed saddles with shallow stony soils. Plants are typically cushioned, or matted, frequently succulent, and flat to the ground in rosettes. Plant cover is generally 15 to 50% and composed of graminoids and forbs.	0 acres	9 acres (0.1%)	0 acres	Small
D10 Recently Logged Areas: Includes clear-cut areas and areas thinned by 50% or more.	0 acres	2 acres (0.1%)	0 acres	Small

a Land cover descriptions are from USGS (2005). Full descriptions of land cover types, including plant species, can be found in Appendix I. Wetlands within the SEZ are not mapped as wetland cover types by SWReGAP.

b Area in acres, determined from USGS (2004).

c Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region. Wetlands within the SEZ are not mapped as wetland cover types by SWReGAP.

Footnotes continued on next page.

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TABLE 10.3.10.1-1 (Cont.)

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[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and within a 1-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project facilities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.

[e] For transmission, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide transmission corridor. Impacts are for the area of the cover type within the assumed ROW, the percentage that area represents of all occurrences of that cover type within the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and are (1) *small*: a relatively small proportion of the cover type (≤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.

[g] To convert acres to km^2, multiply by 0.004047.

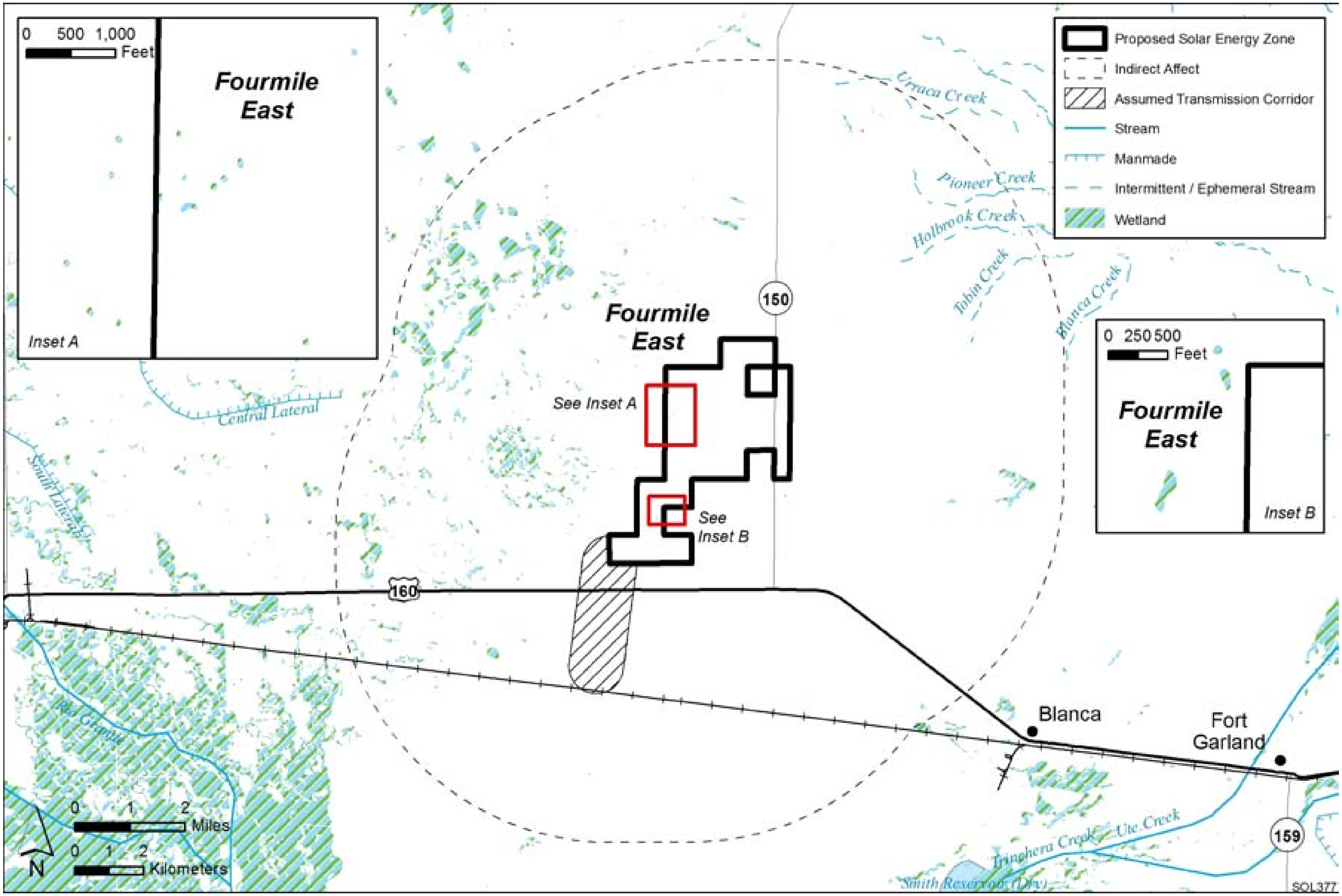

FIGURE 10.3.10.1-2 Wetlands within the Proposed Fourmile East SEZ (Source: USFWS 2009)

that surface water is usually absent but may be present for variable periods (USFWS 2009). Emergent plant communities are composed primarily of herbaceous species rooted in shallow water or saturated soil. Numerous ephemeral dry washes occur within the SEZ and transmission line corridor. These dry washes typically contain water for short periods during or following precipitation events and include temporarily flooded areas. However, these areas typically do not support wetland or riparian habitats. In addition, numerous areas in the SEZ temporarily hold surface water after storms. These areas typically have a hard, cracked sandy substrate and are often unvegetated or support sparse grasses.

Ten wetlands occur within the assumed transmission line corridor, ranging in size from 0.2 to 0.5 acres (0.0008 to 0.002 km^2) and totaling 2.6 acres (0.011 km^2). Two of these wetlands support an emergent plant community, while eight are classified as unconsolidated shore. Unconsolidated shore wetlands have a sparse vegetation cover. These wetlands occur within the Inter-Mountain Basins Greasewood Flat and Inter-Mountain Basins Active and Stabilized Dune cover types, with one located in Inter-Mountain Basins Semi-Desert Shrub Steppe.

Many palustrine emergent wetlands occur near the proposed Fourmile East SEZ to the west and range from intermittently flooded to seasonally flooded, indicating that surface water is present for extended periods, especially in the spring, but is usually absent by the end of the growing season. Many of these wetlands are included within the Blanca ACEC.

The NWI also identifies wetlands near the SEZ to the east as palustrine wetlands with emergent plant communities that are seasonally flooded (USFWS 2009). To the east and northeast, several unvegetated wetlands ranging from seasonally flooded to temporarily flooded (surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface) are identified by the NWI. Several palustrine emergent wetlands occur to the northeast that are classified as saturated, indicating that the soil is saturated to the surface for extended periods during the growing season, but surface water is seldom present (USFWS 2009).

The NWI identifies numerous lakes and palustrine wetlands, including ponds, more than 2 mi (3.2 km) to the west and northwest (USFWS 2009), which lie within the Blanca ACEC. Most of the palustrine wetlands support emergent plant communities. These are mostly classified as North American Arid West Emergent Marsh, Rocky Mountain Alpine-Montane Wet Meadow, Rocky Mountain Lower Montane Riparian Woodland and Shrubland, and Inter-Mountain Basins Playa cover types. The ponds support a variety of wetland plant community types. Other palustrine wetlands are predominantly unvegetated and seasonally flooded. Wetlands to the north of the SEZ are identified by the NWI as palustrine wetlands with emergent plant communities (USFWS 2009). Many of these are Rocky Mountain Subalpine-Montane Riparian Shrubland, Rocky Mountain Lower Montane Riparian Woodland and Shrubland, and Rocky Mountain Alpine-Montane Wet Meadow cover types.

The State of Colorado maintains an official list of weed species that are designated noxious species. Table 10.3.10.1-2 provides a summary of the noxious weed species regulated in Colorado that are known to occur in Alamosa County. No species included in Table 10.3.10.1-2 was observed on the SEZ.

TABLE 10.3.10.1-2 Colorado Noxious Weeds Occurring in Alamosa County

Common Name	Scientific Name	Status
Hoary cress	*Cardaria draba*	List B
Russian knapweed	*Acroptilon repens*	List B
Canada thistle	*Cirsium arvense*	List B
Field bindweed	*Convolvulus arvensis*	List C
Wild Caraway[a]	*Carum carvi*	Not listed

[a] Species not included on the CDA Alamosa County list but is believed to occur in the county (USDA 2010).

Source: CDA (2010).

The Colorado Department of Agriculture classifies noxious weeds into one of three lists (CDA 2010):

- "List A species in Colorado that are designated by the Commissioner for eradication."

- "List B weed species are species for which the Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, develops and implements state noxious weed management plans designed to stop the continued spread of these species."

- "List C weed species are species for which the Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, will develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans will not be to stop the continued spread of these species but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species."

Nineteen noxious weeds and invasive plant species are known or suspected to occur in the San Luis Valley Resource Area, which includes the Fourmile East SEZ (Table 10.3.10.1-3).

Those species that are known to occur near the SEZ include Russian knapweed, hoary cress, Canada thistle, Russian olive, perennial pepperweed, and salt cedar. Camelthorn (*Alhagi pseudalhagi*), a list A species, is also known to occur near the SEZ, in the Blanca Wetlands area. The only species from Table 10.3.10.1-3 on List A, Hydrilla, is an aquatic species that is also known to occur in the Blanca Wetlands area.

TABLE 10.3.10.1-3 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
Kochia	*Bassia prostrata*	Not listed
Hydrilla	*Hydrilla verticillata*	List A
Eurasian water milfoil	*Myriophyllum spicatum*	List B

Source: BLM (2010a).

10.3.10.2 Impacts

The construction of solar energy facilities within the proposed Fourmile East 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 (3,105 acres [12.6 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 that are encountered within the SEZ or along related ROWs are described in more detail in Section 5.10.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. SEZ-specific design features are described in Section 10.3.10.3.

10.3.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact affected a relatively small proportion ($\leq$1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); a moderate impact (>1 but $\leq$10%) could affect an intermediate proportion 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 and Inter-Mountain Basins Greasewood Flat cover types. Additional cover types within the SEZ that would be affected include Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Active and Stabilized Dune, and Inter-Mountain Basins Playa. The potential impacts on land cover types resulting from solar energy development in the proposed Fourmile East SEZ are summarized in Table 10.3.10.1-1. Most of these cover types are relatively common in the SEZ region, however, Inter-Mountain Basins Playa and Inter-Mountain Basins Active and Stabilized Dune are relatively uncommon, representing approximately 0.2% and 0.6% of the land area within the SEZ region, respectively. Sand dune, playa, and dry wash communities are important sensitive habitats in the region. The construction, operation, and decommissioning of solar projects within the SEZ would result in small impacts on each of the cover types in the affected area.

Disturbance of vegetation in dune communities within the SEZ, such as from heavy equipment operation, could result in the loss of substrate stabilization. Re-establishment of dune species could be difficult due to the arid conditions and unstable substrates. Because of the arid conditions, re-establishment of shrub communities in temporarily disturbed areas would likely be very difficult and may require extended periods of time. In addition, noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation.

Potential impacts on wetlands as a result of solar energy facility development are described in Section 5.10.1. Specific to the affected area of the proposed Fourmile East SEZ, approximately 2.1 acres (0.0085 km^2) of wetland habitat occurs within the SEZ and could be affected by project development. In addition, 2.6 acres (0.011 km^2) of wetlands occurs within the assumed transmission line corridor and could be affected by construction within the transmission line ROW.

Grading could result in direct impacts on the wetlands within the SEZ if fill material is placed within wetland areas. Grading near the wetlands in or near the SEZ 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 in or near the SEZ could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in wetland areas, which could degrade or eliminate wetland plant communities. Sedimentation effects or hydrologic changes could also extend to wetlands outside of the SEZ. Communities associated with playa habitats, greasewood flats communities, riparian habitats, or other periodically flooded areas within or downstream from solar projects or the transmission line corridor could also be impacted 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 10.3.9 for further discussion of washes.

Although the use of groundwater within the Fourmile East 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 10.3.9). Plant communities that are supported by groundwater discharge, such as many of the lakes, ponds, and other wetlands in the vicinity of the SEZ, 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 northeast of the SEZ, the predominant downwind direction, are those of the Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Big Sagebrush Shrubland, and Inter-Mountain Basins Greasewood Flat cover types. Inter-Mountain Basins Semi-Desert Grassland, Southern Rocky Mountain Pinyon-Juniper Woodland, Recently Chained Pinyon-Juniper Areas, and Invasive Annual and Biennial Forbland also occur to the northeast.

The construction of transmission lines in ROWs outside of the SEZ could potentially result in direct impacts on wetlands, if fill material is placed within wetland areas, or in indirect impacts as described above. Construction could also affect dry washes within or downstream of the ROW.

10.3.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

On February 8, 1999, the President signed E.O. 13112, "Invasive Species," which directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts of invasive species (*Federal Register*, Volume 64, page 61836, Feb. 8, 1999). Potential impacts resulting from noxious weeds and invasive plant species as a result of solar energy facility development are described in Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in and adjacent to the affected area of the proposed Fourmile East 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 weed species that are known to occur in San Luis Valley near the SEZ include Russian knapweed, hoary cress, Canada thistle, Russian olive, perennial pepperweed, Camelthorn, and salt cedar. Additional species known to occur in Alamosa County or the San Luis Valley Resource Area are given in Table 10.3.10.1-2 and Table 10.3.10.1-3, respectively. Approximately 531 acres (2.15 km^2) of Invasive Annual and Biennial Forbland occurs within the area of indirect effects. Land disturbance from project activities and indirect effects of construction and operation could result in the expansion of these invasive species populations.

Past or present land uses may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Existing roads, livestock grazing, and recreational OHV use within the SEZ area of potential impact would also likely contribute to the susceptibility of plant communities to the establishment and spread of noxious weeds and invasive species. Disturbed areas, including 194 acres (0.8 km^2) of the Recently Mined or Quarried, 1,479 acres (6.0 km^2) of Agriculture, 523 acres (2.1 km^2) of Recently Chained Pinyon-Juniper Areas, 55 acres (0.2 km^2) of Developed, Medium–High Intensity, 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.

10.3.10.3 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 semidesert shrub steppe and greasewood flat habitats and minimize the potential for the spread of invasive species. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

- All wetland, sand dune and sand transport areas, playa, and dry wash habitats within the SEZ and assumed transmission line corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around wetlands, and dry washes to reduce the potential for impacts on these habitats on or near the SEZ.

- Appropriate engineering controls should be used to minimize impacts on wetland, playa, dry wash, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.

- Transmission line towers should be sited and constructed to minimize impacts on wetlands and span them whenever practicable.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetland habitats or springs that are associated with groundwater discharge, such as the Blanca wetlands.

If these SEZ-specific design features are implemented in addition to other programmatic design features, it is anticipated that a high potential for impacts from invasive species and impacts on wetlands, sand dunes, playas, springs, dry washes, and riparian habitats would be reduced to a minimal potential for impact. Residual impacts on wetlands could result from remaining groundwater withdrawal, etc.; however, it is anticipated that these impacts would be avoided in the majority of instances.

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10.3.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Fourmile East 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 SEZ using available GIS surface water datasets.

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 250-ft (76-m) wide portion of an assumed 2-mi (3.2-km) long transmission line corridor. The maximum developed area within the SEZ would be 3,105 acres (12.6 km^2).

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary which includes the 1-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effects (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or transmission line construction area). Potentially suitable habitat for a species within the SEZ greater than the maximum of 3,105 acres (12.6 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 access road because one is not expected to be needed for the SEZ due to the proximity of an existing state highway.

The primary habitat type within the affected area is semiarid shrub-steppe (Section 10.3.10), although marsh and wetland habitats occur in the Blanca Wetlands in Alamosa County, Colorado, to the northwest of the SEZ (Figure 10.3.10.1-1). No permanent water bodies or washes occur within the SEZ (Section 10.3.9.1.1). Several small, palustrine wetlands that may contain surface water for variable periods of time throughout the year occur along the western boundary of the SEZ (Section 10.3.10.1).

10.3.11.1 Amphibians and Reptiles

10.3.11.1.1 Affected Environment

This section addresses amphibian and reptile species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Fourmile East SEZ. The list of amphibian and reptile 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.

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 and wetland habitats located near the SEZ: 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 near the wetlands within the SEZ.

Reptile species that could occur within the SEZ include the fence lizard (*Sceloporus undulatus*), gopher snake (*Pituophis catenifer*), western rattlesnake (*Crotalus viridis*), short-horned lizard (*Phrynosoma hernandesi*), and western terrestrial garter snake (*Thamnophis elegans*) (CDOW 2009; NMDGF 2009; Stebbins 2003).

Table 10.3.11.1-1 provides habitat information and the types and overall area of suitable land cover for representative amphibian and reptile species that could occur in the SEZ.

10.3.11.1.2 Impacts

The types of impacts that amphibians and reptiles could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 10.2.11.1.3 below identifies SEZ-specific design features of particular relevance to the proposed Fourmile East 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 10.3.11.1.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional

TABLE 10.3.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Fourmile East SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Amphibians					
Great Plains toad (*Bufo cognatus*)	Sandy semidesert shrublands in the San Luis Valley. Can be relatively common in agricultural areas. About 1,532,300 acres[h] of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	68,241 acres of potentially suitable habitat (4.5% of available potentially suitable habitat)	69 acres of potentially suitable habitat lost and 1,383 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 2,932,700 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	54,144 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	18 acres of potentially suitable habitat lost and 369 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 2,238,900 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	75,777 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	59 acres of potentially suitable habitat lost and 1,466 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.1-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
Short-horned lizard (*Phrynosoma hernandesi*)	Short-grass prairies, sagebrush, semidesert shrublands, shale barrens, pinyon-juniper and pine-oak woodlands, oak-grass associations, and open conifer forests in mountainous areas. About 2,767,700 acres of potentially suitable habitat occurs in the SEZ region.	589 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat)	18,630 acres of potentially suitable habitat (0.7% of available potentially suitable habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 28 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Snakes					
Gophersnake (*Pituophis catenifer*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 2,079,200 acres of potentially suitable habitat occurs in the SEZ region.	589 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	17,188 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	1 acre of potentially suitable habitat lost and 37 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Western rattlesnake (*Crotalus viridis*)	Most terrestrial habitats. Typically inhabits plains grasslands, sandhills, semidesert and mountain shrublands, riparian areas, and montane woodlands. About 3,823,900 acres of potentially suitable habitat occurs in the SEZ region.	2,609 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	57,866 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	18 acres of potentially suitable habitat lost and 442 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Western terrestrial garter snake (*Thamnophis elegans*)	Most terrestrial and wetland habitats near bodies of water, but can be found many miles from water. About 2,295,600 acres of potentially suitable habitat occurs in the SEZ region.	2,609 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	49,568 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	18 acres of potentially suitable habitat lost and 436 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 3,105 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 3,105 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For transmission line development, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

Footnotes continued on next page.

TABLE 10.3.11.1-1 (Cont.)

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDOW (2009); NatureServe (2010); USGS (2004, 2005, 2007).

required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 10.3.11.1.3).

In general, impacts on amphibians and reptiles would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality to individual amphibians and reptiles. On the basis of the impacts summarized in Table 10.3.11.1-1, direct impacts on representative amphibian and reptile species would be small, as 0.1% or less of potentially suitable habitats identified for each species in the SEZ region would be lost. Larger areas of potentially suitable habitats for reptile species occur within the area of potential indirect effects (e.g., up to 4.5% of available potentially suitable habitat for the Great Plains toad). Indirect impacts on amphibians and reptiles could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, collection, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term 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.

10.3.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

The successful implementation of programmatic design features presented in Appendix A, Section A.2.2, would reduce the potential for effects on amphibians and reptiles, especially for those species that utilize habitat types that can be avoided (e.g., small palustrine wetlands). 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:

- Wetland habitats within the SEZ should be avoided to the extent practicable.

- Appropriate engineering controls should be used to minimize impacts on the washes that drain off of the Sangre de Cristo Mountains and on Smith Reservoir resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats.

- Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas (if present within the finalized ROW location) and span them whenever practicable.

If these SEZ-specific design features are implemented in addition to other programmatic design features, impacts on amphibian and reptile species could be reduced. Any residual impacts on amphibians and reptiles are anticipated to be small given the relative abundance of potentially suitable habitats in the SEZ region. However, as potentially suitable habitats for a number of the amphibian and reptile species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

10.3.11.2 Birds

10.3.11.2.1 Affected Environment

This section addresses bird species that are known to occur, or for which suitable habitat occurs, on or within the potentially affected area of the proposed Fourmile East 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. Within the proposed Fourmile East SEZ and the adjacent area of indirect effects, waterfowl, wading birds, and shorebirds are uncommon because of the lack of aquatic and wetland habitats. Smith Reservoir, located about 5 mi (8 km) southeast of the SEZ, and San Luis Lake, located 5 mi (8 km) northwest of the SEZ, provide more productive habitats for waterfowl, wading birds, and shorebirds. The mountain plover (*Charadrius montanus*) may occur on the SEZ. This special status species is discussed in Section 10.3.12.

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. Neotropical migrant species that are common or abundant within Alamosa County and that are expected to occur within the SEZ include the Brewer’s blackbird (*Euphagus cyanocephalus*), Brewer’s sparrow (*Spizella breweri*), common nighthawk (*Chordeiles minor*), horned lark (*Eremophila alpestris*), 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*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), short-eared owl (*Asio flammeus*), and Swainson's hawk (*Buteo swainsoni*) (CDOW 2009; USGS 2007). Special status birds of prey species are discussed in Section 10.3.12.

Upland Game Birds

Section 4.10.2.2.5 provides an overview of the upland game birds (primarily pheasants, grouse, quail, and doves) that occur within the six-state study area. The mourning dove (*Zenaida macroura*) is the only upland game bird species expected to occur within the proposed Fourmile East SEZ. No activity areas mapped for upland game birds such as the wild turkey (*Meleagris gallopavo*) occur within 5 mi (8 km) of the SEZ (CDOW 2008).

Table 10.3.11.2-1 provides habitat information and the types and overall area of potentially suitable land cover for most of the bird species mentioned above.

10.3.11.2.2 Impacts

The types of impacts that birds could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation measures applied. Section 10.3.11.2.3, below, identifies design features of particular relevance to the proposed Fourmile East 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 10.3.11.2.1 following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with federal or state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on birds (see Section 10.3.11.2.3).

In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality to individual birds. Table 10.3.11.2-1 summarizes the potential impacts on birds resulting from solar energy development in the Fourmile East SEZ. Direct impacts on bird species would be small, as only 0.4% 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 3.4% of available habitat for horned lark). Other impacts on birds could result

TABLE 10.3.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Fourmile East SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
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 2,009,900 acres of potentially suitable habitat occurs in the SEZ region.[d]	1,266 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	31,118 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	52 acres of potentially suitable habitat in area of potential direct effect and 1,046 acres of potentially suitable habitat in area of indirect effect	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 630,900 acres of potentially suitable habitat occurs in the SEZ region.	589 acres of potentially suitable habitat lost (0.09% of available potentially suitable habitat)	7,381 acres of potentially suitable habitat (1.2% of available potentially suitable habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 28 acres of potentially suitable habitat in area of indirect effect	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 2,913,900 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	54,307 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 369 acres of potentially suitable habitat in area of indirect effect	Small overall impact.. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Horned lark (*Eremophila alpestris*)	Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and also occur in agricultural areas. They usually occur where plant density is low and there are exposed soils. About 2,214,500 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	76,183 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,407 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. 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 2,607,400 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	48,950 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 369 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 2,877,800 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	76,933 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,405 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Birds of Prey					
American kestrel (*Falco sparverius*)	Wide variety of open to semi-open habitats including agricultural areas, grasslands, riparian forest edges, and urban areas. Occurs in most habitats, especially during migration. About 4,395,900 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	89,055 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,405 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Golden eagle (*Aquila chrysaetos*)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 4,699,600 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	88,596 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,405 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. 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 3,072,200 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat)	52,359 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 369 acres of potentially suitable habitat in area of indirect effect)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Swainson's hawk (*Buteo swainsoni*)	Grasslands, agricultural areas, shrublands, and riparian forests. Nests in trees in or near open areas. Migrants occur often occur in treeless areas. Large flocks often occur in agricultural areas near locust infestations. About 2,246,600 acres of potentially suitable habitat occurs in the SEZ region.	2,013 acres of potentially suitable habitat lost (0.09% of available potentially suitable habitat)	46,632 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	17 acres of potentially suitable habitat in area of potential direct effect and 347 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Avoidance of nest trees would further reduce the potential for impact.
Upland Game Birds					
Mourning dove (Zenaida macroura)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 3,404,400 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.09% of available potentially suitable habitat)	84,440 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,407 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 3,105 acres of direct effect within the SEZ was assumed.

Footnotes continued on next page.

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TABLE 10.3.11.2-1 (Cont.)

[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 3,105 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For transmission line development, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDOW (2009); NatureServe (2010); USGS (2004, 2005, 2007).

from collision with the transmission line and buildings, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (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, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for bird species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

10.3.11.2.3 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 the potential for effects on birds, especially for those species that depend on habitat types that can be avoided (e.g., palustrine wetlands). 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:

- 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.

- Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition.

- 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.

- Transmission line towers should be sited and constructed to minimize impacts on wetlands and riparian areas (if present within the finalized ROW location) and span them whenever practicable.

- If present, prairie dog colonies (which could provide habitat or a food source for some bird species) should be avoided to the extent practicable.

If these SEZ-specific design features are implemented in addition to other 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.

10.3.11.3 Mammals

10.3.11.3.1 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 Fourmile East 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 Fourmile East 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 10.3.11.3-1 provides a description of the various activity areas that have been mapped for the big game species in Colorado. Table 10.3.11.3-2 (located after the discussion on other mammal species) provides habitat information for representative mammal species, including big game species that could occur within the proposed Fourmile East 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 Fourmile East 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).

TABLE 10.3.11.3-1 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 two worst winters out of ten. 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 five winters out of ten.
Winter range	That part of the overall range where 90% of the individuals are located during an average of five winters out of ten from the first heavy snowfall to spring green-up.

Source: CDOW (2008).

The closest distances of the SEZ to the other American black bear activity areas are fall concentration area, 6 mi (10 km) and summer concentration area, 3 mi (5 km). 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 Fourmile East SEZ.

Bighorn Sheep. The proposed Fourmile East SEZ does not occur within any mapped activity areas for the bighorn sheep (Figure 10.3.11.3-1). The SEZ does occur within 5 mi (8 km) of several bighorn sheep activity areas: overall range, 3 mi (5 km); winter range, 4 mi (7 km);

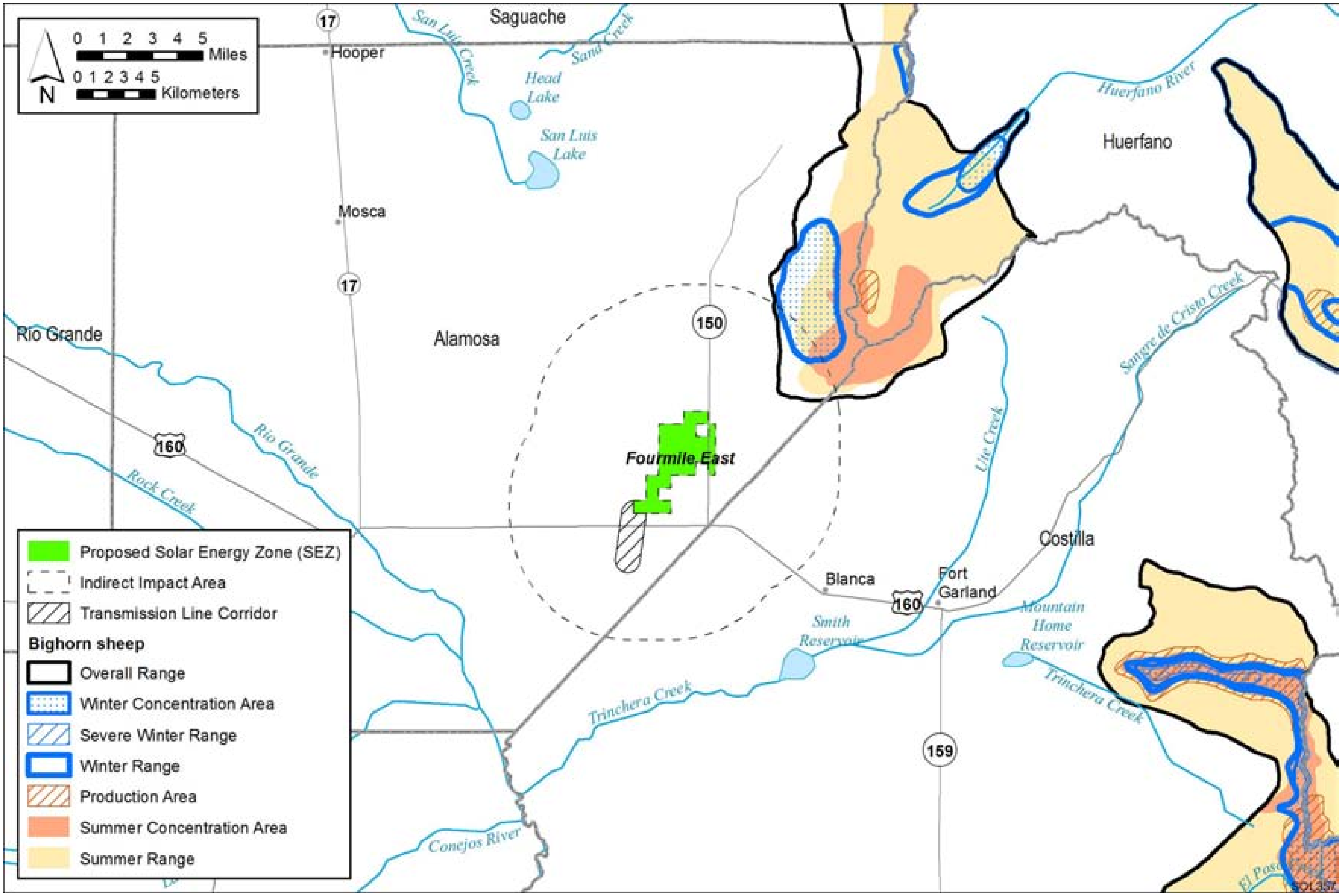

FIGURE 10.3.11.3-1 Bighorn Sheep Activity Areas within the Region That Encompasses the Proposed Fourmile East SEZ (Source: CDOW 2008)

winter concentration area, 4 mi (6.9 km); summer range, 4.0 mi (6.4 km); and summer concentration area, 5 mi (8 km). These activity areas are all located northeast of the SEZ (Figure 10.3.11.3-1). Since bighorn sheep typically inhabit mountains and foothills in Colorado (CDOW 2009), they are not expected to frequent the proposed Fourmile East SEZ.

Cougar. The proposed Fourmile East SEZ occurs within the overall range of the cougar (CDOW 2008). Within Colorado, cougars mostly occur in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands (CDOW 2009). Thus, they are not expected to frequent the SEZ.

Elk. The proposed Fourmile East SEZ occurs within the overall range and summer range of the elk (Figure 10.3.11.3-2). The SEZ also occurs within 5 mi (8 km) of several other elk activity areas: winter range, 0.1 mi (0.2 km); severe winter range, 0.2 mi (0.3 km); winter concentration area, 0.5 mi (0.8 km); summer concentration area, 4 mi (7 km); production area, 4 mi (7 km); and resident population area, 5 mi (8 km). These activity areas are located from north to east of the SEZ (Figure 10.3.11.3-2).

Mule Deer. The proposed Fourmile East SEZ occurs within the mule deer's overall range but does not overlap any of its other mapped activity areas (Figure 10.3.11.3-3). The SEZ also occurs within 5 mi (8 km) of several other mule deer activity areas: winter range, 0.3 mi (0.5 km); severe winter range, 0.7 mi (1.1 km); winter concentration area, 1.2 mi (1.9 km); summer range, 0.3 mi (0.5 km); resident population area, 5 mi (8 km); and concentration area, 4 mi (7 km). The resident population area is west of the proposed Fourmile East SEZ, while the other activity areas are northeast to east of the SEZ (Figure 10.3.11.3-3).

Pronghorn. The proposed Fourmile East SEZ occurs within the overall range and winter range of the pronghorn. The SEZ also occurs 2.6 mi (4.2 km) northwest of a pronghorn winter concentration area (Figure 10.3.11.3-4). No other 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 Fourmile East SEZ. Those species that are fairly common to abundant within the Alamosa County and that could occur within the area of the SEZ include the American badger (*Taxidea taxus*, fairly 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.

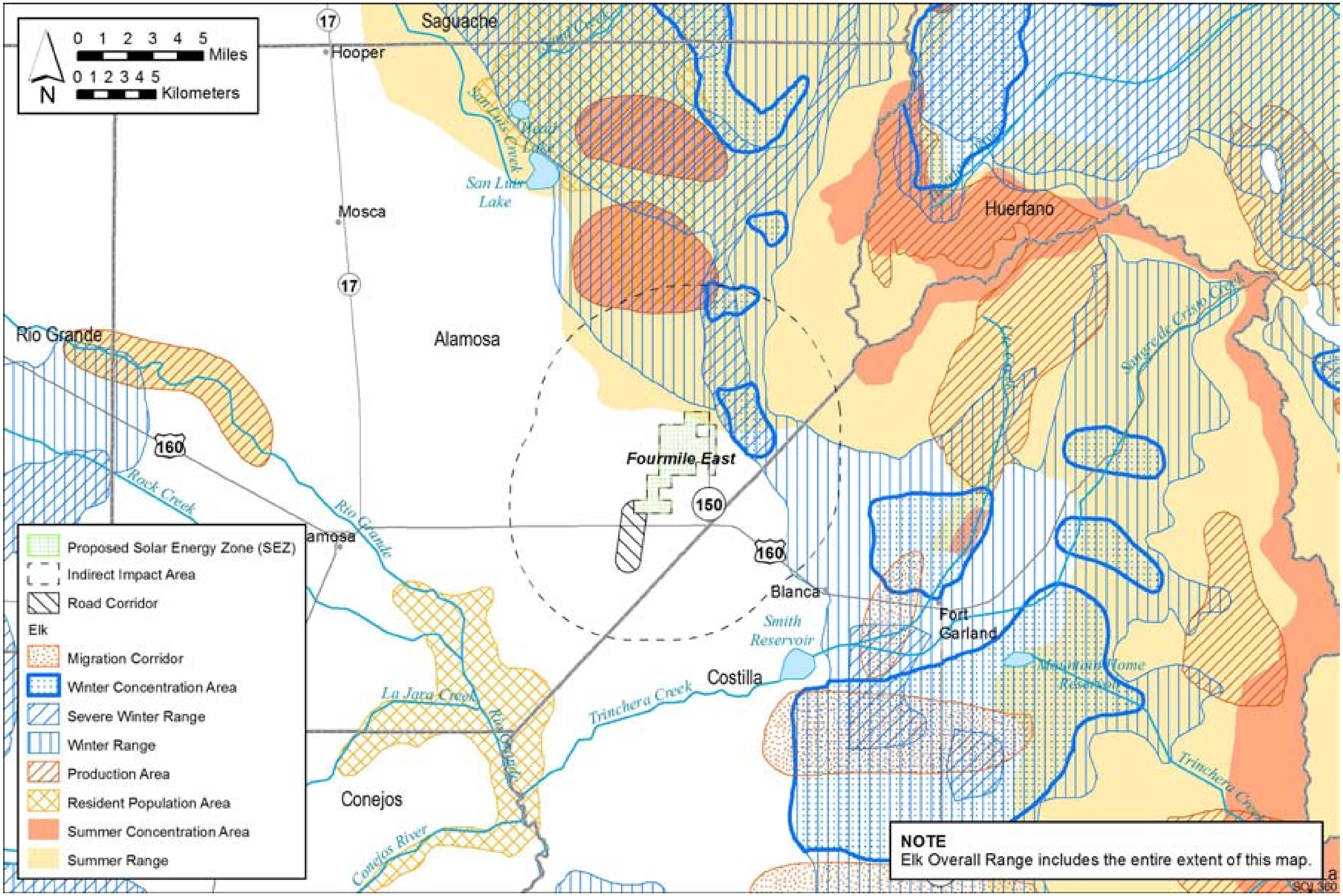

FIGURE 10.3.11.3-2 Elk Activity Areas within the Region That Encompasses the Proposed Fourmile East SEZ (Source: CDOW 2008)

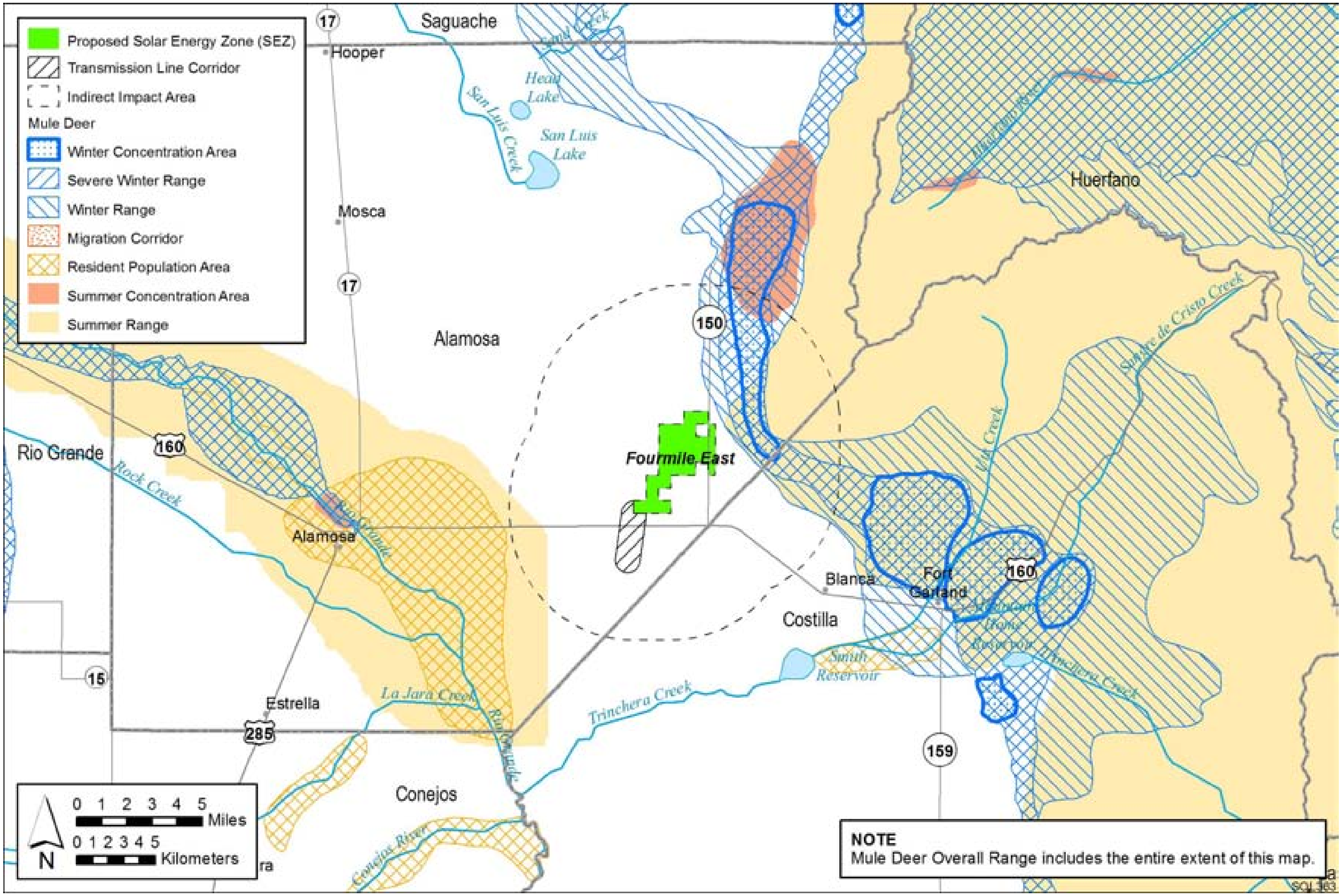

FIGURE 10.3.11.3-3 Mule Deer Activity Areas within the Region That Encompasses the Proposed Fourmile East SEZ (Source: CDOW 2008)

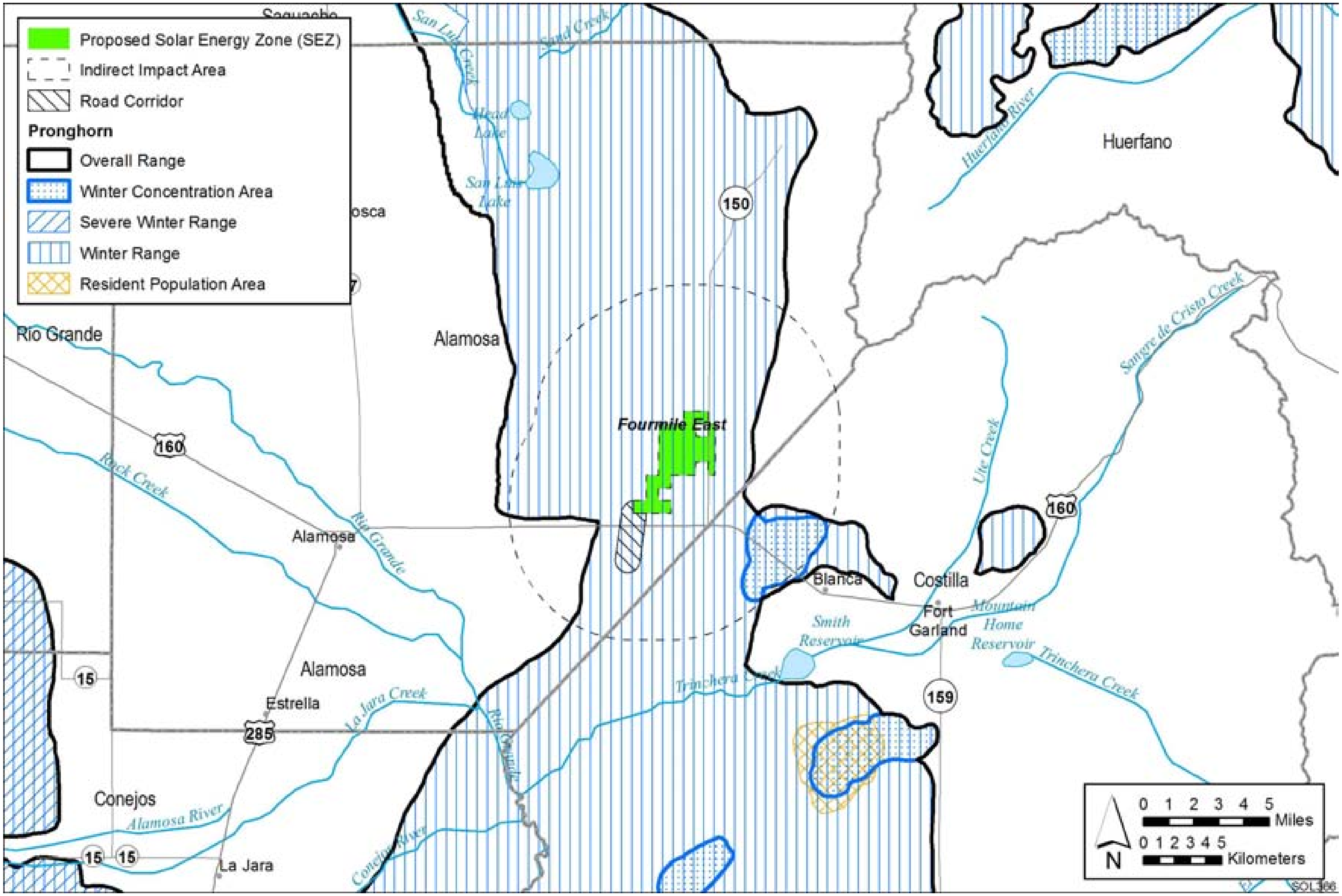

FIGURE 10.3.11 .3-4 Pronghorn Activity Areas within the Region That Encompasses the Proposed Fourmile East SEZ (Source: CDOW 2008)

The small nongame mammal species generally include bats, rodents, and shrews. Those species that are common or abundant within Alamosa County and that could occur within the area of the proposed Fourmile East SEZ include the big brown bat (*Eptesicus fuscus*, abundant), deer mouse (*Peromyscus maniculatus*, abundant), least chipmunk (*Tamias minimus*, common), little brown myotis (*Myotis lucifugus*, abundant), northern pocket gopher (*Thomomys talpoides*, common), Ord's kangaroo rat (*Dipodomys ordii*, abundant), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*, common), and western small-footed myotis (*Myotis ciliolabrum*, common). The Gunnison's prairie dog (*Cynomys gunnisoni*) is fairly common in the county and is also expected to occur within the semidesert habitat found within the SEZ (CDOW 2009). Due to its special status (candidate for listing under the ESA), the species is discussed in Section 10.3.12.

Table 10.3.11.3-2 provides habitat information for representative mammal species that could occur within the proposed Fourmile East SEZ.

10.3.11.3.2 Impacts

The types of impacts that mammals could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 10.3.11.3.3 below identifies SEZ-specific design features of particular relevance to the proposed Fourmile East 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 10.3.11.3.1, following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on mammals (see Section 10.3.11.3.3).

Table 10.3.11.3-2 summarizes the potential impacts on representative mammal species resulting from solar energy development (with the inclusion of programmatic design features) in the proposed Fourmile East SEZ.

American Black Bear

Based on potentially suitable land cover, up to 589 acres (2.4 km^2) of potentially suitable American black bear habitat could be lost by solar energy development within the proposed Fourmile East SEZ and another 1 acre (0.004 km^2) by transmission line construction. This represents 0.02% of potentially suitable American black bear habitat within the SEZ region. Over 17,800 acres (72 km^2) of potentially suitable American black bear habitat occurs within the area of indirect effects. As desert-like shrublands are not the preferred habitat for the American black bear, it is unlikely that impacts on the SEZ would represent an actual loss of occupied habitat.

TABLE 10.3.11.3-2 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Fourmile East SEZ

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Big Game					
American black bear (*Ursus americanus*)	Montane shrublands and forests, and subalpine forests at moderate elevations. Fairly common in Conejos County. About 2,492,300 acres of potentially suitable habitat occurs in the SEZ region.[d]	589 acres[g] of potentially suitable habitat lost (0.02% of available potentially suitable habitat)	17,850 acres of potentially suitable habitat (0.7% of available habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 30 acres of potentially suitable habitat in area of indirect effect	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 3,401,300 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat)	57,021 acres of potentially suitable habitat (1.7% of available habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 363 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Cougar (*Puma concolor*)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. Uncommon in Conejos County. About 3,714,900 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	58,123 acres of potentially suitable habitat (1.6% of available habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 369 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Big Game (Cont.)					
Elk (*Cervis canadensis*)	Semi-open forest, mountain meadows, foothills, plains, valleys, and alpine tundra. Uses open spaces such as alpine pastures, marshy meadows, river flats, brushy clean cuts, forest edges, and semidesert areas. Abundant in Conejos County. About 3,557,400 acres of potentially suitable habitat occurs in the SEZ region.	589 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat)	18,345 acres of potentially suitable habitat (0.7% of available habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 22 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Mule deer (*Odocoileus hemionus*)	Most habitats including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. Common in Conejos County. About 2,518,900 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	87,970 acres of potentially suitable habitat (3.5% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,405 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Pronghorn (*Antilocapra americana*)	Grasslands and semidesert shrublands on rolling topography that affords good visibility. Most abundant in shortgrass or midgrass prairies and least common in xeric habitats. Common in Conejos County. About 2,683,700 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	76,660 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,405 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers					
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 3,944,100 acres of potentially suitable habitat occurs in the SEZ region.[d]	3,105 acres of potentially suitable habitat lost (0.08% of available potentially suitable habitat)	85,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	708 acres of potentially suitable habitat in area of potential direct effect and 1,407 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,956,900 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	89,595 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	73 acres of potentially suitable habitat in area of potential direct effect and 1,475 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Desert cottontail (*Sylvilagus audubonii*)	Grasslands, especially in prairie dog colonies. Also in other habitats such as montane shrublands, riparian lands, semidesert shrublands, pinyon-juniper woodlands, and various woodland-edge habitats. Can occur in areas with minimal vegetation as long as adequate cover is present. About 3,328,100 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.09% of available potentially suitable habitat)	83,689 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,405 acres of potentially suitable habitat in area of indirect effect)	Small overall impact.. Avoidance of prairie dog colonies would further reduce the potential for impact.

TABLE 10.3.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Small Game and Furbearers (Cont.)					
Red fox (*Vulpes vulpes*)	Most common in open woodlands, pasturelands, riparian, and agricultural lands. Prefers areas with a mixture of these vegetation types occurring in small mosaics with good development of ground cover. Also is common in open space and other undeveloped areas adjacent to cities. Also occurs in mountains in montane and subalpine meadows and alpine and forest edges usually near water. About 4,131,400 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	58,925 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 371 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,431,100 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	80,565 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	72 acres of potentially suitable habitat in area of potential direct effect and 1,451 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Small Game and Furbearers (Cont.)					
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 2,486,400 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.1 % of available potentially suitable habitat)	54,784 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	74 acres of potentially suitable habitat in area of potential direct effect and 1,479 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Nongame (Small) Mammals					
Deer mouse (*Peromyscus maniculatus*)	Most habitats (except well-developed wetlands) that contain cover including burrows of other animals, rock cracks and crevices, surface debris and litter, and man-made structures. About 4,422,100 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	81,217 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	73 acres of potentially suitable habitat in area of potential direct effect and 1,480 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Maximum Area of Potential Habitat Affected[b]: Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (Small) Mammals (Cont.)					
Least chipmunk (*Tamias minimus*)	Low-elevation semidesert shrublands, montane shrublands and woodlands, forest edges, and alpine tundra. About 3,478,500 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.09% of available potentially suitable habitat)	86,902 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	70 acres of potentially suitable habitat in area of potential direct effect and 1,407 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Northern pocket gopher (*Thomomys talpoides*)	Various habitats such as agricultural and pasture lands, semidesert shrublands, and grasslands. Most common in meadows and grasslands. About 4,032,400 acres of potentially suitable habitat occurs in the SEZ region.	2,013 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	52,084 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	17 acres of potentially suitable habitat in area of potential direct effect and 347 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
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 1,884,000 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	79,967 acres of potentially suitable habitat (4.2% of available potentially suitable habitat)	73 acres of potentially suitable habitat in area of potential direct effect and 1,469 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 10.3.11.3-2 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (Small) Mammals (Cont.)					
Thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*)	Short and mid-length grasslands. Also occurs in other habitats that are heavily grazed, mowed, or otherwise modified, including prairie dog colonies. About 2,399,000 acres of potentially suitable habitat occurs in the SEZ region.	2,602 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	47,851 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	18 acres of potentially suitable habitat in area of potential direct effect and 363 acres of potentially suitable habitat in area of indirect effect	Small overall impact.. Avoidance of prairie dog colonies would further reduce the potential for impacts.
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 4,517,800 acres of potentially suitable habitat occurs in the SEZ region.	3,105 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat)	88,267 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	60 acres of potentially suitable habitat in area of potential direct effect and 1,548 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 3,105 acres of direct effect within the SEZ was assumed.

Footnotes continued on next page.

TABLE 10.3.11.3-2 (Cont.)

[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 3,105 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For transmission line development, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. As the transmission line corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the transmission line.

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) small: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) moderate: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) large: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDOW (2009); NatureServe (2010); USGS (2004, 2005, 2007).

Overall, impacts on the American black bear from solar energy development in the proposed Fourmile East SEZ would be small.

Bighorn Sheep

Based on potentially suitable land cover, up to 2,602 acres (10.5 km^2) of potentially suitable bighorn sheep habitat could be lost by solar energy development within the proposed Fourmile East SEZ and another 18 acres (0.07 km^2) by transmission line construction. This represents about 0.08% of potentially suitable bighorn sheep habitat within the SEZ region. Over 57,000 acres (230 km^2) of potentially suitable bighorn sheep habitat occurs within the area of indirect effects. Indirect effects could occur to bighorn sheep when occupying their mapped activity areas that occur within 5 mi (8 km) of the SEZ (Table 10.3.11.3-3). Overall, impacts on bighorn sheep from solar energy development in the SEZ would be small.

Cougar

Based on potentially suitable land cover, up to 2,602 acres (10.5 km^2) of potentially suitable cougar habitat could be lost by solar energy development within the proposed Fourmile East SEZ and another 18 acres (0.07 km^2) by transmission line construction. This represents about 0.07% of potentially suitable cougar habitat within the SEZ region. More than 58,100 acres (235 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, 589 acres (2.4 km^2) of potentially suitable elk habitat could be lost by solar energy development within the proposed Fourmile East SEZ and only 1 acre (0.004 km^2) by transmission line construction. This represents 0.02% of potentially suitable elk habitat within the SEZ region. Nearly 18,350 acres (74.3 km^2) of potentially suitable elk habitat occurs within the area of indirect effects. Based on mapped activity areas, 3,105 acres (12.6 km^2) of elk overall range and 213 acres (0.9 km^2) of elk summer range could be directly impacted by solar energy development (Table 10.3.11.3-4). Direct loss of overall range would account for about 0.07% of the overall range occurring within Colorado portion of the SEZ region; while direct loss of summer range would account for <0.01% of the summer range within the Colorado portion of the SEZ region. No direct impacts on other mapped activity areas for the elk would occur (Table 10.3.11.3-4). Overall, impacts on elk from solar energy development in the SEZ would be small.

TABLE 10.3.11.3-3 Potential Magnitude of Impacts on Bighorn Sheep Activity Areas Resulting from Solar Energy Development within the Proposed Fourmile East SEZ

	Amount of Activity Area Affected				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Transmission Line Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	0 acres	3,501 acres[g] (0.4% of overall range)	0 acres	813,2931 acres	None
Summer range	0 acres	1,462 acres (0.2% of summer range)	0 acres	741,450 acres	None
Summer concentration area	0 acres	438 acres (0.4% of summer concentration area)	0 acres	121,225 acres	None
Winter range	0 acres	860 acres (0.3% of winter range)	0 acres	328,477 acres	None
Winter concentration area	0 acres	860 acres (0.8% of winter concentration area)	0 acres	104,808 acres	None

a Activity areas are described in Table 10.3.11.3-1.

b Direct effects within the SEZ consist of ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

c 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.

d For transmission, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1.0-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

e The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

f Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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).

TABLE 10.3.11.3-4 Potential Magnitude of Impacts on Elk Activity Areas Resulting from Solar Energy Development within the Proposed Fourmile East SEZ

	Amount of Activity Area Affected				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Transmission Line Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	3,105 acres[g] (0.07% of overall range)	89,671 acres (2.0% of overall range)	61 acres of overall range in area of potential direct effect and 1,498 acres in area of indirect effect	4,464,355 acres	Small
Summer range	213 acres (<0.01% of summer range)	29,475 acres (1.3% of summer)	0 acres	2,210,542 acres	Small
Summer concentration area	0 acres	2,098 acres (0.4% of summer concentration area)	0 acres	481,589 acres	None
Winter range	0 acres	26,662 acres (1.2% of winter range)	0 acres	2,298,301 acres	None
Winter concentration area	0 acres	3,759 acres (0.6% of winter concentration area)	0 acres	594,176 acres	None
Severe winter range	0 acres	6,942 acres (0.5% of severe winter range)	0 acres	1,264,218 acres	None
Production area	0 acres	2,098 acres (0.4% of production area)	0 acres	595,842 acres	None
Resident population area	0 acres	642 acres (0.6% of resident population area)	0 acres	113,792 acres	None

[a] Activity areas are described in Table 10.3.11.3-1.

[b] 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 3,105 acres (12.6 km^2) would be developed in the SEZ.

Footnotes continued on next page.

[c] 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.

[d] For transmission, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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).

Mule Deer

Based on potentially suitable land cover, up to 3,105 acres (12.6 km^2) of potentially suitable mule deer habitat could be lost by solar energy development within the proposed Fourmile East SEZ and another 70 acres (0.3 km^2) by transmission line construction. This represents about 0.1% of potentially suitable mule deer habitat within the SEZ region. Nearly 88,000 acres (356 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effects. Based on mapped activity areas, 3,105 acres (12.6 km^2) of mule deer overall range could be directly impacted by SEZ development (Table 10.3.11.3-5). Direct loss of overall range would account for about 0.2% of the overall range occurring within Colorado portion of the SEZ region. No direct impacts on other mapped activity areas for the mule deer would occur (Table 10.3.11.3-5). Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Pronghorn

Based on potentially suitable land cover, up to 3,105 acres (12.6 km^2) of potentially suitable pronghorn habitat could be lost by solar energy development within the proposed Fourmile East SEZ and another 70 acres (0.3 km^2) by transmission line construction. This represents about 0.1% of potentially suitable pronghorn habitat within the SEZ region. Less than 76,700 acres (310 km^2) of potentially suitable pronghorn habitat occurs within the area of indirect effects. Based on mapped pronghorn activity areas (Table 10.3.11.3-6), solar development in the proposed Fourmile East SEZ would directly impact 3,105 acres (12.6 km^2)

TABLE 10.3.11.3-5 Potential Magnitude of Impacts on Mule Deer Activity Areas Resulting from Solar Energy Development within the Proposed Fourmile East SEZ

	Amount of Activity Area Affected				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Transmission Line Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	3,105 acres[g] (0.07% of overall range)	89,671 acres (2.0% of overall range)	61 acres of overall range in area of potential direct effect and 1,498 acres in area of indirect effect	4,581,733 acres	Small
Summer range	0 acres	16,820 acres (0.7% of summer range)	0 acres	2,555,171 acres	None
Summer concentration area	0 acres	916 acres (0.3% of summer concentration area)	0 acres	307,721 acres	None
Winter range	0 acres	14,910 acres (0.8% of winter range)	0 acres	1,938,078 acres	None
Winter concentration area	0 acres	3,886 acres (2.3% of winter concentration area)	0 acres	172,264 acres	None
Severe winter range	0 acres	9,736 acres (1.0% of severe winter range)	0 acres	932,751 acres	None

[a] Activity areas are described in Table 10.3.11.3-1.

[b] 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 3,105 acres (12.6 km^2) would be developed in the SEZ.

[c] 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 10.3.11.3-5 (Cont.)

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[d] For transmission, direct effects were estimated within a 2-mi (3.2-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1.0-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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).

of both pronghorn overall range and winter range (about 0.2% of each range occurring within the Colorado portion of the SEZ region). No direct impacts would occur on other activity areas (Table 10.3.11.3-6). 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 0.2% or less of habitats identified for each species would be lost (Table 10.3.11.3-2). Larger areas of suitable habitat for these mammal species occur within the area of potential indirect effects (e.g., up to 4.2% of available habitat for the Ord's kangaroo rat).

Summary

Overall, direct impacts on mammal species would be small for all species, as only 0.2% or less of potentially suitable habitats for the representative mammal species would be lost (Table 10.3.11.3-2). Larger areas of potentially suitable habitat for mammal species occur within the area of potential indirect effects (e.g., up to 4.2% 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 programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed

TABLE 10.3.11.3-6 Potential Magnitude of Impacts on Pronghorn Activity Areas Resulting from Solar Energy Development within the Proposed Fourmile East SEZ

	Amount of Activity Area				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Transmission Line Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	3,105 acres[g] (0.2% of overall range)	69,765 acres (3.5% of overall range)	61 acres of overall range in area of potential direct effect and 1,498 acres in area of indirect effect	1,989,307 acres	Small
Winter range	3,105 acres (0.2% of winter range)	69,765 acres (4.4% of winter range)	61 acres of winter range in area of potential direct effect and 1,498 acres in area of indirect effect	1,576,770 acres	Small
Winter concentration area	0 acres	4,608 acres (2.3% of winter concentration area)	0 acres	201,510 acres	None

[a] Activity areas are described in Table 10.3.11.3-1.

[b] 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 3,105 acres (12.6 km^2) would be developed in the SEZ.

[c] 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.

[d] For transmission, direct effects were estimated within a 2-mi (3.25-km) long, 250-ft (76-m) wide ROW for an assumed new transmission line connecting to the nearest existing line. Indirect effects were estimated within a 1.0-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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).

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.

10.3.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of programmatic design features presented 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.

- To the extent practicable, construction activities should be avoided while pronghorn are on their winter range within the immediate area of the proposed Fourmile East SEZ.

- Development in the 213-acre (0.9-km^2) portion of the SEZ that overlaps elk summer range should be avoided.

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.

10.3.11.4 Aquatic Biota

10.3.11.4.1 Affected Environment

There are no permanent water bodies or perennial streams within the boundaries of the Fourmile East SEZ, within the presumed transmission line corridor, or within the area of indirect effects. The NWI does identify a small number of palustrine wetlands with emergent plant communities at or just outside the western boundary of the SEZ (Sections 10.3.9.1.1 and 10.2.10.1). These wetlands are classified as intermittently flooded, indicating that surface water is usually absent but may be present for variable periods during the year. Many palustrine emergent wetlands also occur 1.2 mi (2.0 km) or more to the northwest within the Blanca ACEC; these wetlands are intermittently flooded to seasonally flooded, indicating that surface water is present for extended periods, especially in spring (Section 10.3.9.1.1).

Outside of the indirect effects area, but within 50 mi of the SEZ, there are approximately 960 mi (1,545 km) of perennial streams, 50 mi (80 km) of intermittent streams, and 190 mi (306 km) of canals. The nearest stream and canal features include the Central Lateral Canal, Trinchera Creek, and the Rio Grande, all located 6 mi (10 km) or more from the boundaries of the Fourmile East SEZ and outside the area of potential indirect effects analyzed here.

There are approximately 6,400 acres (25.9 km^2) of lake and reservoir habitat within 50 mi (80 km) of the SEZ, although there are no lakes or reservoirs within the area considered for analysis of direct or indirect effects. The nearest such habitat is the 800-acre (3.2-km^2) Smith Reservoir, located approximately 7 mi (11 km) to the southeast of the SEZ.

10.3.11.4.2 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 particularly important. 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 could occur on aquatic habitats and biota from development of utility-scale solar energy facilities are discussed in Section 5.10.3. Aquatic habitats, including wetland areas, present on or near the Fourmile East 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.

There are no permanent water bodies or perennial streams within the boundaries of the Fourmile East SEZ or within the presumed transmission line corridor. Consequently, there would be no direct impacts on these aquatic habitats from construction and operation of utility-scale solar energy facilities within the SEZ. In addition, there are no permanent water bodies or perennial streams located within the identified indirect effects area that extends 5 mi (8 km) from the boundaries of the SEZ.

Direct alteration of aquatic habitat associated with the small emergent wetlands located along the western edge of the SEZ would occur with construction activities or placement of facilities directly in the wetlands. The amount of aquatic habitat provided by the wetlands within the Fourmile East SEZ is <1% of total wetland surface area in the 50-mi (80.5-km) SEZ region. Consequently, the potential impacts on populations of aquatic biota from direct alteration would be small. Prohibiting construction activities and placing facilities within the historical boundaries or in the immediate vicinity of wetlands would eliminate direct impacts.

Disturbance of land areas at the SEZ could increase the amount of sediment in nearby wetland areas because of deposition of waterborne and airborne soils from disturbed areas. Because prevailing winds are primarily toward the east, it is likely that only a small portion of the airborne dust associated with SEZ activities would settle in the wetlands near the western border of the SEZ or in the wetlands within the Blanca ACEC located further to the northwest. Sedimentation could be controlled with commonly used structures and practices, such as settling basins and silt fences, or by directing water draining from the developed areas away from surface water features. Maintaining undisturbed areas around the perimeter of on-site or nearby wetlands would further reduce the potential for waterborne sediments to become deposited in those wetlands.

In arid environments, reductions in the quantity of water in aquatic habitats are of particular concern. Reductions in water quantity could occur if the topography within the catchment basins is altered. Water quantity could also be affected if significant amounts of surface water or groundwater are utilized for power plant cooling water, for washing mirrors, or for other needs. The greatest need for water would occur if technologies employing wet cooling, such as parabolic trough or power tower, were developed at the site; the associated impacts would ultimately depend on the water source used (including groundwater from aquifers at various depths). Withdrawing water from Smith Reservoir, the Rio Grande, or other perennial surface water features in the vicinity could affect water levels and, as a consequence, aquatic organisms in those water bodies. Additional details regarding the volume of water required and the types of organisms present in potentially affected water bodies would be required in order to further evaluate the potential for impacts from water withdrawals.

As described in Section 5.10.3, 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 for a solar energy facility. Restricting the use of heavy machinery and pesticides within the immediate catchment basin for those wetlands would mitigate potential impacts from contaminants. Because perennial streams, ponds, or reservoirs are more than 5 mi (8 km) distant from the Fourmile East SEZ, the potential for solar energy development activities within the SEZ to introduce contaminants into those water bodies would be negligible.

10.3.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A would greatly reduce or eliminate the potential for effects on aquatic biota and aquatic habitats from development and operation of solar energy facilities. While some SEZ-specific design features are best established when specific project details are being considered, design features that can be identified at this time include the following:

- Undisturbed buffer areas and sediment and erosion controls should be maintained around wetlands on the SEZ.

- The use of heavy machinery and pesticides should be avoided within the immediate catchment basins for wetlands on the SEZ.

If these SEZ-specific design features are implemented in addition to other 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 Fourmile East SEZ would be small.

10.3.12 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 Fourmile East 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, are 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 Fourmile East 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 of the species provided by the CDOW, CNHP, 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, Conejos, Costilla, Custer, Huerfano, Las Animas, Pueblo, Rio Grande, and Saguache Counties, Colorado, as well as Colfax, Rio Arriba, and Taos Counties, New Mexico. However, the SEZ and affected area occur only in Alamosa and Costilla Counties, Colorado. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

10.3.12.1 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 Fourmile East SEZ, the area of direct effect included the SEZ and the area within the

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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 2008). 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.

transmission corridor where ground-disturbing activities are assumed to occur. No new access road developments are expected to be needed to serve development on the SEZ due to the proximity of existing roads (refer to Section 10.3.1.2 for development assumptions). The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and the portion of the transmission corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. Indirect effects considered in the assessment included effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ and transmission line ROW, but do not include ground-disturbing activities. The potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

The primary habitat type within the affected area is semi-arid shrub steppe (see Section 10.3.10). Potentially unique habitats in the affected area in which special status species may reside include rocky cliffs and outcrops, sand dunes, woodlands, and wetlands (including playas, streams, and mesic grasslands and meadows). As discussed in Section 10.3.11.4.1, there are no permanent water bodies or perennial streams within the Fourmile East SEZ or within the area of indirect effects; however, small seasonally or intermittently inundated palustrine emergent wetlands may occur within and immediately adjacent to the western boundary of the SEZ. The size and abundance of these wetlands increases west and northwest of the SEZ towards the Blanca Wetlands, about 3 mi (5 km) northwest of the SEZ (Figure 10.3.12.1-1).

All special status species that are known to occur within the Fourmile East 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 59 that could occur on or in the affected area, based on recorded occurrences or the presence of potentially suitable habitat in the area. These species, their status, and their habitats are presented in Table 10.3.12.1-1. 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 over 20 mi (32 km) away from the SEZ.

Quad-level occurrences for the following seven special status species intersect the affected area of the Fourmile East SEZ: Altai chickweed, blue-eyed grass, Gray's Peak whitlow-grass, Smith's whitlow-grass, many-stemmed spider flower, American white pelican, and western snowy plover. There are no groundwater-dependent species in the vicinity of the SEZ based upon CNHP records, comments provided by the USFWS (Stout 2009), and the evaluation of groundwater resources in the Fourmile East SEZ region (Section 10.3.9).

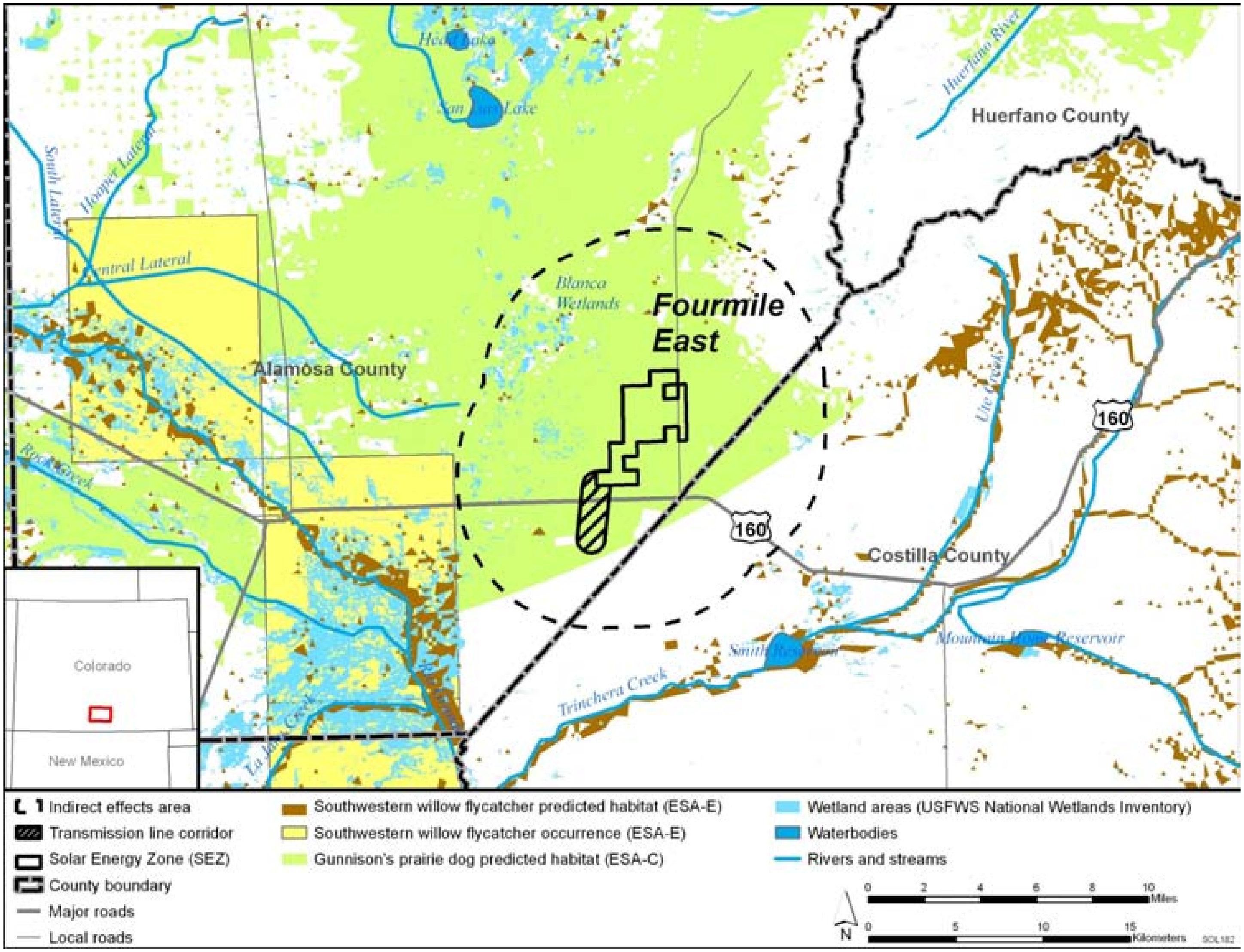

FIGURE 10.3.12.1-1 Locations of Species Listed as Endangered, Threatened, Candidates for Listing, or Species under Review for Listing under the ESA That May Occur in the Proposed Fourmile East SEZ Affected Area (Sources: CNHP 2009; NatureServe 2010; USGS 2007)

TABLE 10.3.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Fourmile East SEZ

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants							
Altai chickweed[l]	***Stellaria irrigua***	CO-S2	Mountain rills and scree above 8,200 ft. This species has a remarkably disjunct distribution where it is known only to occur in Colorado and Siberia. Nearest occurrence intersects the affected area from the Sangre de Cristo Mountains, as near as 5 mi northeast of the SEZ. About 46,156 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	787 acres (1.7% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
American yellow lady's-slipper	*Cypripedium calceolus. parviflorum*	CO-S2	Aspen groves, ponderosa, and Douglas fir forests with rich humus and decaying leaf litter. Soil substrates are sandy to loam. Prefers rocky north or east facing hillsides at elevations between 7,400 and 8,500 ft. Nearest known occurrences are about 40 mi from the SEZ. About 609,418 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	2,317 acres (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Autumn willow	*Salix serissima*	CO-S1	Marshes or fens associated with other *Salix* and *Carex* species. Elevation ranges between 7,800 and 9,300 ft. Nearest occurrence is about 38 mi from the SEZ. About 26,722 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	73 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

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TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Aztec milkvetch	*Astragalus proximus*	CO-S2	Rocky Mountain ponderosa pine woodland, Colorado Plateau pinyon-juniper woodland, Intermountain-basins, semi-desert shrub-steppe, and Rocky Mountain Gambel oak-mixed montane shrublands at elevations between 5,400 and 7,300 ft. Nearest known occurrences are 45 mi from the SEZ. About 1,697,670 acres of potentially suitable shrubland habitat occurs within the SEZ region.	2,013 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	14 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	46,513 acres (2.7% 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.
Blue-eyed grass	***Sisyrinchium demissum***	CO-S2	Moist areas, springs, stream banks, meadows, and forest seeps at elevations between 1,600 and 9,500 ft. Nearest occurrence intersects the affected area from the Blanca Wetlands about 5 mi from the SEZ. About 49,227 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	156 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Bodin milkvetch	*Astragalus bodinii*	CO-S2	Open forest clearings in association with aspen, pinyon-juniper, and ponderosa pine woodlands. Nearest known occurrences are 13 mi north of the SEZ. Occurrences within the region are known from elevations between 7,500 and 7,875 ft. About 815,203 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	7,642 acres (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Brandegee's milkvetch	*Astragalus brandegeei*	BLM-S; CO-S1	Sandy or gravelly banks, flats, and stony meadows within pinyon-juniper woodlands. Substrates are usually sandstone with granite or basalt. Elevation ranges between 5,400 and 8,800. Nearest occurrences are located 40 mi southwest of the SEZ. About 733,938 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	7,480 acres (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Broad-leaved twayblade	*Listera convallarioides*	CO-S2	Rich humus in open woods to boggy meadows with cool, circumneutral soils at elevations below 8,500 ft. Nearest known occurrences are about 45 mi from the SEZ. About 1,371,320 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	7,782 acres (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
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 about 28 mi from the SEZ. About 466,055 acres of potentially suitable habitat occurs within the SEZ region.	589 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	<1 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	7,176 acres (1.5% of available potentially suitable habitat)	Small overall impact. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Dwarf hawksbeard	*Askellia nana*	CO-S2	Steep alpine scree and talus slopes at elevations between 10,000 and 14,000 ft. Nearest known occurrences are about 38 mi from the SEZ. About 46,156 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	787 acres (1.7% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Fragile rockbrake	*Cryptogramma stelleri*	BLM-S; CO-S2	Moist soils on shaded limestone cliffs at elevations greater than 7,000 ft, and often in association with mosses. The nearest known occurrences are located in the San Juan Mountains, about 50 mi to the west of the SEZ. About 12,297 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	282 acres (2.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Grassy slope sedge	*Carex oreocharis*	CO-S1	Granitic soils on dry slopes at elevations between 7,200 and 10,800 ft. Endemic to the southern Rocky Mountains. Nearest known occurrences are about 45 mi from the SEZ. About 368,086 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	642 acres (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Gray's Peak whitlow-grass	***Draba grayana***	CO-S2	Gravelly alpine slopes and fellfields at elevations between 11,500 and 14,000 ft. Endemic to Colorado. Nearest known occurrences intersect the affected area from the western escarpment of the Sangre de Cristo Mountains, about 5 mi northeast of the SEZ. About 54,717 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	796 acres (1.5% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Halfmoon milkvetch	*Astragalus allochrous* var. *playanus*	CO-S1	Gravelly washes and sandbars of summer-dry streams at elevations between 3,000 and 4,000 ft. Nearest known occurrences are about 40 mi from the SEZ. About 87,052 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	295 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Hall fescue	*Festuca hallii*	CO-S1	Alpine tundra and dry subalpine grasslands at elevations between 11,000 and 12,000 ft. Nearest known occurrences are from the Sangre de Cristo Mountains, about 35 mi from the SEZ. About 368,086 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	642 acres (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
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. Elevation ranges between 4,800 and 8,000 ft. Nearest known occurrences are about 50 mi from the SEZ. About 102,599 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	356 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
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 about 12 mi from the SEZ. About 1,178,982 acres of potentially suitable habitat occurs within the SEZ region.	589 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	14,394 acres (1.2% of available potentially suitable habitat)	Small overall impact. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
King's campion	*Gastrolychnis kingii*	CO-S1	Spruce-fir, sedge, and alpine tundra communities at elevations between 10,800 and 11,300 ft. Endemic to Wyoming, western Colorado, and Utah. Nearest known occurrences are about 20 mi from the SEZ. About 256,575 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	957 acres (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Livermore fiddleleaf	*Nama dichotomum*	CO-S1	Plains and prairies at elevations between 7,000 and 10,200 ft. Nearest known occurrences are about 30 mi from the SEZ. About 60,516 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	384 acres (0.6% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Many-flowered gilia	*Ipomopsis multiflora*	CO-S1	Open sites, desert shrublands, and woodlands. Nearest known occurrences are about 45 mi from the SEZ. About 1,419,012 acres of potentially suitable habitat occurs within the SEZ region.	3,868 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	58 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	73,393 acres (5.2% of available potentially suitable habitat)	Small overall impact. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Many-stemmed spider-flower	***Cleome multicaulis***	BLM-S; CO-S2; FWS-SC	San Luis Valley on saturated soils created by waterfowl management on public lands. Nearest occurrences intersect the affected area from the Blanca Wetlands, about 3 mi west and northwest of the SEZ. About 4,439 acres of potentially suitable habitat occurs within the SEZ region in the Blanca Wetlands.	0 acres	0 acres	137 acres (3.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Marsh-meadow indian-paintbrush	*Castilleja lineata*	CO-S1	Montane woodlands and meadows at elevations between 8,500 and 12,000 ft. Nearest known occurrences are about 40 mi from the SEZ. About 1,898,264 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	10,761 acres (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c] Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Mingan's moonwort	*Botrychium minganense*	CO-S1	Dense forest to open meadow and from summer-dry meadows to permanently saturated fens and seeps but most common in moist meadows and woodlands in association with riparian corridors. Recorded sites are often associated with old (>10 year) disturbances. Nearest known occurrences are about 42 mi from the SEZ. About 1,978,082 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	11,055 acres (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Mountain bladder fern	*Cystopteris montana*	CO-S1	Moist, rich soil in closed-canopied spruce-fir forests at elevations between 9,000 and 11,000 ft. Nearest known occurrences are about 50 mi from the SEZ. About 265,575 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	957 acres (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Mountain whitlow-grass	*Draba rectifructa*	CO-S2	Openings in sagebrush ponderosa pine, aspen, spruce-fir, lodgepole pine, and moderately moist alpine meadow communities at elevations between 6,400 and 9,600 ft. Nearest known occurrences are about 30 mi from the SEZ. About 946,322 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	3,575 acres (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
New Mexico cliff fern	*Woodsia neomexicana*	CO-S2	Cliffs and rocky slopes usually on sandstone or igneous substrates. Elevations range between 7,875 and 11,500 ft. Nearest occurrences are from the Sangre de Cristo Mountains, about 12 mi from the SEZ. About 12,297 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	282 acres (2.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Pale moonwort	*Botrychium pallidum*	CO-S2	Open exposed hillsides, burned or cleared areas, or old mining situations at elevations between 9,800 and 10,600 ft. Nearest known occurrences are about 28 mi from the SEZ. About 47,267 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	970 acres (2.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Parry's crazy-weed	*Oxytropis parryi*	CO-S1	Gravelly, calcareous soil on exposed ridgetops in the alpine zone. Occurs within the SEZ region at elevations between 8,200 and 10,200 ft. Nearest known occurrences are from the Sangre de Cristo Mountains, about 25 mi east of the SEZ. About 94,561 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	962 acres (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Peck sedge	*Carex peckii*	CO-S1	Calcareous soils on dry to mesic slopes in partial shade within rich, deciduous or mixed deciduous-coniferous woodlands; open woods; bases of slopes; or full sun on exposed outcrops. Occurs as elevations below 6,600 ft. Nearest known occurrences are about 50 mi from the SEZ. About 818,045 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	2,400 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
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 about 12 mi from the SEZ. About 261,409 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	800 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Porsild's whitlow-grass	*Draba porsildii*	CO-S1	Scree and grassy meadows, along ridges, slopes, and in summits within the alpine zone at elevations between 9,600 and 13,000 ft. Nearest known occurrences are from the Sangre de Cristo Mountains, about 10 mi east of the SEZ. About 54,717 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	800 acres (1.5% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
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 about 30 mi from the SEZ. About 1,518,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	9,250 acres (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Ripley's milkvetch	*Astragalus ripleyi*	BLM-S; CO-S2; FWS-SC	Mixed conifer and shrubland habitats on rocky substrates at elevations above 8,000 ft. The nearest known occurrences are located 30 mi to the west of the SEZ. About 394,308 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,350 acres (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Rock sandwort	*Minuartia stricta*	CO-S1	Moist, granitic gravel sedge meadows, heath, alpine or arctic tundra at elevations between 300 and 12,500 ft. Nearest occurrences are within the Sangre de Cristo Mountains about 11 mi east of the SEZ. About 139,426 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	510 acres (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Rock-loving aletes	*Neoparrya lithophila*	BLM-S; CO-S2	Igneous rock outcrops on north-facing cliffs and ledges within pinyon-juniper woodlands at elevations greater than 7,000 ft. Endemic to south-central Colorado. Found as near as 15 mi southwest of the SEZ. About 434,485 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	5,750 acres (1.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Rocky Mountain bladderpod	*Lesquerella calcicola*	CO-S2	Shale bluffs, limy hillsides, gypseous knolls and ravines, and various calcareous substrates at elevations between 5,000 and 7,500 ft. Nearest known occurrences are about 40 mi from the SEZ. About 12,297 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	282 acres (2.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
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 about 12 mi from the SEZ. About 1,393,825 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	7,850 acres (0.6% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassland habitat in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Slender cottongrass	*Eriophorum gracile*	CO-S2	Fens and subalpine wetlands that are supported by groundwater discharge or snowmelt at elevations between 7,100 and 12,000 ft. Nearest known occurrences are about 40 mi from the SEZ. About 95,143 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	210 acres (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Slender sedge	*Carex lasiocarpa*	CO-S1	Very wet boreal wetlands including sedge meadows, fens, bogs, lakeshores, and stream banks. Nearest known occurrences are about 12 mi from the SEZ. About 152,679 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	550 acres (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Small-winged sedge	*Carex stenoptila*	CO-S1	Open, rocky sites within coniferous woodlands at elevations between 7,900 and 9,500 ft. Nearest known occurrences are about 30 mi from the SEZ. About 1,402,150 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	10,900 acres (0.8% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Smith's whitlow-grass	***Draba smithii***	CO-S2	Talus slopes providing shaded and protected crevices at elevations between 8,000 and 11,000 ft. Endemic to the mountains of southern Colorado. Nearest known occurrences intersect the affected area from the Sangre de Cristo Mountains, about 5 mi northeast of the SEZ. About 58,453 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,069 acres (1.8% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Tundra saxifrage	*Muscaria monticola*	CO-S1	Rock outcrops, crevices, talus, scree slopes, rocky tundra, fellfields, nunataks, and stream banks at elevations below 14,700 ft. Nearest known occurrences are about 28 mi from the SEZ. About 67,015 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,078 acres (1.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
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 about 30 mi from the SEZ. About 641,197 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	2,200 acres (0.3% 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 137,044 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	2,990 acres (2.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Arthropods							
Sphinx moth	*Sphinx dollii*	CO-S2	Madrean oak woodland, arid brushlands, and desert foothills with woody broad-leafed shrubs. Nearest occurrence is from the Great Sand Dunes National Park, about 12 mi north of the SEZ. About 1,250,756 acres of potentially suitable habitat occurs within the SEZ region.	2,603 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	15 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	45,839 acres (3.7% 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; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
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 about 40 mi northwest of the SEZ. About 3,277,511 acres of potentially suitable habitat occurs within the SEZ region.	2,000 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	48 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	48,240 acres (1.5% of potentially suitable available 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 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
American white pelican	***Pelecanus erythrorhynchos***	BLM-S; CO-SC; CO-S1; FWS-SC	Large reservoirs in summer. May be observed in the Blanca Wetlands, about 5 mi northwest of the SEZ. About 205,596 acres of potentially suitable habitat occurs within the SEZ region associated with the Blanca Wetlands.	0 acres	0 acres	1,290 acres (0.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
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. Occurs locally in semiarid shrubland habitats where there is an abundance of small mammal prey. Known to occur in riparian habitats along the Rio Grande about 10 mi west of the SEZ. About 2,072,279 acres of potentially suitable habitat occurs within the SEZ region.	1,800 acres of potentially suitable foraging habitat lost (0.1% of available habitat)	14 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	43,930 acres (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.
Barrow's goldeneye	*Bucephala islandica*	BLM-S; CO-S2	Winter resident in the SEZ region on larger lakes and rivers. Known to occur in the San Luis Valley. About 163,900 acres of potentially suitable habitat occurs in the affected area.	0 acres	0 acres	1,420 acres (1.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Ferruginous hawk	*Buteo regalis*	BLM-S; CO-SC	Summer resident in the affected area, but year-round resident in portions of the SEZ region. Grasslands, sagebrush, and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands. Known to occur in San Luis State Park and Wildlife Area, about 10 mi northwest of the SEZ. About 1,360,614 acres of potentially suitable habitat occurs within the SEZ region.	2,000 acres of potentially suitable foraging habitat lost (0.2% of available potentially suitable habitat)	50 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	36,287 acres (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.
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 25 mi southeast of the SEZ. About 1,709,413 acres of potentially suitable habitat occurs within the SEZ region.	1,800 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	14 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	40,385 acres (2.4% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Short-eared owl	*Asio flammeus*	CO-S2	Year-round resident in the SEZ region. Nesting habitat includes grasslands, sagebrush, marshes, and tundra. Wintering habitat include grasslands and marshes. Nearest occurrences are about 12 mi from the SEZ. About 2,426,482 acres of potentially suitable habitat occurs within the SEZ region.	2,382 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	15 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	49,715 acres (2.0% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Southwestern willow flycatcher	*Empidonax traillii extimus*	ESA-E; CO-E	Nests in thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands in the Alamosa National Wildlife Refuge along the Rio Grande, about 7.5 mi southwest of the SEZ. Suitable habitats may occur in the Blanca Wetlands about 3 mi west of the SEZ. About 210,962 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	390 acres (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; 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 the San Luis Valley. About 2,209,000 acres of potentially suitable habitat occurs in the SEZ region.	2,425 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	19 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	48,000 acres (2.2% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied burrows and habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Western Snowy plover	***Charadrius alexandrinus nivosus***	BLM-S; CO-S1; CO-SC	Breeds in Colorado on alkali flats around reservoirs and sandy shorelines. May be observed as a summer breeder and fall migrant in the Blanca Wetlands, about 3 mi northwest of the SEZ. About 29,290 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,466 acres (5.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line ROW (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals							
Big free-tailed bat	*Nyctinomops macrotis*	BLM-S; CO-S1; FWS-SC	Year-round resident in the SEZ region. Roosts in rock crevices on cliff faces or in buildings. Forages primarily in coniferous forests and arid shrublands to feed on moths. May occur in the San Luis Valley. About 2,745,262 acres of potentially suitable habitat occurs within the SEZ region.	3,800 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	63 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	80,840 acres (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.
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 about 40 mi from the SEZ. About 1,191,389 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	5,516 acres (0.5% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Gunnison's prairie dog	*Cynomys gunnisoni*	ESA-C	Mountain valleys, plateaus, and open brush habitats in the project area at elevations between 6,000 and 12,000 ft. Known to occur as near as 20 mi south of the SEZ. About 1,938,641 acres of potentially suitable habitat occurs within the SEZ region.	3,882 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	62 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	80,178 acres (4.1% 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; translocation of individuals from areas 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 10.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Transmission Line ROW (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	BLM-S; CO-SC; CO-S2; FWS-SC	Year-round resident in the SEZ region. Semiarid shrublands, pinyon-juniper woodlands, and montane forests to elevations of 9,500 ft. Roosts in caves, mines, rock crevices, under bridges, or within buildings. Known to occur in the San Luis Valley about 25 mi southwest of the SEZ. About 3,075,160 acres of potentially suitable habitat occurs within the SEZ region.	1,800 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	16 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	51,488 acres (1.7% 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.

[a] BLM-S = listed as a sensitive species by the BLM; CO-E = listed as endangered by the State of Colorado; CO-S1 = ranked as S1 in the State of Colorado; CO-S2 = ranked as S2 in the State of Colorado; CO-SC = species of special concern in the State of Colorado; CO-T = listed as threatened by the State of Colorado; ESA-C = candidate for listing under the ESA; ESA-E = listed as endangered under the ESA; FWS-SC = USFWS species of concern.

[b] For plant and invertebrate species, potentially suitable habitat was determined using SWReGAP land cover types. 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 SEZ region. Habitat availability for each species within the SEZ region was determined using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. No new access roads are assumed to be needed due to the proximity of existing roads to the SEZ.

[d] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[e] For transmission line development, direct effects were estimated within a 2-mi (3-km) , 250-ft (76-m) wide ROW from the SEZ to the nearest transmission line. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide transmission corridor.

Footnotes continued on next page.

TABLE 10.3.12.1-1 (Cont.)

[f] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portion of the transmission corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[g] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of the population or its habitat would be lost, and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat, would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[h] Species-specific mitigation is presented for those species that could occur in the area of direct effects and have particular habitat features that could be readily avoided.

[i] To convert ft to m, multiply by 0.3048.

[j] To convert mi to km, multiply by 1.609.

[k] To convert acres to km^2, multiply by 0.004047.

[l] Species in bold text have been recorded or have designated critical habitat in the affected area.

10.3.12.1.1 Species Listed under the ESA That Could Occur in the Affected Area

In scoping comments on the proposed Fourmile East SEZ, the USFWS did not identify any ESA-listed species that may occur within the affected area of the SEZ (Stout 2009). However, one species listed under the ESA, the southwestern willow flycatcher, has the potential to occur within the affected area of the SEZ on the basis of observed occurrences near the affected area and the presence of apparently suitable habitat in the affected area (Table 10.3.12.1-1, Figure 10.3.12.1-1). In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

The southwestern willow flycatcher is known to occur and breed in riparian habitats along the Rio Grande in the Alamos National Wildlife Refuge, about 7.5 mi (12 km) southwest of the Fourmile East SEZ. This area is considered to be outside of the areas of direct and indirect effects. The species has not been recorded on the SEZ or within the affected area. According to the SWReGAP habitat suitability model, potentially suitable habitat for the southwestern willow flycatcher does not occur on the SEZ or within the transmission corridor. However, potentially suitable habitat may occur outside of the SEZ in the area of indirect effects, particularly among habitats associated with the Blanca Wetlands (Table 10.3.12.1-1, Figure 10.3.12.1-1). Designated critical habitat for this species does not occur in the SEZ region.

10.3.12.1.2 Species That Are Candidates for Listing under the ESA

In scoping comments on the proposed Fourmile East 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, one candidate species, the Gunnison's prairie dog, may occur near the proposed Fourmile East SEZ (Table 10.3.12.1-1). The known distribution of this species relative to the Fourmile East SEZ is shown in Figure 10.3.12.1-1. 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 about 20 mi (32 km) south of the Fourmile East SEZ (Figure 10.3.12.1-1). According to the SWReGAP habitat suitability model, potentially 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 may also occur throughout the affected area, including the transmission corridor and the area of indirect effects (Figure 10.3.12.1-1, Table 10.3.12.1-1).

10.3.12.1.3 BLM-Designated Sensitive Species

Fourteen BLM-designated sensitive species may occur in the affected area of the Fourmile East SEZ (Table 10.3.12.1-1). These BLM-designated sensitive species include the following (1) plants: Brandegee's milkvetch, fragile rockbrake, many-stemmed spider-flower, Ripley's milkvetch, and rock-loving aletes; (2) birds: American peregrine falcon, American white pelican, Barrow's goldeneye, ferruginous hawk, mountain plover, western burrowing owl, and western snowy plover; and (3) mammals: big free-tailed bat and pale Townsend's big-eared bat. Habitats in which these species are found, the amount of potentially suitable habitat in the affected area, and known locations of the species relative to the SEZ are presented in Table 10.3.12.1-1. These species are discussed below and additional life history information for these species is provided in Appendix J. Of these BLM-designated sensitive species with potentially suitable habitat in the affected area, occurrences of the many-stemmed spider-flower, American white pelican, and western snowy plover intersect the affected area of the Fourmile East SEZ.

Brandegee's Milkvetch

The Brandegee's milkvetch is a perennial forb that is known from disjunct locations in Arizona, Colorado, New Mexico, and Utah. The species inhabits sandy or gravelly banks, flats, and rocky meadows within pinyon-juniper woodlands at elevations between 5,400 and 8,800 ft (1,645 and 2,680 m). Nearest quad-level occurrences of this species are about 40 mi (64 km) southwest of the Fourmile East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or within the transmission corridor; however, potentially suitable pinyon-juniper woodland and mesic meadow habitats may occur in the area of indirect effects (Table 10.3.12.1-1).

Fragile Rockbrake

The fragile rockbrake is a perennial forb that is widespread across North America, Europe, and Asia. The species inhabits moist soils on shaded limestone cliffs at elevations greater than 7,000 ft (2,130 m). Nearest quad-level occurrences of this species are from the San Juan Mountains, about 50 mi (80 km) west of the Fourmile East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable rocky cliffs and outcrops may occur within the area of indirect effects (Table 10.3.12.1-1).

Many-Stemmed Spider-Flower

The many-stemmed spider-flower is an annual forb that is known from disjunct locations from central Wyoming, south-central Colorado, southeast Arizona, and southwest Texas. The species inhabits saturated soils of saline depressions, such as alkali sinks, alkaline meadows, and playa margins. Within the San Luis Valley of south-central Colorado, the species is known from saturated soils created by waterfowl management on public lands. Nearest quad-level occurrences of this species are from the Blanca Wetlands, within 5 mi (8 km) west and northwest of the Fourmile East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable playa or mesic meadow habitats may occur within the area of indirect effects (Table 10.3.12.1-1).

Ripley's Milkvetch

The Ripley's milkvetch is a perennial forb that is restricted to a range of less than 1,000 mi^2 (2,590 km^2) in Conejos County, Colorado and Taos and Rio Arriba Counties, New Mexico. The species inhabits mixed conifer woodlands on rocky volcanic substrates at elevations above 8,000 ft (2,440 m). Nearest quad-level occurrences of this species are about 30 mi (48 km) west of the Fourmile East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable rocky cliff and outcrops or pinyon-juniper woodland habitats may occur within the area of indirect effects (Table 10.3.12.1-1).

Rock-Loving Aletes

The rock-loving aletes is a perennial forb that is endemic to south-central Colorado. The species occurs on volcanic rock substrates such as outcrops, cracks, or ledges. It is associated with pinyon-juniper woodlands on these substrates at elevations greater than 7,000 ft (2,130 m). Nearest quad-level occurrences of this species are about 15 mi (24 km) southwest of the Fourmile East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or transmission corridor. However, potentially suitable rocky cliff and outcrops or pinyon-juniper woodland habitats may occur within the area of indirect effects (Table 10.3.12.1-1).

American Peregrine Falcon

The American peregrine falcon occurs 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, about 40 mi (64 km) northwest of the Fourmile East SEZ (Table 10.3.12.1-1). According to the SWReGAP habitat suitability model, potentially suitable year-round foraging nesting habitat for the American peregrine falcon may occur on the SEZ, the transmission corridor, and throughout portions of the area of indirect effects. On the basis of an evaluation of SWReGAP land cover types, however, potentially suitable nesting habitat (cliffs or outcrops) does not occur within the area of direct effects but about 280 acres (1 km^2) of cliff and rock outcrop habitat that may be potentially suitable nesting habitat occurs in the area of indirect effects.

American White Pelican

The American white pelican occurs in Colorado on larger lakes and reservoirs. The species is known to occur in the San Luis Valley, and, according to the SWReGAP habitat suitability model, potentially suitable summer nesting and migratory habitat for the species is predicted to occur within the affected area of the Fourmile East SEZ. Quad-level occurrences for this species intersect the SEZ affected area in association with the Blanca Wetlands. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the transmission corridor; however, potentially suitable summer nesting habitat may occur in the area of indirect effects (Table 10.3.12.1-1). The potentially suitable habitat within the area of indirect effects is primarily associated with the Blanca Wetlands, about 3 mi (5 km) northwest of the SEZ.

Barrow's Goldeneye

The Barrow's goldeneye is a diving duck that occurs in Colorado on larger lakes and rivers. The species is known to occur in the San Luis Valley, and, 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 Fourmile East SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the transmission corridor; however, potentially suitable habitat may occur in the area of indirect effects (Table 10.3.12.1-1). The potentially suitable habitat within the area of indirect effects is primarily associated with the Blanca Wetlands, about 3 mi (5 km) northwest of the SEZ.

Ferruginous Hawk

The ferruginous hawk is a summer resident in the Fourmile East SEZ affected area and a year-round resident in portions of the SEZ region. The species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper woodlands. The ferruginous hawk is known to occur in the San Luis Valley about 10 mi (16 km) northwest of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species may occur on the SEZ, transmission corridor, and within the area of indirect effects (Table 10.3.12.1-1). Most of this suitable habitat is represented by foraging habitat (shrublands). On the basis of an evaluation of SWReGAP land cover types, there is no suitable nesting habitat (rock outcrops or trees) on the SEZ or within the transmission corridor. However, about 10,300 acres (42 km^2) of forested habitat and 280 acres (1 km^2) of cliffs and rock outcrops within the area of indirect effects may be potentially suitable nesting habitat for the ferruginous hawk.

Mountain Plover

The mountain plover inhabits prairie grasslands and arid plains and fields, and nests in shortgrass prairie habitats associated with prairie dogs, bison, and cattle. The species occurs within the San Luis Valley, and the nearest quad-level occurrences are about 25 mi (40 km) southeast of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, potentially suitable summer habitat for this species may occur on the SEZ, transmission corridor, and within the area of indirect effects (Table 10.3.12.1-1). The availability of suitable nesting habitat on the SEZ and in other portions of the affected area has not been determined.

Western Burrowing Owl

The western burrowing owl occurs in open areas with sparse vegetation where it forages in grasslands, shrublands, and open disturbed areas, and nests in burrows typically constructed by mammals. The species is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, potentially suitable summer habitat for this species occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.3.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009, and shrubland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

Western Snowy Plover

The western snowy plover nests on alkaline flats around reservoirs and sandy shorelines. It is known to occur as a summer breeder and fall migrant in the Blanca Wetlands, about 3 mi (5 km) northwest of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur in the SEZ affected area. On the basis of SWReGAP land cover types, however, potentially suitable habitat may occur in the area of indirect effects (Table 10.3.12.1-1). No potentially suitable land cover types occur in the area of direct effects. The potentially suitable habitat within the area of indirect effects is primarily associated with the Blanca Wetlands, about 3 mi (5 km) northwest of the SEZ.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident in the Fourmile East SEZ region where it forages in a variety of habitats including coniferous forests and desert shrublands. The species roosts in rock crevices or in buildings. The species is known to occur in the San Luis Valley of southern Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the big free-tailed bat occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects.

Pale Townsend's Big-Eared Bat

The 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 Fourmile East SEZ region. The species roosts in caves, mines, tunnels, buildings, and other manmade structures. Nearest recorded quad-level occurrences of this species are about 25 mi (40 km) southwest of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the pale Townsend's big-eared bat occurs on the SEZ, transmission corridor, and in portions of the area of indirect effects (Table 10.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the affected area.

10.3.12.1.4 State-Listed Species

Three bird species listed by the State of Colorado may occur in the Fourmile East SEZ affected area (Table 10.3.12.1-1). Two species (southwestern willow flycatcher and western burrowing owl) were discussed in Section 10.3.12.1.1 and Section 10.3.12.1.3 because of their status under the ESA and BLM. The other state-listed species that may occur in the Fourmile East SEZ affected area is the bald eagle. This species as related to the SEZ is described in this section and presented in Table 10.3.12.1-1. Additional life history information for this species is provided in Appendix J.

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 this species are from the Rio Grande, about 10 mi (16 km) west of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for the species could occur on the SEZ, transmission corridor, 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 or within the transmission corridor (Table 10.3.12.1-1); however, about 80 acres (0.3 km^2) of riparian woodlands that may be potentially suitable nesting habitat occur in the area of indirect effects.

10.3.12.1.5 Rare Species

Fifty-seven species that have a state status of S1 or S2 in Colorado or New Mexico or are species of concern by the USFWS or Colorado that may occur in the affected area of the Fourmile East SEZ (Table 10.3.12.1-1). Of these species, 42 have not been discussed as ESA-listed (Section 10.3.12.1.1), candidates for listing under the ESA (Section 10.3.12.1.2), BLM-designated sensitive (Section 10.3.12.1.3), or state-listed (Section 10.3.12.1.4).

10.3.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Fourmile East SEZ is discussed in this section. The types of impacts that special status species could incur from construction and operation of utility-scale solar energy facilities are discussed in Section 5.10.4.

The assessment of impacts on special status species is based on available information on the presence of species in the affected area as presented in Section 10.3.12.1 following the analysis approach described in Appendix M. It is assumed that, prior to development, surveys would be conducted to determine the presence of special status species and their habitats in and near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA consultations, and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid, minimize, or mitigate impacts on special status species (see Section 10.3.12.3).

Solar energy development within the Fourmile East SEZ could affect a variety of habitats (see Section 10.3.10). Based on CNHP records, occurrences for the following seven special status species intersect the Fourmile East SEZ affected area: Altai chickweed, blue-eyed grass, Gray's Peak whitlow-grass, many-stemmed spider flower, Smith's whitlow-grass, American white pelican, and western snowy plover. Suitable habitat for each of these species may occur in the affected area. Other special status species may occur on the SEZ or within the affected area based on the presence of potentially suitable habitat. As discussed in Section 10.3.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur in the affected area, and may therefore overestimate impacts to some special status species.

Potential direct and indirect impacts on special status species within the SEZ and in the area of indirect effects outside the SEZ are presented in Table 10.3.12.1-1. In addition, the overall potential magnitude of impacts on each species (assuming programmatic design features are in place) is presented along with any potential species-specific mitigation measures that could further reduce impacts.

Impacts on special status species could occur during all phases of development (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy project within the SEZ. Construction and operation activities could result in short- or long-term impacts on individuals and their habitats, especially if these activities are sited in areas where special status species are known to or could occur. As presented in Section 10.3.1.2, a 2-mi (3-km) long transmission line from the SEZ is assumed to be needed to serve development in this SEZ. No new access road developments are assumed to be needed due to the proximity of U.S. Highway 160 adjacent to the southern boundary of the SEZ.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ and within the assumed transmission line ROW where ground-disturbing activities are expected to occur. Indirect impacts could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, harassment, and lighting. No ground-disturbing activities associated with project development are anticipated to occur within the area of indirect effects. Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if original land contours and native plant communities were restored in previously disturbed areas.

The successful implementation of programmatic design features (discussed in Appendix A) would reduce direct impacts on some special status species, especially those that depend on habitat types that can be easily avoided. Indirect impacts on special status species could be reduced to negligible levels by implementing programmatic design features especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.

10.3.12.2.1 Impacts on Species Listed under the ESA

In their scoping comments on the proposed Fourmile East SEZ, the USFWS did not express concern for impacts of project development within the SEZ to any ESA-listed species (Stout 2009). However, on the basis of CNHP recorded occurrences and the presence of potentially suitable habitat, the southwestern willow flycatcher has the potential to occur in the affected area. The species has not been recorded on the SEZ or in the area of indirect effects, and, according to the SWReGAP habitat suitability model, suitable habitat does not occur on the SEZ or within the transmission corridor. However, about 390 acres (1.5 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 0.2% of the available potentially suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the southwestern willow flycatcher from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

10.3.12.2.2 Impacts on Species That Are Candidates for Listing under the ESA

In their scoping comments on the proposed Fourmile East 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 could occur in the affected area. Quad-level occurrences of this species are known to occur as near as 20 mi (32 km) south of the SEZ, and Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009. According to the SWReGAP habitat suitability model, approximately 3,882 acres (15.5 km^2) of potentially suitable shrubland habitat on the SEZ and about 62 acres (0.3 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents about 0.2% of available suitable habitat in the SEZ region. About 80,178 acres (324 km^2) of suitable habitat occurs in the area of potential indirect impacts; this area represents about 4.1% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the Gunnison's prairie dog from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the region. The implementation of programmatic design features may be sufficient to reduce indirect impacts on the Gunnison's prairie dog to negligible levels.

Avoidance of all potentially suitable habitats for the Gunnison's prairie dog is not a feasible means of mitigating impacts because these habitats (shrublands) are widespread throughout the area of direct effect. However, direct impacts could be reduced by avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Development of mitigation for the Gunnison's prairie dog, including development of a survey protocol, avoidance and minimization measures, and, potentially, translocation or compensatory mitigation, should be developed in coordination with the USFWS per Section 7 of the ESA. Consultation with the CDOW should also occur to determine any state mitigation requirements.

10.3.12.2.3 Impacts on BLM-Designated Sensitive Species

There are 14 BLM-designated sensitive species that could occur in the affected area of the Fourmile East SEZ Impacts on these BLM-designated sensitive species are discussed below.

Brandegee's Milkvetch

The Brandegee's milkvetch is known to occur about 40 mi (64 km) southwest of the SEZ and potentially suitable habitat may occur in the affected area of the Fourmile East SEZ. According to the SWReGAP land cover model, potentially suitable pinyon-juniper woodland and mesic meadow habitats do not occur on the SEZ or within the transmission corridor. However, about 7,480 acres (30 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents 1.0% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the Brandegee's milkvetch from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Fragile Rockbrake

The fragile rockbrake is known to occur about 50 mi (80 km) west of the Fourmile East SEZ, and potentially suitable habitat may occur in the affected area. According to the SWReGAP land cover model, potentially suitable rocky cliffs and outcrops do not occur on the SEZ or within the transmission corridor. However, about 282 acres (1 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents 2.3% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the fragile rockbrake from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Many-Stemmed Spider-Flower

The many-stemmed spider-flower is known from the Blanca Wetlands, about 3 mi (5 km) northwest of the Fourmile East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or within the transmission corridor. However, about 137 acres (0.5 km^2) of potentially suitable playa or mesic meadow habitats may occur in the area of indirect effects; this area represents 3.1% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the many-stemmed spider-flower from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Ripley's Milkvetch

The Ripley's milkvetch is known to occur about 30 mi (48 km) west of the Fourmile East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor. However, about 1,350 acres (5.5 km^2) of potentially suitable woodland habitat may occur in the area of indirect effects; this area represents 0.3% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the Ripley's milkvetch from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Rock-Loving Aletes

The rock-loving aletes is known to occur about 15 mi (24 km) southwest of the Fourmile East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor. However, about 5,750 acres (23 km^2) of potentially suitable rocky cliffs and outcrops or pinyon-juniper woodland habitats may occur in the area of indirect effects; this area represents 1.3% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the rock-loving aletes from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

American Peregrine Falcon

The American peregrine falcon is a year-round resident in the Fourmile East SEZ region and is known to occur about 40 mi (64 km) northwest of the SEZ. According to the SWReGAP habitat suitability model, about 2,000 acres (8 km^2) of potentially suitable habitat on the SEZ and 48 acres (0.2 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents less than 0.1% of potentially suitable habitat in the SEZ region. About 48,240 acres (195 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.5% of the potentially suitable habitat in the SEZ region (Table 10.3.12.1-1). Most of this area could serve as foraging habitat (open shrublands). On the basis of an evaluation of SWReGAP land cover data, potentially suitable nest sites for this species (rocky cliffs and outcrops) do not occur on the SEZ or the transmission corridor, but about 280 acres (1 km^2) of this habitat may occur in the area of indirect effects.

The overall impact on the American peregrine falcon from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of 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.

American White Pelican

The American white pelican is a summer resident and fall migrant within the San Luis Valley. According to CNHP records, this species has been observed in the Blanca Wetlands about 5 mi (8 km) northwest of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the transmission corridor; however, about 1,290 acres (5 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 0.6% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the American white pelican from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Barrow's Goldeneye

The Barrow's goldeneye is a winter resident within the San Luis Valley. According to CNHP records, the species has not been recorded on the Fourmile East SEZ or in the affected area. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the transmission corridor; however, about 1,420 acres (6 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 1.0% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1).

The overall impact on the Barrow's goldeneye from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Ferruginous Hawk

The ferruginous hawk is a summer breeding resident in the Fourmile East SEZ region and is known to occur about 10 mi (16 km) northwest of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, about 2,000 acres (8 km^2) of potentially suitable habitat on the SEZ and 50 acres (<0.5 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents 0.2% of available suitable habitat in the SEZ region. About 36,287 acres (147 km^2) of potentially 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 10.3.12.1-1). 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 (trees and rocky cliffs and outcrops) do not occur on the SEZ. However, about 10,300 acres (42 km^2) of forested habitat and 280 acres (1 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 Fourmile East SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of impacts on suitable foraging habitat is not a feasible way to mitigate impacts on the ferruginous hawk because potentially suitable shrubland is widespread throughout the area of direct effects and readily available in other portions of the affected area.

Mountain Plover

The mountain plover is a summer breeding resident in the Fourmile East SEZ region and is known to occur about 25 mi (40 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, about 1,800 acres (7.5 km^2) of potentially suitable habitat on the SEZ and 14 acres (<0.5 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents 0.1% of available suitable habitat in the SEZ region. About 40,375 acres (163 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.4% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1). Most of this area could serve as foraging and nesting habitat.

The overall impact on the mountain plover from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of all potentially suitable foraging and nesting habitats is not feasible to mitigate impacts on the mountain plover because potentially suitable habitats are widespread throughout the area of direct effect and may be readily available in other portions of the SEZ region. Direct impacts on the mountain plover could be reduced by avoiding or minimizing disturbance to occupied nests and suitable habitat in the area of direct effects. If avoiding or minimizing disturbance to all occupied habitat is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Western Burrowing Owl

The western burrowing owl is a summer breeding resident in the San Luis Valley. According to the SWReGAP habitat suitability model, about 2,425 acres (10 km^2) of potentially suitable habitat on the SEZ and 19 acres (<0.1 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents about 0.1% of potentially suitable habitat in the SEZ region. About 48,000 acres (194 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.2% of the potentially suitable habitat in the SEZ region (Table 10.3.12.1-1). Most of this area could serve as foraging and nesting habitat. The abundance of burrows suitable for nesting on the SEZ, transmission corridor, 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 Fourmile East SEZ is considered small because the amount of potentially suitable foraging and nesting habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging and nesting habitat in the region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of all potentially suitable habitats is not feasible to mitigate impacts on the western burrowing owl because potentially suitable shrubland habitats are widespread throughout the area of direct effect and readily available in other portions of the SEZ region. However, impacts on the western burrowing owl could be reduced by avoiding or minimizing disturbance to occupied burrows and habitat in the area of direct effects. If avoiding or minimizing disturbance to all occupied habitat is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting preconstruction surveys for the species and its habitat within the area of direct effects.

Western Snowy Plover

The western snowy plover is a summer resident and fall migrant within the San Luis Valley. According to CNHP records, the species has been observed in the Blanca Wetlands about 5 mi (8 km) northwest of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur in the affected area; however, on the basis of SWReGAP land cover types, about 1,466 acres (6 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 5.0% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1). No potentially suitable land cover types occur in the area of direct effects. The potentially suitable habitat within the area of indirect effects is primarily associated with the Blanca Wetlands, about 3 mi (5 km) northwest of the SEZ.

The overall impact on the western snowy plover from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident within the Fourmile East SEZ region and is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, about 3,800 acres (15.5 km^2) of potentially suitable habitat on the SEZ and 63 acres (<0.5 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents about 0.2% of available suitable habitat in the SEZ region. About 80,840 acres (327 km^2) of potentially suitable habitat occurs in the area of potential indirect impacts; this area represents about 2.9% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1). 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; about 280 acres (1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the big free-tailed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Pale Townsend's Big-Eared Bat

The pale Townsend's big-eared bat is a year-round resident within the Fourmile East SEZ region and is known to occur about 25 mi (40 km) southwest of the SEZ. According to the SWReGAP habitat suitability model, about 1,800 acres (7.5 km^2) of potentially suitable habitat on the SEZ and 16 acres (<0.5 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents about 0.1% of available suitable habitat in the SEZ region. About 51,488 acres (208 km^2) of potentially suitable habitat occurs in the area of potential indirect impacts; this area represents about 1.7% of the available potentially suitable habitat in the SEZ region (Table 10.3.12.1-1). 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; about 280 acres (1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the pale Townsend's big-eared bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Fourmile East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of 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.

10.3.12.2.4 Impacts on State-Listed Species

Three state-listed species could occur in the affected area of the Fourmile East SEZ: bald eagle, southwestern willow flycatcher, and western burrowing owl. Two of these species (southwestern willow flycatcher and western burrowing owl) were discussed in Section 10.3.12.2.1 and Section 10.3.12.2.3 because of their status under the ESA and BLM. For the remaining state listed species, the bald eagle, impacts from solar development within the Fourmile East SEZ are discussed below.

The bald eagle is a year-round resident within the Fourmile East SEZ region and is known to occur about 10 mi (16 km) west of the SEZ. According to the SWReGAP habitat suitability model, about 1,800 acres (7.5 km^2) of potentially suitable habitat on the SEZ and 14 acres (<1 km^2) of potentially suitable habitat within the assumed transmission corridor could be directly affected by construction and operations (Table 10.3.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. About 43,930 acres (178 km^2) of suitable habitat occurs in the area of potential indirect effect; this area represents about 2.1% of the available suitable habitat in the SEZ region (Table 10.3.12.1-1). 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, potentially suitable nesting habitat for the bald eagle (riparian woodlands) does not occur on the SEZ or within the transmission corridor. However, about 80 acres (0.3 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 Fourmile East SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of 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.

10.3.12.2.5 Impacts on Rare Species

Fifty-seven species with a state status of S1 or S2 in Colorado or that are listed as species of concern by the USFWS or Colorado may occur in the affected area of the Fourmile East SEZ. Impacts have been previously discussed for 15 of these species that are also listed under the ESA (Section 10.3.12.2.1), are candidates for listing under the ESA (10.3.12.2.2), are BLM-designated sensitive (10.3.12.2.3), or are state-listed species (10.3.12.2.4). Impacts on the remaining 42 rare species that do not have any other special status designation are presented in Table 10.3.12.1-1.

10.3.12.3 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 and transmission corridor to determine the presence and abundance of special status species, including those identified in Table 10.3.12.1-1; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that uses one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.

- Avoiding or minimizing impacts on grassland habitat in the transmission corridor could reduce impacts on the Livermore fiddleleaf, 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, a candidate species for listing under the ESA. Coordination would identify an appropriate survey protocol, avoidance measures, and, potentially, translocation or compensatory mitigation.

- Harassment or disturbance of federally listed species, candidates for federal listing, BLM-designated sensitive species, state-listed species, rare species, and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and CDOW.

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on special status species would be reduced.

10.3.13 Air Quality and Climate

10.3.13.1 Affected Environment

10.3.13.1.1 Climate

The proposed Fourmile East SEZ is located in southeastern portion of Alamosa County in south-central Colorado. The SEZ, with an average elevation of about 7,620 ft (2,323 m), is located in the central part of the San Luis Valley. The valley lies in a broad depression between the Sangre de Cristo Mountain Range to the east and the San Juan and La Garita Mountain Ranges to the west; they converge to the north. As a result of these barriers, the valley experiences an arid climate, which is marked by cold winters and moderate summers, light precipitation, a high rate of evaporation, and abundant sunshine due to the thin atmosphere caused by its high elevation (NCDC 2009a). Meteorological data collected at the San Luis Valley Regional Airport and Blanca, which are about 12 mi (19 km) west-southwest and 7 mi (11 km) southeast of the Fourmile East SEZ, respectively, are summarized below.

A wind rose from the San Luis Valley Regional Airport in Alamosa, Colorado, for the 5-year period 2004 to 2008 taken at a level of 33 ft (10 m) is presented in Figure 10.3.13.1-1 (NCDC 2009b). During this period, the annual average wind speed at the airport was about 7.4 mph (3.3 m/s), with a relatively weak prevailing wind direction from the southwest (about 7.9% of the time). Winds that ranged from the south to west-southwest occurred for about 30.5% of the time and prevailed throughout the year, except in July and August when east-southeast winds prevailed. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (about one-fifth of the time) because of the stable conditions caused by strong radiative cooling that lasted from late night to sunrise. Average wind speeds were the highest in spring at 9.6 mph (4.3 m/s); lower in summer and fall at 7.4 mph (3.3 m/s) and 6.7 mph (3.0 m/s), respectively; and lowest in winter at 6.1 mph (2.7 m/s).

In Colorado, topography plays a large role in determining the temperature of any specific location (NCDC 2009c). The San Luis Valley is at a relatively high elevation; thus temperatures are relatively lower than at lesser elevations of comparable latitude. For the 1909 to 2009 period, the annual average temperature at Blanca was 42.2°F (5.7°C) (WRCC 2009). January was the coldest month, with an average minimum temperature of 2.0°F (–16.7°C), and July was the warmest month, with an average maximum temperature of 81.6°F (27.6°C). In summer, daytime maximum temperatures over 90°F (32.2°C) were infrequent, and minimum temperatures were in the low 40s. On most days of the colder months (November through March), the minimum temperatures recorded were below freezing (≤32°F [0°C]), and subzero temperatures were common in January and December. For the 1909 to 2009 period, the highest temperature, 97°F (36.1°C), was reached in June 1961, and the lowest, –38°F (–38.9°C), was reached in January 1963. Each year, about 1.7 days had a maximum temperature that was 90°F (32.2°C) or greater, while about 220 days had a minimum temperature at or below freezing.

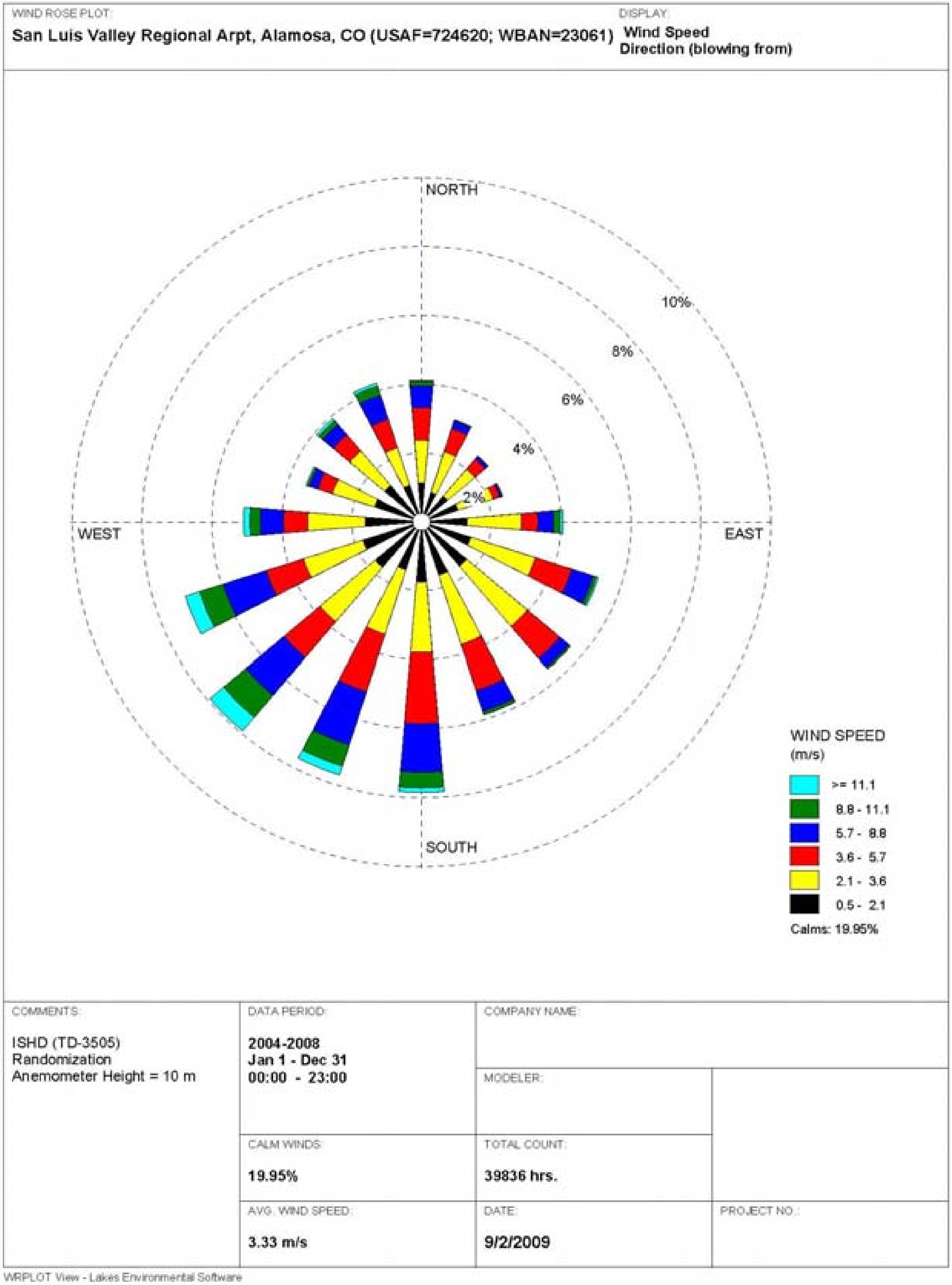

FIGURE 10.3.13.1-1 Wind Rose at 33-ft (10-m) Height at San Luis Valley Regional Airport, Alamosa, Colorado, 2004–2008 (Source: NCDC 2009b)

In Colorado, precipitation patterns are largely controlled by mountain ranges and elevation (NCDC 2009c). Because the San Luis Valley is so far from major sources of moisture and is surrounded by mountain ranges, precipitation is relatively light there. The valley is among the driest areas in Colorado. In the 1909 to 2009 period, annual precipitation at Blanca averaged about 8.59 in. (21.8 cm) (WRCC 2009). On average, 56 days a year have measurable precipitation (0.01 in. [0.025 cm] or higher). Nearly half of the annual precipitation occurs during summer months, when the Southwest Monsoon is most active (NCDC 2009c). Most of it is in the form of scattered, light showers and thunderstorms that develop over the mountains and move into the valley from the southwest. Scattered afternoon thunderstorms can accompany locally heavy rain and occasional hail. Snow occurs mainly in light falls that start as early as October and continue as late as May; most of the snow falls from November through April. The annual average snowfall at Blanca is about 24.4 in. (62.0 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).

In 1999, two floods were reported in Alamosa County (NCDC 2010). These floods caused considerable property and crop damage.

In Alamosa County, 13 hail events have been reported since 1961, one of which caused some property and crop damage. Hail measuring 2.50 in. (6.4 cm) in diameter was reported in 2008. In Alamosa County, 22 high wind and 10 thunderstorm wind events have been reported since 1995 and 1962, respectively. Such events, with up to a maximum wind speed of 104 mph (46 m/s), have occurred any time of the year. Nine injuries and some property damage have been reported (NCDC 2010).

No dust storm events have been reported in Alamosa County (NCDC 2010). Nevertheless, the ground surface of the SEZ is covered predominantly with loamy fine sands and loamy sands, which have relatively high dust storm potential. High winds can trigger large amounts of blowing dust in areas of Alamosa County that have dry and loose soils with sparse vegetation. Dust storms can reduce air quality and visibility and may cause adverse health effects, 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 Alamosa County, which encompasses the proposed Fourmile East SEZ, occur infrequently. In the period 1950 to June 2010, a total of 15 tornadoes (0.3 per year) were reported in Alamosa County (NCDC 2010). However, most of those tornadoes were relatively weak (i.e., nine were F0, five were F1, and one was F2 on the Fujita tornado scale), three of these caused minor property damage. Two of these tornadoes occurred about 3 to 4 mi (5 to 6 km) from the SEZ.

10.3.13.1.2 Existing Air Emissions

In Alamosa County, there are 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. 160 and U.S. 285, and several state routes exist in Alamosa County. Thus, onroad mobile source emissions are not substantial. Data on annual emissions of criteria pollutants and VOCs in Alamosa County, which encompasses the proposed Fourmile East SEZ, are presented in Table 10.3.13.1-1 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). In 2002, onroad and area sources were major contributors to SO_2 emissions, accounting for about 29% and 28%, respectively, of the county total SO_2 emissions. Onroad sources accounted for about 48% of the NO_x emissions and 68% of the CO emissions. Biogenic sources (e.g., vegetation, including trees, plants, and crops, and soils) accounted for about 88% of the VOC emissions. Area sources accounted for most of the county emissions of PM_{10} and $PM_{2.5}$, about 94% and 84%, respectively. Nonroad sources were secondary contributors to SO_2 (about 22%), NO_x (about 29%), and CO emissions (about 15%). In Alamosa County, point and fire sources were minor contributors to most of criteria pollutants and VOCs, except that point sources were secondary contributors to SO_2 emissions (about 21%).

TABLE 10.3.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Alamosa County, Colorado, Encompassing the Proposed Fourmile East SEZ, 2002[a]

Pollutant[b]	Emissions (tons/yr)
SO_2	49
NO_x	1,219
CO	9,604
VOCs	9,165
PM_{10}	1,223
$PM_{2.5}$	327

a Includes point, area, onroad and nonroad mobile, biogenic, and fire emissions.

b Notation: CO = carbon monoxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

Source: WRAP (2009).

In 2005, Colorado produced about 118 million metric tons (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%) and transportation (31%) sectors accounted

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.

for about three-fourths of the CO_2 total, and the residential, commercial, and industrial sectors accounted for the remainder.

10.3.13.1.3 Air Quality

Colorado State Ambient Air Quality Standards (SAAQS) include six criteria pollutants: SO_2, NO_2, CO, 1-hour O_3, PM_{10}, and Pb (5 *Code of Colorado Regulations* 1001-14; CDPHE 2008a). The Colorado SAAQS are identical to the National Ambient Air Quality Standards (NAAQS) for annual NO_2, CO, 1-hour O_3, and 24-hour PM_{10} (EPA 2010), but Colorado has no standards for 1-hour, 24-hour, and annual SO_2; 1-hour NO_2; 8-hour O_3; $PM_{2.5}$; and calendar quarter and rolling 3-month Pb. Colorado has more stringent standards than the NAAQS for 3-hour SO_2 and 1-month Pb, and it still maintains an annual average PM_{10} standard, for which the national standard was revoked by the EPA on December 18, 2006. The NAAQS/SAAQS for criteria pollutants are presented in Table 10.3.13.1-2.

Alamosa County, which encompasses the Fourmile East 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 Conejos, Costilla, Mineral, Rio Grande, and Saguache Counties, which is the same as Colorado State AQCR 8. Currently, Colorado State AQCR 8 is designated as being in unclassifiable/attainment for all criteria pollutants (40 CFR 81.306).

Because of low population density, low level of industrial activities (except for agriculture-related activities), and low traffic volume, the quantity of anthropogenic emissions in the San Luis Valley is small, and ambient air quality is thus 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 2008a).

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 10.3.13.1-2 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 phaseout of leaded gasoline in automobiles in the 1970s, average Pb concentrations throughout the country have decreased dramatically. Accordingly, Pb is not an air quality concern except at certain locations, such as lead smelters, waste incinerators, and lead-acid battery facilities, where the highest levels of lead in air are found.

TABLE 10.3.13.1-2 Applicable Ambient Air Quality Standards and Background Concentration Levels Representative of the Proposed Fourmile East SEZ in Alamosa County, Colorado

			Background Concentration Level	
Pollutant[a]	Averaging Time	NAAQS/ SAAQS[b]	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 (1.6 km) northeast of Ignacio on County Road 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.

Footnotes continued on next page.

TABLE 10.3.13.1-2 (Cont.)

[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.

[g] Colorado has also established increments limiting the allowable increase ambient concentrations over an established baseline.

[h] Colorado state standard for 3-hour SO_2 is 700 $\mu g/m^3$ (0.267 ppm).

[i] Effective April 12, 2010.

[j] The EPA revoked the 1-hour O_3 standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").

[k] Effective December 18, 2006, the EPA revoked the annual PM_{10} standard of 50 $\mu g/m^3$.

[l] The Colorado Pb standard is 1-month average of 1.5 $\mu g/m^3$.

[m] Effective January 12, 2009.

Sources: CDPHE (2008a); 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 locate within 62 mi (100 km) of a Class I area. There are several Class I areas around the Fourmile East SEZ, four 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 9 mi (14 km) north of the Fourmile East SEZ. This Class I area is located downwind of prevailing winds at the Fourmile East SEZ (see Figure 10.3.13.1-1). Two other Class I areas in this range—Weminuche and La Garita WAs—in Colorado are located about 62 mi (100 km) west and west-northwest of the Fourmile East SEZ, respectively. The fourth Class I area is the Wheeler Peak WA in New Mexico (40 CFR 81.421), which is located about 60 mi (97 km) south of the Fourmile East SEZ. The latter three Class I areas are not located downwind of the prevailing winds at the Fourmile East SEZ.

10.3.13.2 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 sources with generally low-level emissions would exist for any of the four types of solar technologies evaluated. A solar facility would either not burn fossil fuels or burn only small amounts during operation. (For facilities using HTFs, fuel could be used to maintain the temperature of the HTFs for more efficient daily start-up.) Conversely, solar facilities would displace air emissions that would otherwise be released from fossil-fuel power plants.

Air quality impacts shared by all solar technologies are discussed in detail in Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific to the Fourmile East 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 10.3.13.3 below identifies SEZ-specific design features of particular relevance to the Fourmile East SEZ.

10.3.13.2.1 Construction

The Fourmile East 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 wind-blown 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 AERMOD model (EPA 2009c). Details for emissions estimation, the description of AERMOD, input data processing procedures, and modeling assumption are described in Section M.13 of Appendix M. Estimated air concentrations were compared with the applicable NAAQS/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 Fourmile East SEZ, the modeling was conducted on the basis of the following assumptions and input:

- Uniformly distributed emissions over the 3,000 acres (12.1 km^2) in the southern and central portions of the SEZ, close to the nearest residence and the towns of Alamosa and Blanca;

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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.

- Surface hourly meteorological data from the San Luis Valley Regional Airport in Alamosa and upper air sounding data from Denver for the 2004 to 2008 period;

- A regularly spaced receptor grid over a modeling domain of 62 mi × 62 mi (100 km × 100 km) centered on the proposed SEZ; and

- Additional discrete receptors at the SEZ boundaries and at the nearest Class I area—Great Sand Dunes WA—about 9 mi (14 km) north 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 10.3.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled at the site boundaries would be about 569 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. Total 24-hour PM_{10} concentrations of 596 μg/m^3 would also exceed the standard level, by about a factor of 4, at the SEZ boundary. However, high PM_{10} concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Predicted maximum 24-hour PM_{10} concentration increments would be about 130 μg/m^3 at the nearest residence about 0.8 mi (1.3 km) southwest of the SEZ, about 20 μg/m^3 at Alamosa and Blanca, about 13 μg/m^3 at Estrella and Mosca, and about 8 μg/m^3 at Fort Garland, La Jara, and Sanford. Annual modeled and total PM_{10} concentration increments at the SEZ boundary would be about 101 μg/m^3 and 114 μg/m^3, respectively, which are higher than the standard level of 50 μg/m^3. Annual PM_{10} increments would be much lower for the mentioned locations, about 3 μg/m^3 at the nearest residence, about 0.7 μg/m^3 at Blanca and about 0.3 μg/m^3 at Alamosa and Mosca. Total 24-hour $PM_{2.5}$ concentrations would be 57 μg/m^3 at the SEZ boundary, which is about 162% of the standard level; modeled concentrations are more than twice background concentrations. The total annual average $PM_{2.5}$ concentration would be 14.1 μg/m^3, which is just 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 4 and 0.3 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 34.2 and 1.1 μg/m^3, or 427% and 28%, respectively, of the allowable PSD increment levels for Class I areas. When distance, prevailing winds, and topography are considered, concentration increments at the other three Class I areas (La Garita WA and Weminuche WA, and Wheeler Peak WA, New Mexico) would be much lower than those at the Great Sand Dunes WA.

In conclusion, predicted 24-hour and annual PM_{10} and 24-hour $PM_{2.5}$ concentration levels could exceed air quality standard levels 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 BLM design features, aggressive dust control measures would be used. Additionally, potential air quality impacts on neighboring

TABLE 10.3.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Fourmile East SEZ

			Concentration (µg/m^3)				Percentage of NAAQS/SAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background	Total	NAAQS/ SAAQS	Increment	Total
PM_{10}	24 hours	H6H	569	27	596	150	379	397
	Annual	–	101	13	114	50	202	228
$PM_{2.5}$	24 hours	H8H	40.8	16	56.8	35	117	162
	Annual	–	10.1	4	14.1	15	67	94

a $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 µm; PM_{10} = particulate matter with a diameter of ≤10 µm.

b Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the five-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the five-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

Source: Chick (2009) for background concentration data.

communities would be much lower. Predicted total concentrations for annual $PM_{2.5}$ would be below the standard level. Modeling indicates that construction activities could result in concentrations above Class I PSD PM_{10} increment levels at the nearest federal Class I area, 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 gage 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 engine exhaust of heavy equipment and vehicles could cause potential 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 BLM design features would require that ultra-low–sulfur fuel with a sulfur content of 15 ppm would be used. NO_x emissions from engine exhaust would be primary contributors to potential impacts on AQRVs. Construction-related emissions are temporary in nature and thus would cause some unavoidable but short-term impacts.

It is assumed that a transmission line would need to be constructed to connect to the nearest existing line located about 2 mi (3 km) south of the Fourmile East SEZ. As discussed in Section 5.11.1.5, this activity would result in fugitive dust emissions from soil disturbance and engine exhaust emissions from heavy equipment and vehicles (commuter, visitor, support, and delivery vehicles), as at other construction sites. Because of the short distance to the regional grid, transmission line construction from the Fourmile East SEZ could be performed in a relatively short time (likely a few months). The construction site along the transmission line ROW would move continuously; thus no particular area would be exposed to air emissions for a prolonged period, and potential air quality impacts on nearby residences along the transmission lines ROW, if any, would be minor and temporary.

10.3.13.2.2 Operations

Emission sources associated with the operation of a solar facility include auxiliary boilers; vehicle traffic (commuter, visitor, support, and delivery); maintenance (e.g., mirror cleaning and repair or replacement of damaged mirrors); and drift from cooling towers for the parabolic trough or power tower technology if wet cooling was implemented (drift constitutes low-level PM emissions).

The types 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 Fourmile East SEZ are presented in Table 10.3.13.2-2. Total power generation capacity ranging from 345 to 621 MW was estimated for the Fourmile East SEZ for various solar technologies (see Section 10.3.1.2). 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 Fourmile East SEZ was fully developed, it is expected that the emissions avoided would be somewhat substantial. Development of 345 to 621 MW of solar power in the SEZ would result in avoided air emissions ranging from 1.3 to 2.3% 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 0.6% 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 1.2% of SO_2, 0.4% of NO_x, and 1.0% of CO_2 emissions in the state of Colorado (EPA 2009a; WRAP 2009). These emissions would be up to 0.3% of total emissions from all source categories in the six-state study area. Power generated 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 Fourmile East 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 inspection and maintenance. However, these activities would occur infrequently, and 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 Fourmile East SEZ is located in an arid desert environment, these emissions would be small, and the potential

TABLE 10.3.13.2-2 Annual Emissions from Combustion-Related Power Generation Displaced by Full Solar Development of the Proposed Fourmile East 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
3,882	345–621	604–1,088	799–1,439	922–1,659	0.005–0.009	597–1,075
Percentage of total emissions from electric power systems in the state of Colorado[d]			1.3–2.3%	1.3–2.3%	1.3–2.3%	1.3–2.3%
Percentage of total emissions from all source categories in the state of Colorado[e]			0.68–1.2%	0.23–0.40%	–[f]	0.57–1.0%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.32–0.57%	0.25–0.45%	0.18–0.32%	0.23–0.41%
Percentage of total emissions from all source categories in the six-state study area[e]			0.17–0.31%	0.03–0.06%	–	0.07–0.13%

[a] It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km^2) per MW (parabolic trough technology) to 9 acres (0.036 km^2) per MW (power tower, dish engine, and PV technologies) would be required.

[b] A capacity factor of 20% is assumed.

[c] Composite combustion-related emission factors for SO_2, NO_x, Hg, and CO_2 of 2.64, 3.05, 1.71×10^{-5}, and 1,976 lb/MWh, respectively, were used for the state of Colorado.

[d] Emission data for all air pollutants are for 2005.

[e] Emission data for SO_2 and NO_x are for 2002, while those for CO_2 are for 2005.

[f] A dash indicates not estimated.

Source: EPA (2009a,d); WRAP (2009).

impacts on ambient air quality would be negligible, taking into consideration infrequent occurrences of and small amount of emissions from corona discharges.

10.3.13.2.3 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 in nature. The same mitigation measures adopted during the construction phase would also be implemented during the decommissioning phase (Section 5.11.3).

10.3.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. Limiting dust generation during construction and operations at the Fourmile East SEZ (for example by increased watering frequency, or road paving or treatment) is a required design feature under BLM's Solar Energy Program. These extensive fugitive dust control measures would keep off-site PM levels (particularly at Great Sand Dunes WA) as low as possible during construction.

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10.3.14 Visual Resources

10.3.14.1 Affected Environment

10.3.14.1.1 Regional Setting

The proposed Fourmile East SEZ is located approximately 33.5 mi (53.9 km) north of the Colorado–New Mexico border on the eastern side of the San Luis Valley in Alamosa County in southern Colorado. Section 10.1.7.1.1 discusses the regional setting (San Luis Valley) for Fourmile East and the other Colorado SEZs.

10.3.14.1.2 Fourmile East SEZ

The proposed Fourmile East SEZ (3,882 acres [15.7 km^2]) occupies an area approximately 4.0 mi (6.4 km) north to south (at greatest extent) and 3.3 mi (5.3 km) east to west and is located approximately 11.8 mi (18.9 km) (at closest approach) east–northeast of the town of Alamosa, Colorado, and 6.4 mi (10.3 km) northwest of the community of Blanca. CO 150 (Los Caminos Antiguos Scenic Byway) passes through the far eastern side of the SEZ, and U.S. 160 parallels the far southern boundary of the SEZ at a distance of 0.5 mi (0.8 km). The elevation of the proposed Fourmile East SEZ ranges from 7,589 ft (2,313 m) along the western portion of the SEZ to 7,678 ft (2,339 m) in the northeastern portion, along State Route 150.

The SEZ is a flat treeless plain; the strong horizon line is the dominant visual feature except for views to the northeast, which are dominated by Blanca Peak and the surrounding mountains a short distance from the northeast corner of the SEZ.

Vegetation varies somewhat in different parts of the SEZ. Some areas contain primarily low shrubs (generally less than 4 ft [1.2 m] in height), mixed with prickly pear cacti, and many large areas of bare, generally tan soil, presenting varied colors and generally coarse foreground textures. In other areas, grasses predominate, and vegetative cover is thicker, with more consistent color and finer visual texture. During a July 2009 site visit, the vegetation presented a range of gray-blues, greens, and grays, with banding and other variation sufficient to add visual interest. Some or all the vegetation might be snow-covered in winter, and the snow cover might significantly affect the visual qualities of the area by changing the color contrasts associated with the vegetation and could in turn change the contrasts associated with the introduction of solar facilities into the landscape.

No permanent water features are present on the SEZ. This landscape type is common within the region.

Although the SEZ itself is generally natural appearing, cultural modifications within the SEZ detract somewhat from the SEZ's scenic quality. In addition to State 150, several gravel and dirt roads of various sizes cross the SEZ. Traffic on U.S. 160 is visible from much of the SEZ. Panoramic views of the SEZ are shown in Figures 10.3.14.1-1, 10.3.14.1-2, and 10.3.14.1-3.

Off-site views are dominated by Blanca Peak and the surrounding mountains, which rise abruptly from the valley floor just northeast of the SEZ. The spatial relationship of the SEZ and the nearby mountains makes the Blanca Peak area seem somewhat isolated from the rest of the Sangre de Cristo Range and adds to Blanca Peak's visual prominence. The slopes of the nearby mountains are forested, with snow at the higher elevations, adding variety in color and texture. While evidence of past timber harvesting on the mountain slopes detracts slightly from the visual integrity of the view of Blanca Peak, the dramatic visual presence of the adjacent mountains adds significantly to the scenic value of the SEZ.

Immediately north of the visual mass of Blanca Peak and the surrounding mountains, the low form of light-colored sand dunes within the western portions of Great Sand Dunes National Park (approximately 8.6 mi [13.8 km] distant at the point of closest approach) is visible against the darker backdrop of the Sangre de Cristo Range, which recedes northward almost as far as the eye can see. To the northwest, west, and southwest, the low forms of the distant San Juan Mountains are visible across the valley floor, and the Sangre de Cristo Range is visible to the southeast.

While the land to the east and northeast of the SEZ is undeveloped, the lands to the north, west, and south of the SEZ are rural in character, and off-site views from the SEZ in these directions include a number of cultural modifications that detract slightly from the scenic quality of the area. Isolated ranches and homes and associated structures are visible in private lands adjacent to the SEZ, as are roads and local traffic. Scattered tanks and other structures associated with ranching and farming are visible, primarily west of the SEZ. Some of these cultural modifications are visible in Figure 10.3.14.1-1.

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. Classes I and II are the most valued; Class III represents a moderate value; and Class IV represents the least value. Class I is reserved for specially designated areas, such as national wildernesses and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape. Class II is the highest rating for lands without special designation. More information about VRI methodology is available in Section 5.12 and in Visual Resource Inventory, BLM Manual Handbook 8410-1 (BLM 1986a).

The VRI values for the SEZ and immediate surroundings are VRI Class III, indicating moderate 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, and the relative commonness of the landscape type within the region. Positive scenic quality attributes included some variety in vegetation types and color and attractive off-site views; however, these positive attributes were insufficient to raise the scenic quality to the "Moderate"

FIGURE 10.3.14.1-1 Approximately 180° Panoramic View from the Southern Portion of the Proposed Fourmile East SEZ Facing North, Including Blanca Peak and Great Sand Dunes National Park at Far Right

FIGURE 10.3.14.1-2 Approximately 120° Panoramic View from the South-Central Portion of the Proposed Fourmile East SEZ Facing Northwest, Including San Juan Mountains in Background

FIGURE 10.3.14.1-3 Approximately 120° Panoramic View from the Central Portion of the Proposed Fourmile East SEZ Facing Northeast, Including Blanca Peak at Right Center and Great Sand Dunes National Park and Sangre de Cristo Range at Left

level. The inventory indicates high sensitivity for the SEZ and its immediate surroundings. The inventory indicates relatively low levels of use; however, the overall sensitivity rating is "High" because the Los Caminos Antiguos Byway passes through the SEZ. The byway is noted as a major route to access Great Sand Dunes National Park, in addition to its historic and scenic values.

Other factors contributing to the sensitivity rating include the following:

- Changes here would attract public attention.

- The SEZ is visible from the Sangre de Cristo Wilderness.

- The SEZ is within the Sangre de Cristo NHA.

- The Blanca Wetlands ACEC is nearby.

Lands within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ contain 139,836 acres (566 km^2) of VRI Class II areas, primarily northwest of the SEZ in the Lake Mead area; 402,069 acres (1,627 km^2) of Class III areas surrounding the SEZ, primarily north of the SEZ; and 41,928 acres (170 km^2) of VRI Class IV areas, surrounding the SEZ.

The VRI map for the SEZ and surrounding lands is shown in Figure 10.3.14.1-4. More information about VRI methodology is available in Section 5.7 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The San Luis Resource Management Plan (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 SEZ and surrounding lands is shown in Figure 10.3.14.1-5. More information about BLM's VRM program is available in Section 5.7 and in *Visual Resource Management*, BLM Manual Handbook 8400 (BLM 1984).

10.3.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Fourmile East 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

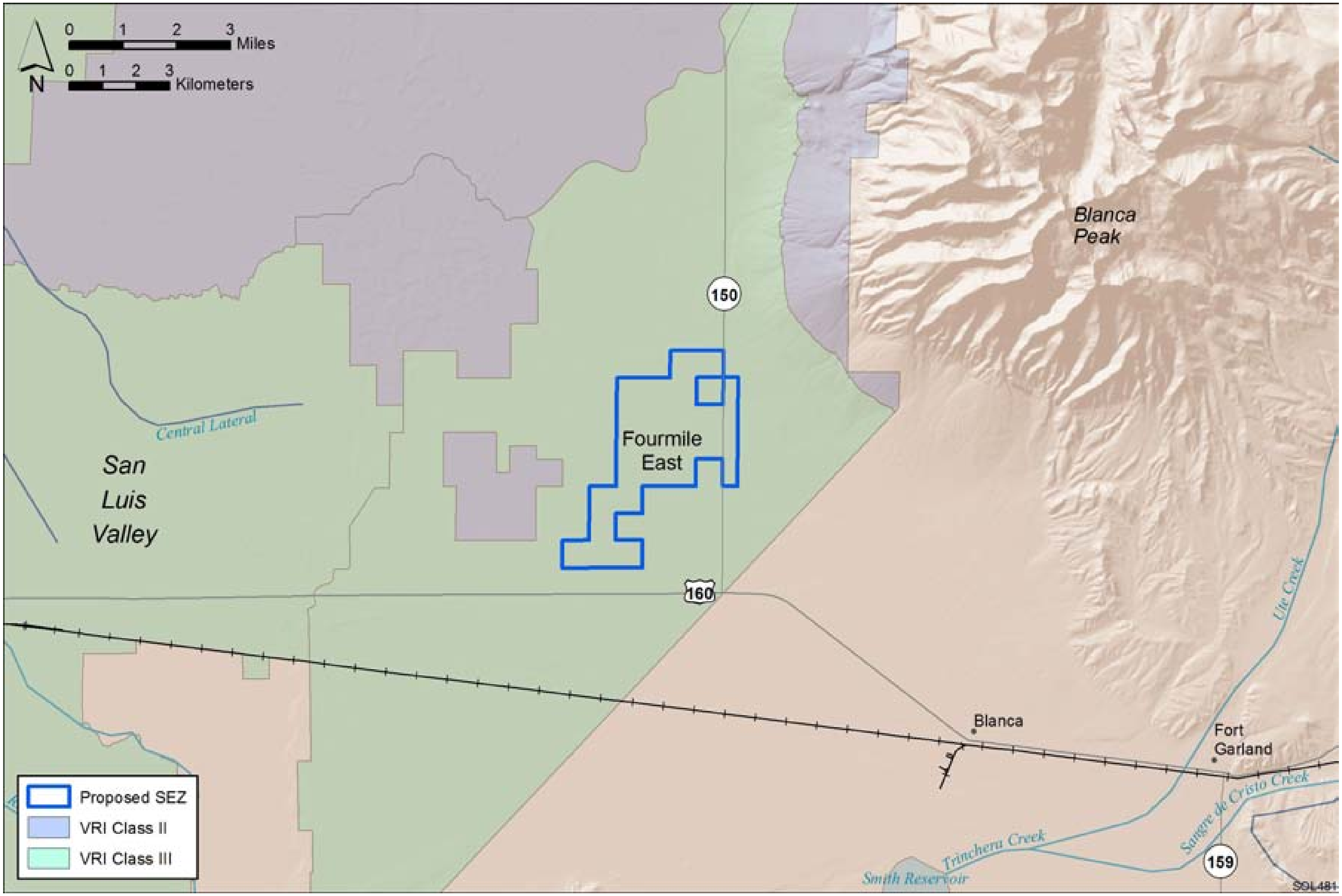

FIGURE 10.3.14.1-4 Visual Resource Inventory Values for the Proposed Fourmile East SEZ and Surrounding Lands

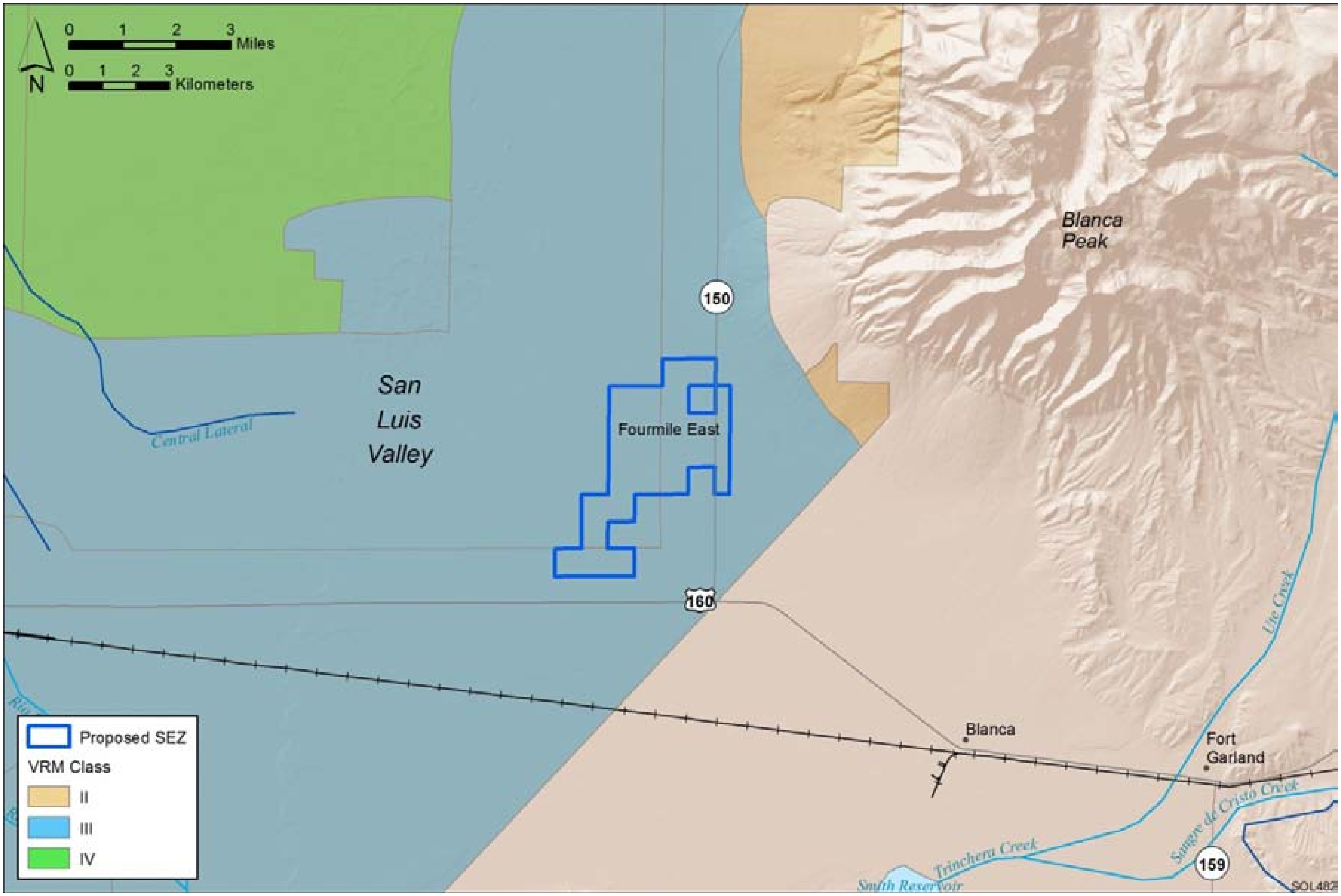

FIGURE 10.3.14.1-5 Visual Resource Management Classes for the Proposed Fourmile East SEZ and Surrounding Lands

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 on the methodology employed for the visual impact assessment for this Solar Energy PEIS, including assumptions and limitations, is presented in Appendix M.

Potential glint and glare impacts. Similarly, the nature and magnitude of potential glint- and glare-related visual impacts for a given solar facility are 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 thus is not possible given the scope of the PEIS. Therefore, the following analysis does not describe or suggest potential contrast levels arising from glint and glare for facilities that might be developed within the SEZ; however, it should be assumed that glint and glare are possible visual impacts from any utility-scale solar facility, regardless of size, landscape setting, or technology type. The occurrence of glint and glare at solar facilities could potentially cause large, though temporary, increases in brightness and visibility of the facilities. The visual contrast levels projected for sensitive visual resource areas discussed in the following analysis do not account for potential glint and glare effects; however, these effects would be incorporated into a future site-and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more information about potential glint and glare impacts associated with utility-scale solar energy facilities, see Section 5.12 of this PEIS.

10.3.14.2.1 Impacts on the Proposed Fourmile East 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 in 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 or 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 10.3.22.4.13 of this 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. VRPM Class IV management objectives include major modification of the existing character of the landscape. As shown in Figure 10.3.14.1-5, 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 Fourmile East 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).

10.3.14.2.2 Impacts on Lands Surrounding the Proposed Fourmile East SEZ

Impacts on Selected Sensitive Visual Resource Areas

Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, lands outside the SEZ would be subjected to visual impacts related to construction, operation, and decommissioning of utility-scale solar energy facilities. The affected areas and extent of impacts would depend on a number of visibility factors and viewer distance (for a detailed discussion of visibility and related factors, see Section 5.12). A key component in determining impact levels is the intervisibility between the project and potentially affected lands; if topography, vegetation, or structures screen the project from viewer locations, there is no impact.

Preliminary viewshed analyses were conducted to identify which lands surrounding the proposed SEZ could have views of solar facilities in at least some portion of the SEZ (see Appendix M for 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 10.3.14.2-1 shows the combined results of the viewshed analyses for all four solar technologies. The colored portions 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

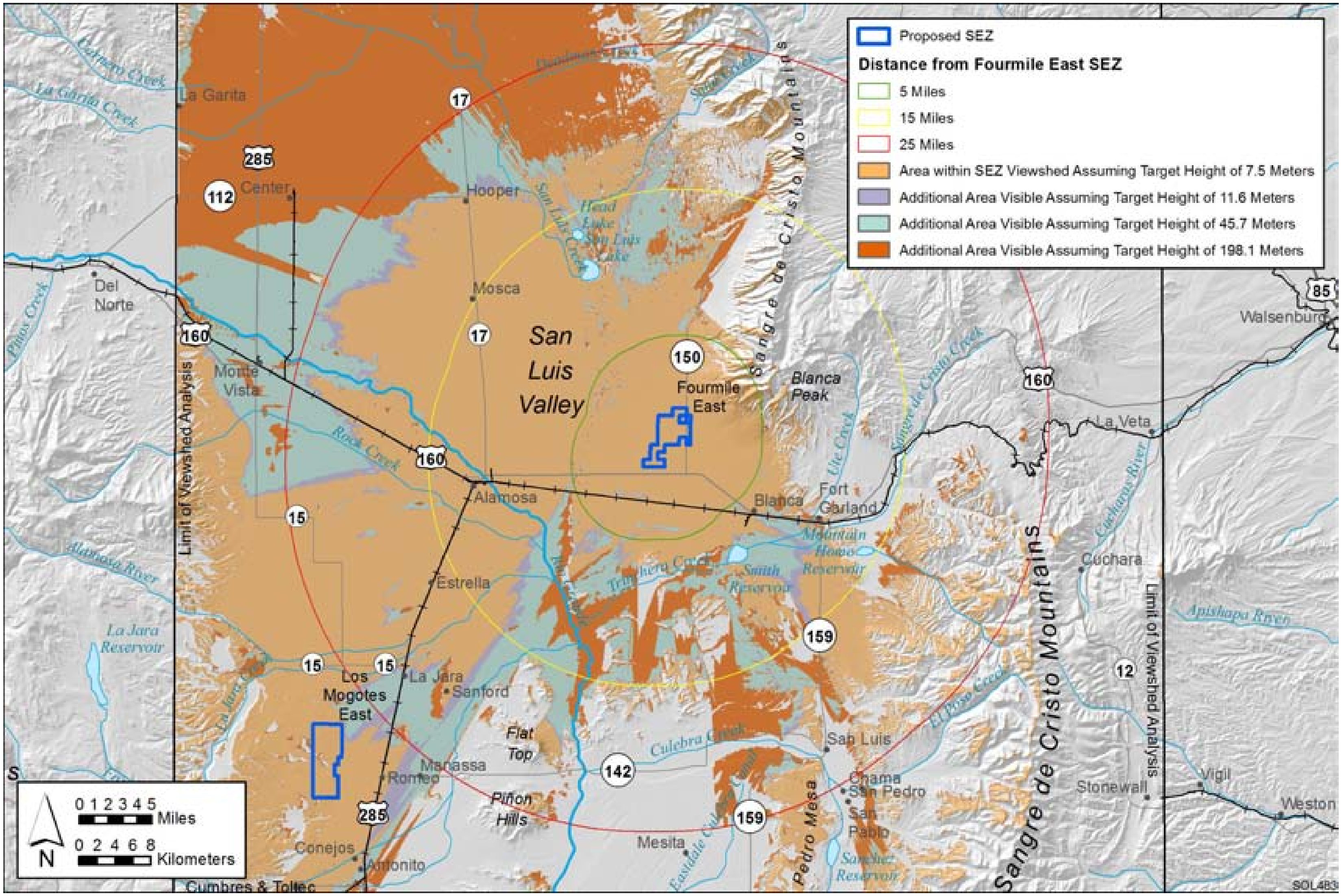

FIGURE 10.3.14.2-1 Viewshed Analyses for the Proposed Fourmile East SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

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 light brown and the additional areas shaded light purple. Transmission towers and short solar power towers would be visible from the areas shaded light brown and light purple and the additional areas shaded dark purple. Power tower facilities located in the SEZ could be visible from areas shaded light brown, light purple, and dark purple and at least the upper portions of power tower receivers could be visible from the additional areas shaded 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, respectively, for solar energy technologies analyzed in this PEIS. Viewsheds for solar dish and CSP technology power blocks (38 ft [11.6 m]) and for transmission towers and short solar power towers (150 ft [45.7 m]) are presented in Appendix N. The visibility of these facilities would fall between that for tall power towers and PV and parabolic trough arrays.

Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual Resource Areas

Figure 10.3.14.2-2 shows the results of a GIS analysis that overlays selected federal-, state-, and BLM-designated sensitive visual resource areas onto the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds, in order to illustrate which of these sensitive visual resource areas could have views of solar facilities within the SEZ and therefore potentially would be subject to visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-specified foreground-middleground distance (5 mi [8 km]), background distance (15 mi [24.1 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;

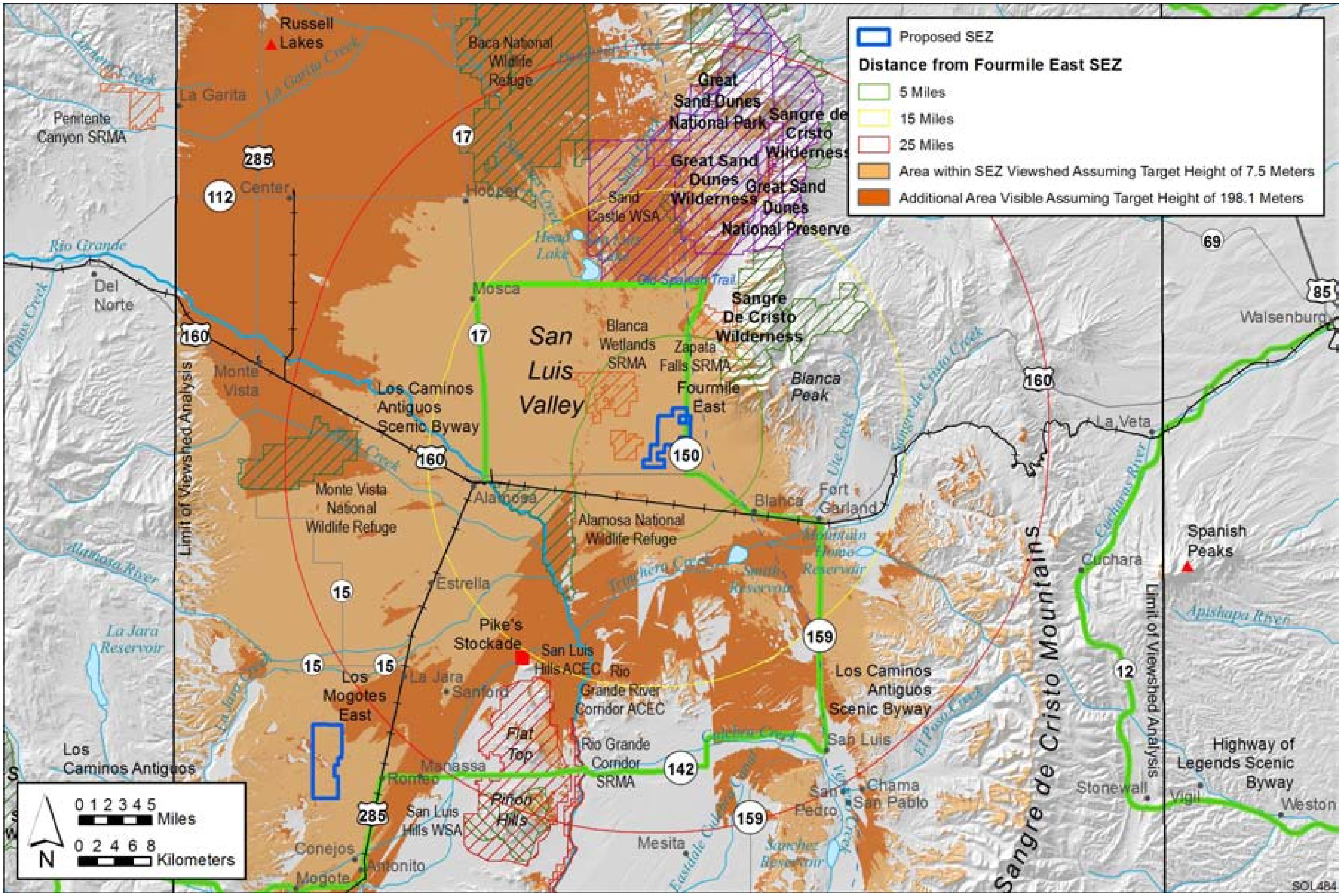

FIGURE 10.3.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds

- National Historic Landmarks and National Natural Landmarks;
- All-American Roads, National Scenic Byways, State Scenic Highways, and BLM- and USFS-designated scenic highways/byways;
- BLM-designated Special Recreation Management Areas; and
- ACECs designated because of outstanding scenic qualities.

Potential impacts on specific sensitive resource areas visible from and within 25 mi (40 km) of the proposed Fourmile East SEZ are discussed below. The results of this analysis are also summarized in Table 10.3.14.2-1. Further discussion of impacts on these areas is available in Sections 10.3.3 (Specially Designated Areas and Lands with Wilderness Character) and 10.3.17 (Cultural Resources) of this PEIS.

The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are changes in the landscape as seen by viewers, including changes in the forms, lines, colors, and textures of objects seen in the landscape. A measure of *visual impact* includes potential human reactions to the visual contrasts arising from a development activity, based on viewer characteristics, including attitudes and values, expectations, and other characteristics that that are viewer- and situation-specific. Accurate assessment of visual impacts requires knowledge of the potential types and numbers of viewers for a given development and their characteristics and expectations; specific locations where the project might be viewed from; and other variables that were not available or not feasible to incorporate into 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.

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section uses 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 10.3.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Fourmile East 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/Linear Distance)	Visible within 5 mi	5 and 15 mi	15 and 25 mi
National Park	Great Sand Dunes (80,913 acres)	0 acres	35,693 acres (44%)[b]	22,701 acres (28%)
National Preserve	Great Sand Dunes (41,670 acres)	0 acres	48 acres (0.1%)	6,056 acres (15%)
National Historic Trail	Old Spanish	12 mi	20 mi	23 mi (37 km)
NHL	Pike's Stockade (4 acres)	0 acres	0 acres	4 acres (100%)
WAs	Great Sand Dunes (32,841 acres)	0 acres	9,047 acres (28%)	9,056 acres (28%)
	Sangre de Cristo (217,702 acres)[c]	1,317 (0.6%)	2,223 acres (1%)	8,256 acres (4%)
WSA	San Luis Hills (10,896 acres)	0 acres	0 acres	1,175 acres (11%)
	Sand Castle (1,097 acres)	0 acres	885 acres (81%)	69 acres (6%)
NWRs	Alamosa (12,098 acres)	0 acres	11,219 acres (93%)	0 acres
	Monte Vista (14,761 acres)	0 acres	0 acres	9,736 acres (66%)
	Baca (92,596 acres)	0 acres	1,081 acres (1%)	7,037 acres (51%)
ACECs designated for outstanding scenic values	San Luis Hills (39,421 acres)	0 acres	0 acres	5,956 acres (15%)
	Rio Grande River Corridor (4,644 acres)	0 acres	0 acres	133 acres (3%)
Scenic Highways/Byway	Los Caminos Antiguos	13.6 mi	44.5 mi	12.9 mi

TABLE 10.3.14.2-1 (Cont.)

		Feature Area or Linear Distance[a]		
			Visible between	
Feature Type	Feature Name (Total Acreage/Linear Distance)	Visible within 5 mi	5 and 15 mi	15 and 25 mi
SRMAs	Blanca Wetlands (8,599 acres)	7,450 acres (87%)	1,131 acres (13%)	0 acres
	Rio Grande River Corridor (4,368 acres)	0 acres	0 acres	324 acres (7%)
	Zapata Falls (3,702 acres)	103 acres (3%)	2,235 acres (60%)	0 acres

[a] To convert acres to km^2, multiply by 0.004047. To convert mi to km, multiply by 1.609.

[b] Percentage of total feature acreage or road length viewable.

[c] Includes both BLM and NPS WA acreage.

National Parks

- *Great Sand Dunes*—The Great Sand Dunes National Park and Preserve contains the tallest sand dunes in North America within its 80,913 acres (327 km^2) designated as national park. It is located 8.5 mi (13.7 km) due north of the SEZ at the point of closest approach. As shown in Figure 10.3.14.2-2, the area of the national park within the 650-ft (198.1-m) viewshed of the SEZ includes 58,394 acres (236.31 km^2), or 72% of the total park acreage. The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 22,594 acres (91.435 km^2), or 28% of the total park acreage. The visible area of the national park extends approximately 20 mi (33 km) from the northern boundary of the SEZ.

  The foothills of Blanca Peak and the surrounding mountains screen views of the SEZ from the park's visitor facility and much of the eastern portions of the park. Intervening dunes screen views of the SEZ from many locations within the dune field; however, the SEZ would be visible from the crests of many dunes within the park, provided the dunes were far enough west to avoid the topographic screening. The park's dune field is higher in elevation than the SEZ, but the distance to the SEZ is great enough (at least 8.5 mi [13.7 km]) that the collector/reflector arrays of solar facilities within the SEZ would be seen at low viewing angles, and would occupy a small part of the total horizontal field of view.

Figure 10.3.14.2-3 is a three-dimensional perspective visualization created with Google Earth™ depicting the SEZ as it would be seen from the crest of a high dune in the eastern portion of the national park, approximately 15 mi (24 km) north of the SEZ. The viewpoint is about 900 ft (270 m) higher in elevation than the SEZ.

The visualization includes a simplified wireframe model of a hypothetical solar power tower facility. The model was placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities for this and other visualizations shown in this section of the PEIS. The receiver tower depicted in the visualization is a properly scaled model of a 459-ft (140-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats, and the tower/heliostat system represents about 100 MW of electric generating capacity.

This visualization suggests that the far eastern portion of the SEZ would be screened by the lower slopes of the Sangre de Cristo Mountains. Despite the elevated viewpoint, the distance to the SEZ is great enough that the vertical angle of view from the viewpoint to the SEZ would be very low. At this low viewing angle, solar collector/reflector arrays in the SEZ would be seen edge-on, which would make their large areal extent and regular geometry much less apparent and would cause them to appear to repeat the strong horizontal line of the horizon, thus tending to decrease visual contrast. Because of the distance (15 mi [24 km]) and because of the partial screening, the SEZ would occupy a very small portion of the field of view.

Any operating power towers within the SEZ would likely appear as points of light against the backdrop of the Sangre de Cristo Range. The tower structures could be visible. Other taller solar facility components, such as transmission towers, could also be visible, depending on lighting, but might not be noticed by casual observers.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from this location in the national park; however, lighting from other sources in the San Luis Valley as well as other lighting associated with solar facilities in the SEZ could be visible as well.

Visual contrasts from solar facilities in the SEZ would vary depending on the number, layout, and types of facilities within the SEZ, as well as other visibility factors. Under the 80% development scenario analyzed in the PEIS, solar energy development within the SEZ would be expected to create weak visual contrasts for viewers at this location.

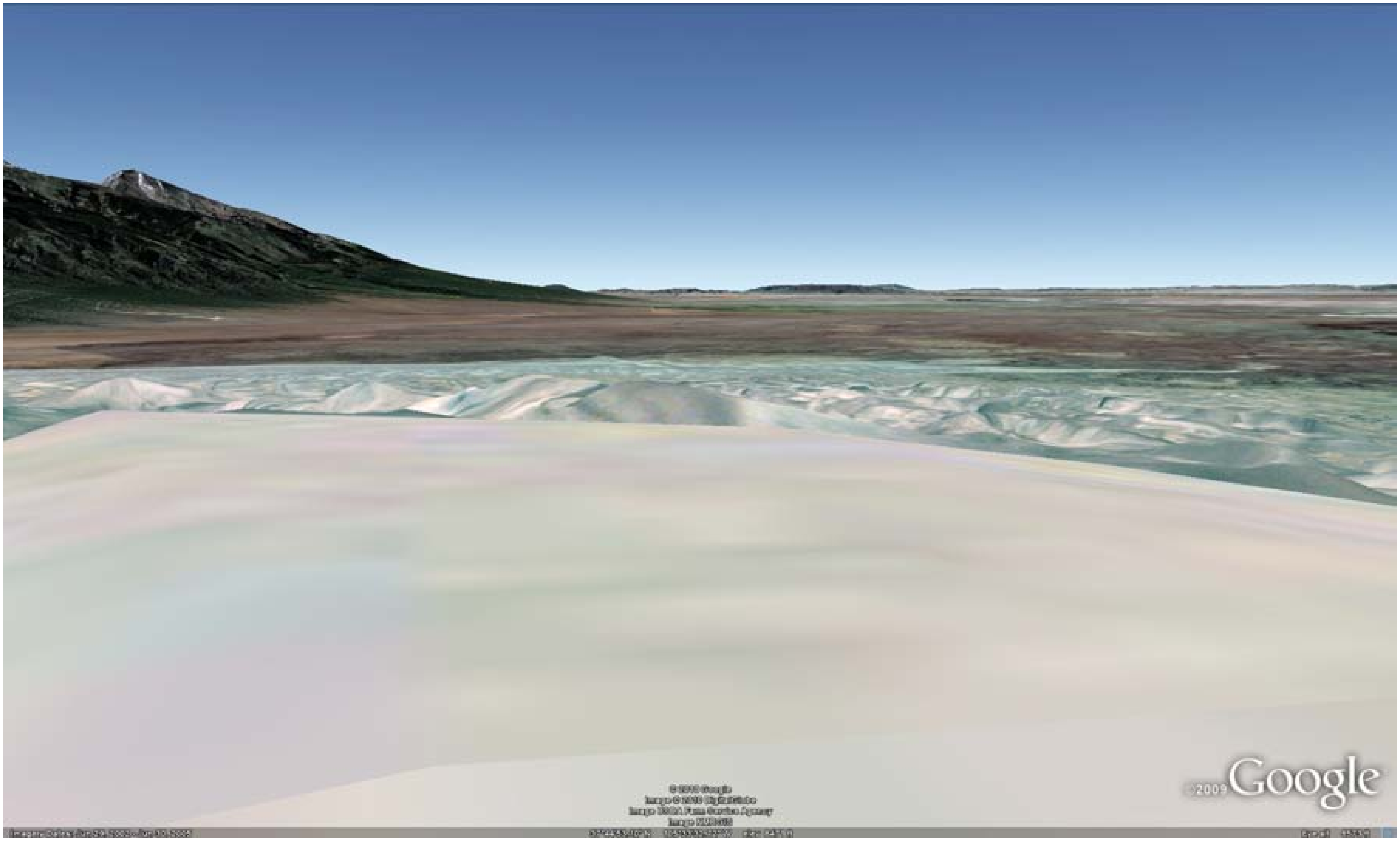

FIGURE 10.3.14.2-3 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Great Sand Dunes National Park, Eastern Section

Figure 10.3.14.2-4 is a Google Earth visualization depicting the SEZ as it would be seen from a low ridge in the far western portion of the national park, approximately 10.5 mi (16.9 km) north–northwest of the SEZ. The SEZ area is depicted in orange; the heliostat fields in blue. The viewpoint is about 50 ft (15 m) lower in elevation than the SEZ, so the vertical angle of view is extremely low. At this low viewing angle, solar collector/reflector arrays would be seen edge-on, which would make their large areal extent and regular geometry much less apparent and would cause them to appear to repeat the strong horizontal line of the horizon, thus tending to decrease visual contrast. The SEZ would occupy a small portion of the field of view. Operating power towers within the SEZ would likely appear as bright point light sources against the backdrop of the Sangre de Cristo Range. Other taller solar facility components, such as transmission towers, could be visible as well.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from this location in the national park; however, lighting from other sources in the San Luis Valley and lighting associated with solar facilities in the SEZ could be visible as well.

Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create weak visual contrasts for viewers within the national park.

In general, because of the relatively long distance to the SEZ from the park, and because of a low vertical angle of view, only weak levels of visual contrast would be expected for viewpoints in Great Sand Dunes National Park. Contrast levels would generally be higher at higher elevation viewpoints and at viewpoints in the western portion of the national park.

National Preserves

- *Great Sand Dunes*—The Great Sand Dunes National Park and Preserve contains 41,670 acres (168.63 km^2) designated as preserve. It is located 11.9 mi (19.2 km) northeast of the SEZ at the point of closest approach. The area of the preserve within the viewshed is 14 mi (23 km) from the northeast corner of the SEZ, and portions stretch to the extent of the 25-mi (40-km) distance zone and beyond. The area of the national preserve within the 650-ft (198.1-m) viewshed of the SEZ includes 6,104 acres (24.70 km^2), or 15% of the total preserve acreage. The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 5,157 acres (20.87 km^2), or 12% of the total preserve acreage.

  The Great Sand Dunes National Preserve is part of the Great Sand Dunes National Park and Preserve and is located immediately east of Great Sand

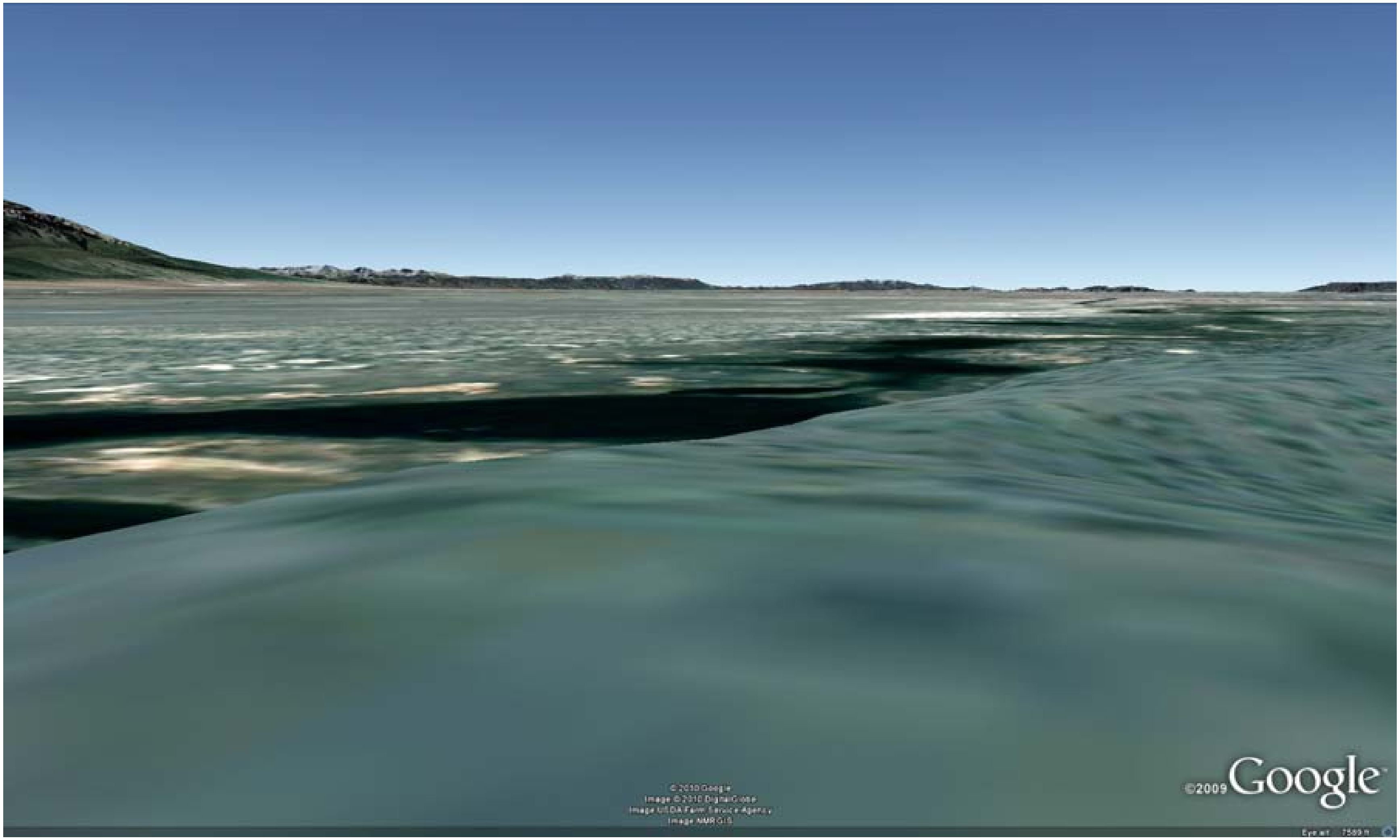

FIGURE 10.3.14.2-4 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Great Sand Dunes National Park, Western Section

Dunes National Park. Lands within the preserve are generally at much higher elevations than those within the park; much of the preserve is within the Sangre de Cristo mountain range.

The viewshed analysis suggests that the SEZ is not visible from lower elevations within the preserve because of topographic screening from intervening mountain ridges. In addition, much of the national preserve is forested, so views from many areas would be screened by trees. However, on some of the high mountain ridges within the preserve, vegetation is absent and a clear line of sight to the SEZ exists. In these areas, the angle of view is high enough that the tops of solar arrays within the SEZ would be visible and the arrays would therefore not repeat the line of the horizon, but because the SEZ is at least 14 mi (23 km) distant, it would occupy a very small portion of the field of view. Power towers within the SEZ would be visible as point light sources with the valley floor as a backdrop. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create minimal to weak visual contrasts for viewers within the preserve.

Wilderness Areas

- *Great Sand Dunes*—The 32,841-acre (132.90-km^2) Great Sand Dunes Wilderness is a congressionally designated WA located 11 mi (17 km) northeast of the SEZ at the point of closest approach. Portions of the WA within the 650-ft (198.1-m) viewshed (approximately 18,103 acres [73.260 km^2], or 55% of the total WA acreage) extend from the point of closest approach at the northeast corner of the SEZ to approximately 19.3 mi (31.1 km) from the SEZ. Portions of the WA within the 24.6-ft (7.5-m) viewshed encompass approximately 7,788 acres (31.52 km^2), or 24% of the total WA acreage.

  The Great Sand Dunes WA is entirely contained within Great Sand Dunes National Park and constitutes much of the eastern portion of the national park, including the dune field. Potential impacts on the WA from solar energy development within the SEZ are the same as those described for the eastern portion of the national park (discussed above).

- *Sangre de Cristo*—The 217,702-acre (881.009-km^2) Sangre de Cristo WA (including both NPS- and BLM-managed units) is located approximately 2.8 mi (4.5 km) northeast of the SEZ at the point of closest approach. As shown in Figure 10.3.14.2-2, a small portion of the WA (approximately 10,479 acres [42.407 km^2]) is within the 650-ft (198.1-m) viewshed of the SEZ, generally limited to the southern tip of the range and including 1,320 acres (5.341 km^2) within the BLM foreground-middleground distance of 5 mi (8 km). Visible portions extend up to 4.5 mi (7.2 km) from the northern boundary of the SEZ. Approximately 9,045 acres (36.60 km^2) of the WA is within the 24.6-ft (7.5-m) SEZ viewshed.

Views of the SEZ from most of the WA are fully screened by landform, and much of the area not screened by landform is screened by vegetation, as much of the WA is forested. Vegetative screening is absent or insufficient in some areas that are above timberline or otherwise unable to support vegetation tall enough or dense enough to screen views. At these locations, the elevated viewpoint and relatively close proximity of the SEZ result in a high viewing angle, so that the tops of solar collectors could be visible. A larger portion of the solar facilities would be visible relative to low-angle views, increasing potential visual contrasts from the facilities, and the high viewing angle would also make the regular geometry of visible solar facilities more apparent. The strong, regular geometry of the solar collector arrays would generally be inconsistent with the natural background in terms of form, line, and texture, and possibly color, depending on mitigation employed.

Views from the WA toward the SEZ would also encompass a variety of cultural disturbances, such as towns, railroads, center-pivot irrigation circles, transmission lines, and other disturbances common to rural settings; however, because of the close proximity of the SEZ to the southern portion of the WA, the addition of utility-scale solar energy development within the SEZ would represent a major new source of visual contrast.

At locations within the WA nearest to the SEZ, facilities in the northeastern portions of the SEZ could be close enough that they would occupy a large portion of the field of view and could potentially create strong visual contrasts. This is shown in Figure 10.3.14.2-5, a Google Earth visualization depicting the SEZ as it would be seen from an unpaved road within the WA, approximately 3.2 mi (5.1 km) northeast of the SEZ. The viewpoint is near the point in the WA closest to the SEZ. The viewpoint is about 2,400 ft (730 m) higher in elevation than the SEZ. The SEZ area is depicted in orange; the heliostat field in blue.

The visualization suggests that the SEZ is close enough, and the angle of view high enough, that under the development scenario analyzed in the PEIS, solar energy developments within the SEZ could strongly attract visual attention and could dominate the view from this location. The tops of collector/reflector arrays for solar facilities within the SEZ would be visible, revealing their large areal extent and their strong regular geometry, which would likely contrast strongly with the more natural appearing background. Taller ancillary facilities, such as buildings, transmission structures, cooling towers, and plumes (if present) would likely be visible projecting above the collector/reflector arrays, and their structural details could be evident, at least for nearby facilities. The ancillary facilities would likely create form and line contrasts with the strongly horizontal, regular, and repeating forms and lines

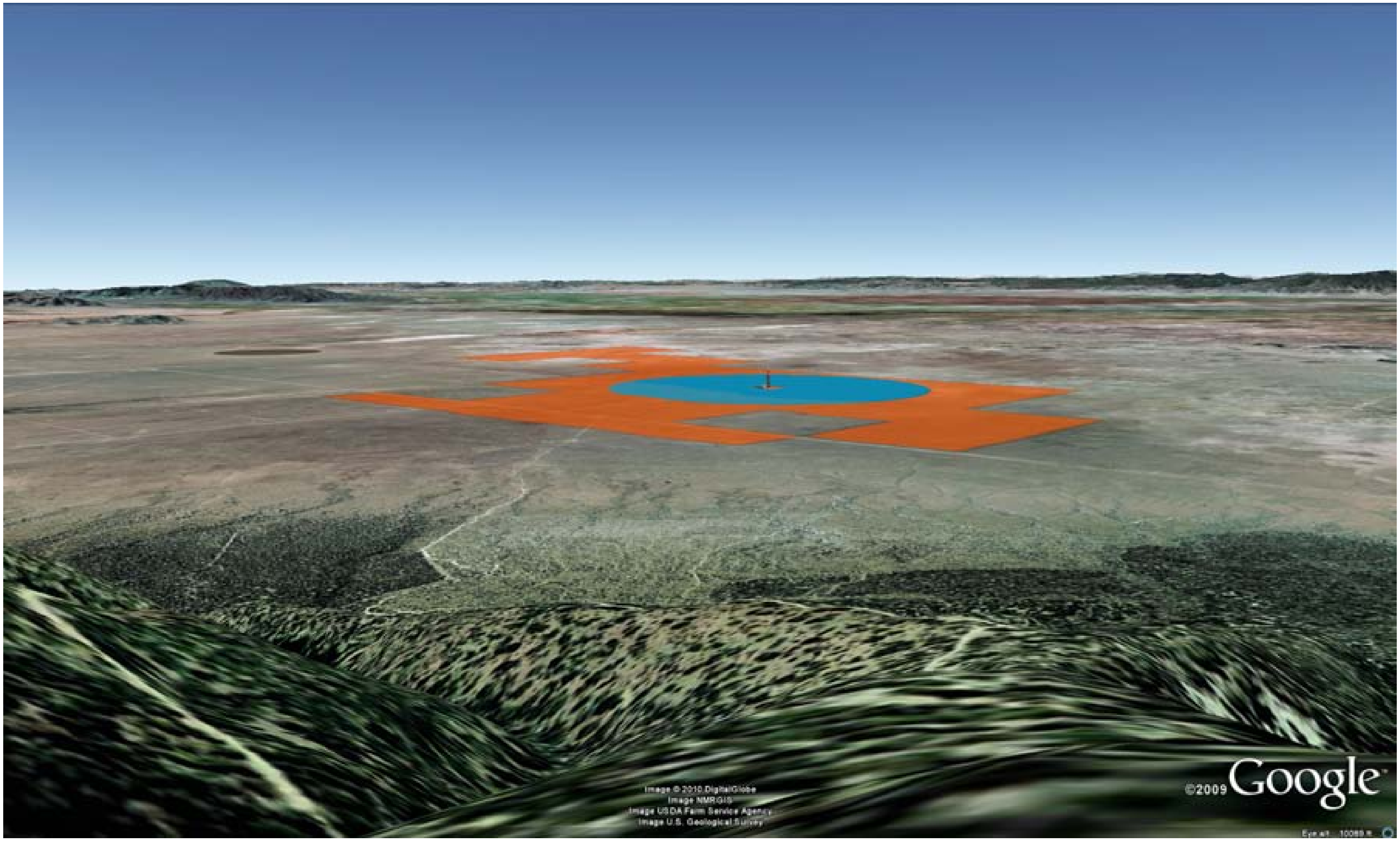

FIGURE 10.3.14.2-5 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from a Road in the Sangre de Cristo WA

of the collector/reflector arrays. Color and texture contrasts would also be likely, but their extent would depend on the materials and surface treatments utilized in the facilities.

Operating power towers within the SEZ would likely appear as very bright white non-point (i.e., with a visible cylindrical or rectangular shape) light sources atop clearly discernable tower structures. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the towers. When operating, the power towers would likely strongly attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from this location in the National Park; however, lighting from other sources in the San Luis Valley and lighting associated with solar facilities in the SEZ could be visible as well.

Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts for viewers within the national park.

Figure 10.3.14.2-6 is a Google Earth visualization depicting the SEZ (highlighted in orange) as it would be seen from Ellingwood Point, a mountain peak within the WA connected to Blanca Peak and a popular destination for climbers, about 6.6 mi (10.7 km) northeast of the SEZ. The viewpoint is about 6,300 ft (1,900 m) higher in elevation than the SEZ. The heliostat field is highlighted in blue.

In terms of distance, this visualization shows the appearance of the SEZ from a high-elevation viewpoint within the WA. At this distance and with partial screening by an intervening mountain ridge, the apparent size of the SEZ is much reduced; however, it would still be likely to attract attention, though it would not be expected to dominate the view. The visualization also shows that in addition to the Fourmile East SEZ, both the Antonito Southeast SEZ (visible as orange-tinted area at the far left of the image) and the Los Mogotes East SEZ (visible to the left of center of the image) would be visible from Ellingwood Point and nearby locations, although the much greater distance to these SEZs and the resultant lower viewing angle suggest much smaller visual impacts from solar energy development in these SEZs.

Observed visual contrasts from solar energy development within the proposed SEZ would be highly dependent on viewer location within the WA, as well as on project characteristics and location within the SEZ and other visibility parameters. Under the 80% development scenario analyzed in this PEIS, solar

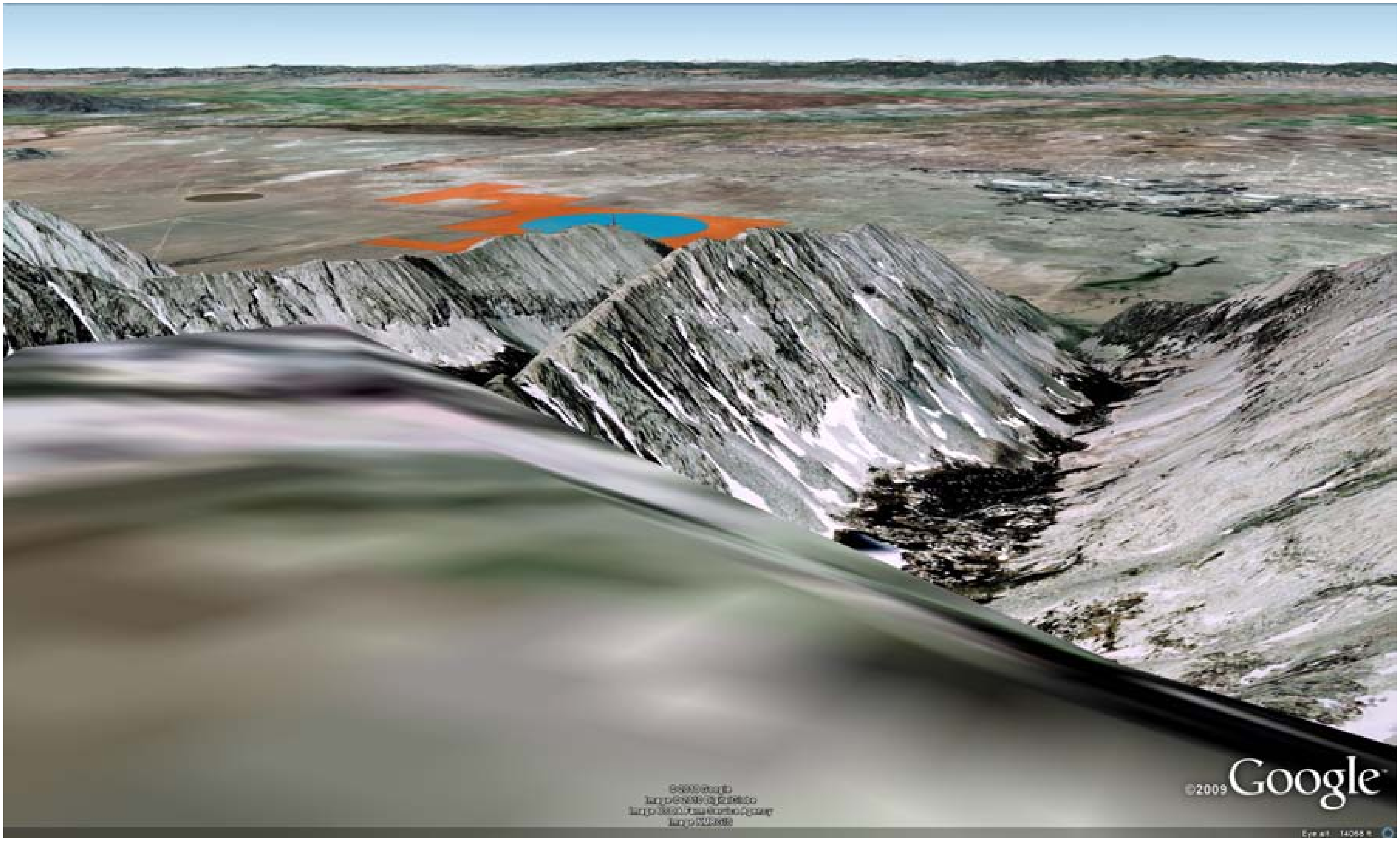

FIGURE 10.3.14.2-6 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Ellingwood Point in the Sangre de Cristo WA

energy development within the SEZ would be expected to create weak to strong visual contrasts, as seen from the WA.

Wilderness Study Areas

- *San Luis Hills*—The San Luis Hills WSA is located approximately 23.3 mi (37.5 km) southwest of the SEZ at the point of closest approach and encompasses 10,896 acres (44.09 km^2). As shown in Figure 10.3.14.2-2, the area of the WSA within the 650-ft (198.1-m) viewshed of the SEZ includes 1,175 acres (4.755 km^2), or 11% of the total WSA acreage. The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 954 acres (3.86 km^2), or 9% of the total WSA acreage. The visible area extends from approximately 24 mi (39 km) from the southwest corner of the SEZ to approximately 26 mi (42 km) from the SEZ.

  The WSA encompasses most of the Pinyon Hills. The San Luis Hills WSA is located entirely within the San Luis Hills ACEC, and both the ACEC and the WSA were designated in part for their scenic values and opportunities for solitude. The WSA provides panoramic views of the San Luis Valley and the surrounding mountain ranges. The SEZ viewshed includes the northeast-facing slopes of the Pinyon Hills and some lower elevation areas east of the Pinyon Hills; however, in the lower areas, intervening landforms would screen views of low-height solar technologies within the SEZ.

  The upper slopes and peaks of the Pinyon Hills are sparsely vegetated, and where intervening landforms do not screen the view, these areas have relatively open views of the distant Fourmile East proposed SEZ. Even at the higher elevations, the angle of view is low enough that the tops of solar collector arrays would likely not be visible and the arrays would repeat the line of the plain in which the SEZ is located. Operating power towers within the SEZ would likely be visible as distant starlike points of light at the base of the Great Sands Dunes dune field or the lower slopes of the Sangre de Cristo Mountains. At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lights that could be visible from some points in the WSA. Under the development scenario analyzed in this PEIS, solar facilities within the SEZ would be expected to be minimal to weak visual contrasts as viewed from the WSA, depending on viewer location and other visibility factors.

- *Sand Castle*—The Sand Castle WSA is located approximately 12 mi (19 km) north of the SEZ at the point of closest approach and encompasses 1,097 acres (4.439 km^2). The area of the WSA within the 650-ft (198.1-m) viewshed of the SEZ includes 954 acres (3.86 km^2), or 87% of the total WSA acreage. The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 123 acres (0.498 km^2), or 11% of the total WSA acreage. The visible area extends from the point of closest approach on the northern boundary of the SEZ to approximately 15 mi (24 km) from the SEZ.

The elevation of the WSA is about the same or slightly higher than that of the SEZ, and at about 12 mi (19 km) from the SEZ, the vertical angle of view from the WSA to the SEZ would be very low. At this very low viewing angle, solar collector/reflector arrays in the SEZ would be seen edge-on, which would make their large areal extent and regular geometry much less apparent and would cause them to appear to repeat the strong horizontal line of the horizon, thus tending to decrease visual contrast. Because of the distance (12 mi [19 km] or more), the SEZ would occupy a very small portion of the field of view.

Any operating power towers within the SEZ would likely appear as points of light projecting above the southern horizon. The tower structures could be visible. Other taller solar facility components, such as transmission towers, could also be visible, depending on lighting, but might not be noticed by casual observers.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from the WSA; however, lighting from other sources in the San Luis Valley would be visible as well.

Visual contrasts from solar facilities in the SEZ would be highly dependent on viewer location within the WSA, but would also vary depending on the number, layout, and types of facilities within the SEZ, as well as other visibility factors. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create weak visual contrasts for viewers in the WSA.

National Historic Trail

- *Old Spanish National Historic Trail*—The Old Spanish National Historic Trail is a congressionally designated multistate historic trail that passes within 0.86 mi (1.4 km) of the SEZ at the point of closest approach on the east side of the SEZ. A high potential segment of the trail begins 1.25 mi (2.0 km) northeast of the northeast corner of the SEZ. Nearly 50 mi (80.5 km) of the trail is within the viewshed of the SEZ, including 25 mi (40.2 km) of the high-potential segment.

Within 25 mi (40 km) of the SEZ, the trail runs generally north–south on the east side of the San Luis Valley and generally along the base of the Sangre de Cristo Range. The SEZ is within view of the trail for much of the area. Within the viewshed, the trail runs through alluvial flats and wetlands and through salt flats and sand dunes.

For northbound/westbound trail users, the trail enters the 25-mi (40-km) SEZ viewshed approximately 4 mi (6 km) north of the community of San Luis, approximately 19 mi (31 km) south–southeast of the SEZ. At this point, in the absence of screening by vegetation, the upper portions of sufficiently tall power towers would come into view, likely appearing as distant starlike points of light on the north–northwest horizon. In this area, the trail passes through agricultural lands, with roads and other cultural disturbances typical of a rural setting.

At a distance of about 14 mi (23 km) from the SEZ, low-height solar facilities within the SEZ could become visible, in the absence of vegetative screening. At about this same distance, the trail turns slightly west directly toward the SEZ. As trail users travel northwest toward the SEZ, solar facilities would slowly increase in apparent size and would be visible in the direction of travel, resulting in more and longer views. At these distances and viewing angles, under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create minimal to weak contrasts as viewed from the trail.

At approximately 10 mi (16 km) southeast of the SEZ, the trail passes through a low area (approximately 2.5 mi [4 km] of the trail) near Blanca, Colorado, where only the upper parts of sufficiently tall power towers would likely be visible. After trail users leave this area (approximately 8 mi [13 km] from the SEZ), low-height solar facilities would again come into view, but at a very low viewing angle, such that they would appear as a thin horizontal band that would repeat the strong horizon line of the valley floor, tending to reduce visual contrast. Expected contrast levels would be weak.

At about 3 mi (5 km) southeast of the SEZ, the trail turns back to the north, and the SEZ would gradually shift out of the center of the field of view (looking down the trail) to the left of center. As it passes the SEZ, the trail is nearly parallel to the eastern boundary of the SEZ, and at a distance of approximately 1 mi (1.6 km), under the development scenario analyzed in this PEIS, solar facilities within the SEZ would fill the view to the west looking out over the San Luis Valley.

Figure 10.3.14.2-7 is a Google Earth visualization depicting a view of the SEZ as seen from a point on the Old Spanish National Historic Trail route approximately 0.9 mi (1.5 km) from the SEZ. The viewpoint is about 130 ft (40 m) higher in elevation than the SEZ. The power tower in the visualization

FIGURE 10.3.14.2-7 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, as Seen from Viewpoint on Old Spanish National Historic Trail

is 2.5 mi (4 km) from the viewpoint. The SEZ area is depicted in orange; the heliostat field in blue.

The visualization suggests that solar facilities within the SEZ would be in full view from this point on the Old Spanish National Historic Trail. Because the SEZ is so close to the viewpoint, the SEZ is too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole SEZ. Under the 80% development scenario analyzed in the PEIS, solar facilities within the SEZ would likely dominate the view from this location.

The viewpoint on the trail is slightly elevated with respect to the SEZ, and the tops of the solar collector/reflector arrays might be visible, depending on their height. The collector array would repeat the strong line of the horizon, tending to decrease visual contrast; however, for facilities in the closest portion of the SEZ, collector/reflector elements could be close enough that their forms and structural details would be visible. This would increase contrast.

Taller ancillary facilities, such as buildings, transmission structures, cooling towers, and plumes (if present) would likely be visible projecting above the collector/reflector arrays, and their structural details could be evident, at least for nearby facilities. The ancillary facilities would likely create form and line contrasts with the strongly horizontal, regular, and repeating forms and lines of the collector/reflector arrays. Color and texture contrasts would also be likely, but their extent would depend on the materials and surface treatments used in the facilities.

Operating power towers within the nearest portions of the SEZ would likely appear as brilliant white non-point (i.e., with a visible cylindrical or rectangular shape) light sources atop clearly discernable tower structures. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the towers. When operating, the power towers would likely strongly attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be very conspicuous from this viewpoint, although light from other sources in the San Luis Valley and other light associated with solar facilities in the SEZ would likely be visible as well.

Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts for trail users at this viewpoint.

For southbound/eastbound, the high potential segment of the Old Spanish National Historic Trail enters the 25-mi (40-km) SEZ viewshed approximately

7 mi (11 km) south of the community of Crestone at the base of the Sangre de Cristo Range, at which point the SEZ would come into view as trail users cross ridges in the foothills of the Sangre de Cristo Range, in the absence of screening by vegetation. As successive ridges are crossed, the very distant SEZ would alternately be visible from ridge tops the trail crosses, then not visible where the trail crosses washes between the ridges, but gradually increasing in apparent size as trail users move southward on the trail. Where visible, the SEZ would appear just to the right of the center of the field of view looking down the trail.

Frequent intermittent visibility of the SEZ would continue until trail users cross the Great Sand Dunes dune field (approximately 11.5 mi [18.5 km] north of the SEZ). From this point southward, the land is somewhat more level, and the SEZ would more often be in view and sometimes centered in the field of view looking down the trail.

At approximately 6.5 mi (10.5 km), the trail begins to increase in elevation gradually and steadily, so that intermittent visibility of the SEZ would end, and the SEZ would be in full view. As the distance to the SEZ shortens and the viewpoint elevation rises, the level of potential visual contrast associated with solar energy development within the SEZ would increase. At approximately 4 mi (6 km), the SEZ would occupy a substantial portion of the field of view, but the angle of view would still be low enough that solar arrays would repeat the strong horizontal line of the valley floor, and this would tend to reduce visual contrast.

At 3.3 mi (5.3 km) north of the SEZ, the trail begins a slightly steeper climb, so that by the end of the high-potential trail segment (1.3 mi [2.0 km] from the SEZ), the trail is more than 300 ft (90 m) above the SEZ.

Figure 10.3.14.2-8 is a Google Earth visualization that depicts a view of the SEZ as seen from a point near the southern end of the high-potential segment of the Old Spanish National Historic Trail route, about 1.3 mi (2.0 km) from the SEZ. The SEZ area is depicted in orange; the heliostat field in blue.

The visualization suggests that solar energy facilities within the SEZ would occupy most of the horizontal field of view of trail users looking out to the southwest over the valley and would be expected to dominate their views in that direction.

The elevated viewpoint would make the very regular geometry of the solar collector field apparent; structural details of facility components could be visible; and power tower receivers and other tall solar facility components (e.g., associated transmission towers) would be seen in the BLM foreground-middleground distance, and this would tend to increase visual contrast.

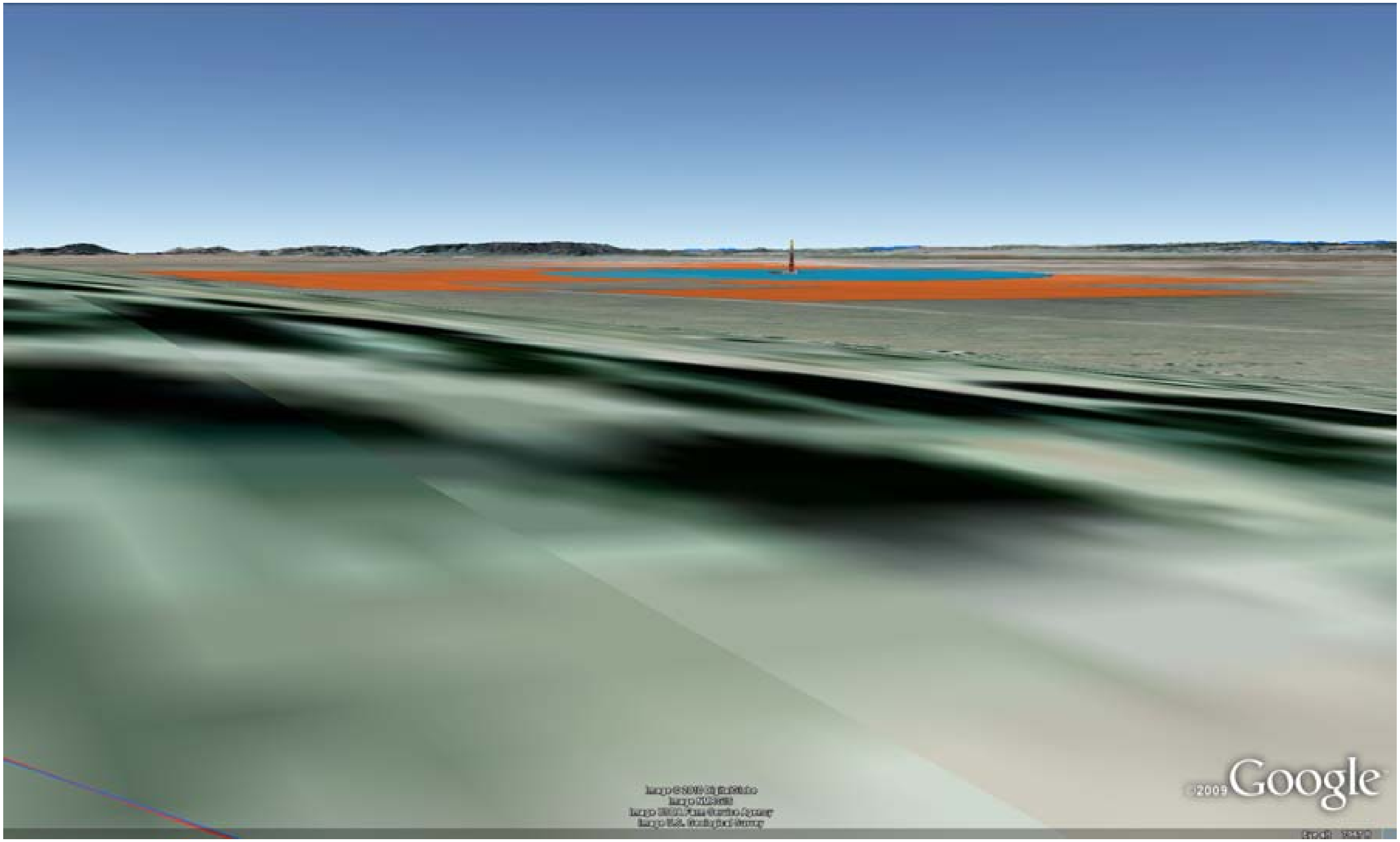

FIGURE 10.3.14.2-8 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, as Seen from Viewpoint on High-Potential Segment of Old Spanish National Historic Trail

Operating power towers within the nearest portions of the SEZ would likely appear as brilliant white non-point (i.e., with a visible cylindrical or rectangular shape) light sources atop clearly discernable tower structures. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the towers. When operating, the power towers would likely strongly attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be very conspicuous from this viewpoint, although light from other sources in the San Luis Valley and other light associated with solar facilities in the SEZ would likely be visible as well.

From the elevated viewpoints in this portion of the high-potential trail segment and with the short distance to the SEZ, under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts for trail users.

Past the end of the high-potential trail segment, impacts would continue to increase because the angle of view continues to increase while distance to the SEZ decreases. However, within about 0.5 mi (0.8 km) of the southern end of the high-potential segment, the trail elevation begins to fall and the distance to the SEZ begins to increase, so visual contrasts would be expected to diminish.

In summary, nearby elevated locations on the Old Spanish National Historic Trail with open views of the SEZ could be subject to strong levels of visual contrast associated with solar energy facilities within the SEZ. Some viewpoints at lower elevations on the trail would still have expansive views of the SEZ, but because of the lower viewing angle, these viewpoints would be expected to be subjected to substantially lower levels of visual contrast. Expected contrast levels would range from minimal levels for distant or low-elevation points on the trail to strong levels for viewpoints very close to the SEZ, and especially for those points on the trail at higher elevations than the SEZ.

National Historic Landmarks

- *Pike's Stockade*—Although the original 1807 stockade is no longer standing, this archeological site with a reconstructed stockade is located 15.6 mi (25.1 km) southwest of the southwest corner of the Fourmile East SEZ. It is contained within the SEZ viewshed.

  Pike's Stockade is located within a heavily wooded riparian area along the Rio Grande. It is likely that vegetation would screen the site from views of the

SEZ; however, visitors driving to or from Pike's Stockade would be outside the wooded area when going to or from the site and might have open views of the SEZ. Pike's Stockade is approximately 55 ft (17 m) lower in elevation than the lowest point in the SEZ, so if solar energy facilities were visible within the SEZ, the associated collector/reflector arrays would repeat the line of the horizon and this would tend to reduce apparent contrast. Power tower receivers would not project above the distant line of the Sangre de Cristo range and, at the relatively long distance to the SEZ, would appear as distant points of light. Primarily because of vegetative screening, visual impacts from solar energy development within the SEZ would not be expected at the Pike's Stockade site, but if screening were absent in the surrounding area, minimal visual contrast would be expected.

National Wildlife Refuges

- *Alamosa*—The 12,098-acre (48.96-km^2) Alamosa NWR contains the headquarters and visitor center for the San Luis Valley National Wildlife Refuge Complex. The refuge is a haven for migratory birds and other wildlife. The Alamosa NWR consists of wet meadows, river oxbows and riparian corridor primarily within the flood plain of the Rio Grande, and dry uplands vegetated with greasewood and saltbush. It is located 5.1 mi (8.2 km) east–southeast of the SEZ at the closest point of approach. Approximately 11,219 acres (45.402 km^2) of the site is within the 650-ft (198.1-m) viewshed of the SEZ, but only 5,038 acres (20.39 km^2) is within the 24.6-ft (7.5-m) viewshed.

  Much of the NWR is located in a shallow depression with a higher ridge extending from north to south along the eastern side of the NWR. The ridge would screen views of low-height solar facilities for much of the eastern portion of the NWR, although the upper parts of sufficiently tall operating power tower receivers would be visible over the ridge in almost all of the refuge, appearing as very bright light sources at the base of Blanca Peak. The elevation of the NWR is slightly lower than that of the SEZ, so the angle of view is low. Figure 10.3.14.2-9 is a Google Earth three-dimensional visualization of the SEZ as seen from the Alamosa NWR. The viewpoint is 5.1 mi (8.2 km) from the nearest point in the SEZ, and is about 90 ft (27 m) lower in elevation than the SEZ. The SEZ would occupy a small portion of the field of view, and because the viewpoint is lower than the SEZ, the vertical angle of view would be very low, so that collector/reflector arrays of solar facilities within the SEZ would be seen edge-on. This would make the large areal extent and regular geometry of the arrays less apparent, and they would appear as thin lines on the horizon. Lower-height facility components in the SEZ would be partially screened because of the low viewpoint elevation, but taller ancillary facilities, such as transmission components, cooling towers, and others, could be visible projecting above the arrays and could contrast in

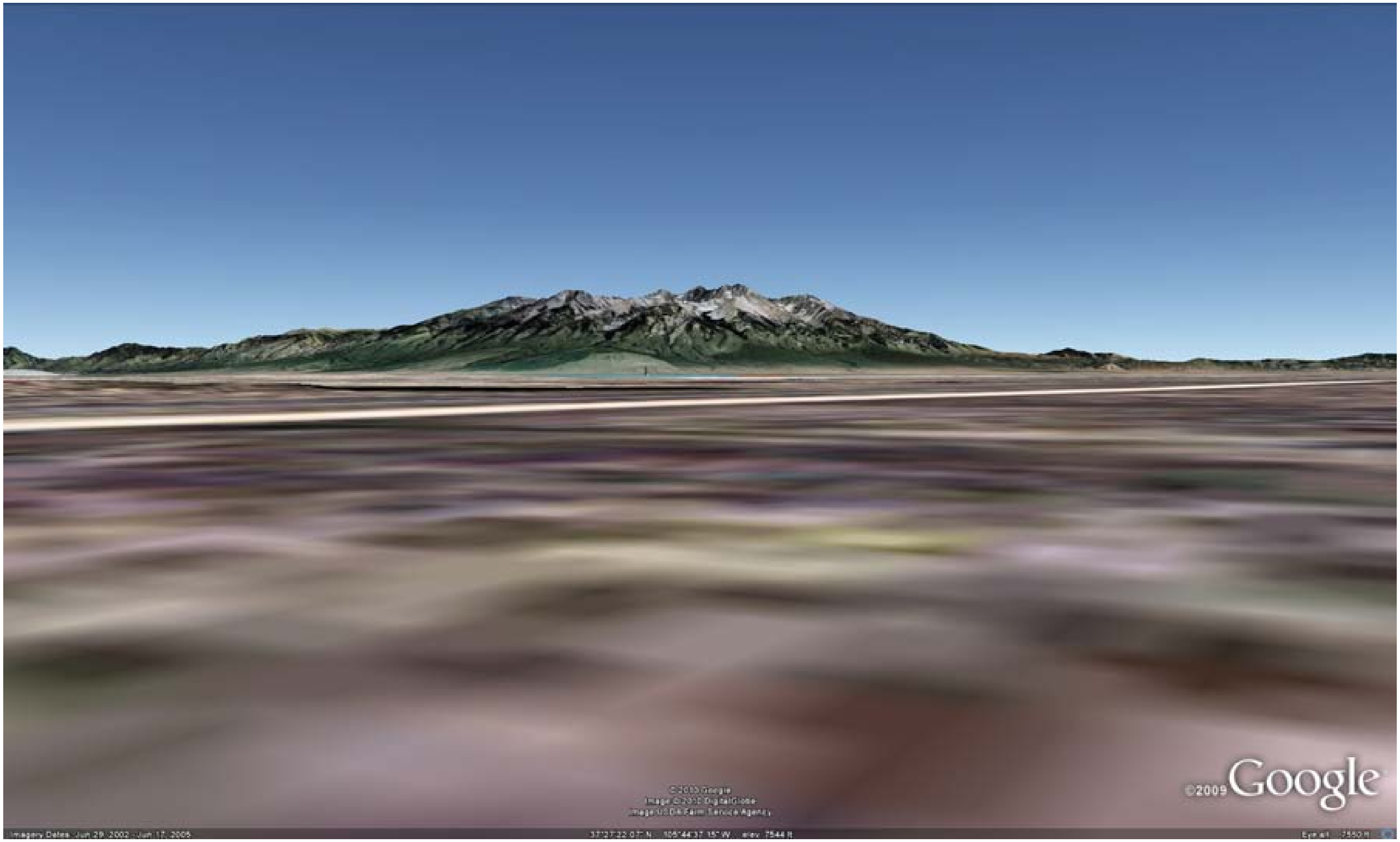

FIGURE 10.3.14.2-9 Google Earth Visualization of the Proposed Fourmile East SEZ and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Alamosa NWR

form, line, and possibly color with the very regular and strongly horizontal collector/reflector arrays.

Operating power towers within the SEZ would likely appear as very bright white lights atop discernable tower structures. They would likely attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from this viewpoint, although light from other sources in the San Luis Valley and other light associated with solar facilities in the SEZ could also be visible.

Under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would be expected to create weak contrasts as viewed from the NWR, depending on viewer location and other visibility factors, with lower contrasts levels visible from the southern portions of the NWR.

- *Baca*—The 92,596-acre (374.72-km^2) Baca NWR is located approximately 14 mi (23 km) at the closest point of approach northwest of the SEZ. Approximately 48,118 acres (194.73 km^2), or 52% of the Baca NWR total acreage, is contained within the 650-ft (198.1-m) viewshed of the SEZ, and 9,761 acres (39.50 km^2), or 11% of the NWR total acreage, is within the 24.6-ft (7.5-m) viewshed. From the point of closest approach at the northwest corner of the SEZ, the NWR stretches another 12 mi (19 km) beyond the extent of the 25-mi (40-km) distance zone. The refuge is currently closed to the public.

  The elevation of the NWR is slightly lower than that of the SEZ, so the angle of view is low. Because of the relatively long distance from the NWR to the SEZ and the lower elevation of the NWR relative to the SEZ, low-height solar facilities within the SEZ would be difficult to see from the NWR. Where visible, the solar collector fields would repeat the horizontal line of the landscape, tending to reduce visual contrast. The upper parts of sufficiently tall power tower receivers would be visible in almost all of the refuge, however, likely appearing as distant points of light at the base of the Sangre de Cristo Range.

  At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from the NWR, although light from other sources in the San Luis Valley would likely be visible as well.

  Under the development scenario analyzed in this PEIS, solar facilities within the SEZ would be expected to create minimal to weak contrasts as viewed from the NWR, depending on viewer location and other visibility factors, with lower contrasts visible from the northern portions of the NWR.

- *Monte Vista*—The 14,761-acre (59.74-km^2) Monte Vista NWR includes more than 11,000 acres (45 km^2) of wetlands located primarily within the Rio Grande flood plain. The refuge is located 19.8 mi (31.9 km) due west of the SEZ and is entirely contained within the viewshed of the SEZ. The NWR's wet meadows, river oxbows, and riparian corridors provide habitat for migratory birds and other wildlife. The NWR can be viewed from county roads and on a 4-mi (6.4-km) auto tour.

  The elevation of the NWR is approximately the same as that of the SEZ, so the angle of view between the NWR and the SEZ would be very low. Because of the very long distance from the NWR to the SEZ and the low viewing angle, the SEZ and solar facilities within the SEZ would occupy a very small portion of the visual field for viewers in the NWR. From portions of the NWR, operating power towers within the SEZ could be visible as distant lights on the horizon. At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that could be visible from the NWR, although light from other sources in the San Luis Valley would likely be visible as well. Visual contrast levels from solar energy development within the SEZ as seen from the NWR would likely be minimal.

ACECs Designated for Outstanding Scenic Qualities

- *Rio Grande River Corridor*—The Rio Grande River Corridor ACEC is a 4,644-acre (18.79-km^2) BLM-designated ACEC that follows the Rio Grande for 22 mi (35.4 km), beginning just south of La Sauses Cemetery in Colorado and extending to the New Mexico state line. The ACEC was designated to provide special management for the significant natural, scenic, and recreational values along this stretch of the Rio Grande. The ACEC is located 18 mi (29 km) south–southwest of the SEZ at the point of closest approach. The area of the ACEC within the viewshed of the SEZ includes the northern-most portion of the ACEC and extends south for approximately 1.9 mi (3.1 km). It encompasses 133 acres (0.538 km^2) in the 650-ft (198.1-m) viewshed, or 3% of the total ACEC acreage. Portions of the ACEC within the 24.6-ft (7.5-m) viewshed include approximately 20 acres (0.08 km^2), or 0.5% of the total ACEC acreage.

  Because the Rio Grande is located within a canyon in the ACEC vicinity, persons on the water would not see the SEZ or solar development within the SEZ; however, the SEZ is visible from some locations in the Fairy Hills and from local peaks such as Sugarloaf. Vegetation in these areas is sparse and likely would not screen views of the SEZ. The elevation at the northern end of the ACEC is about the same as that of the SEZ, though local peaks like Sugarloaf are a few hundred feet higher; thus the angle of view is low. Because the distance from the ACEC to the SEZ exceeds 17 mi (27 km), the

SEZ would occupy a very small portion of the field of view. Where visible, any operating power tower receivers within the SEZ would be seen as distant points of light at the base of the Sangre de Cristo Range. At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that could be visible from the ACEC, although light from other sources in the San Luis Valley would likely be visible as well. In some areas, intervening terrain would obstruct views of low-height facility components, and much of the southern portion of the SEZ would be screened as well. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create minimal visual contrasts as viewed from the ACEC.

- *San Luis Hills*—The San Luis Hills ACEC is a 39,421-acre (159.53-km^2) BLM-designated ACEC located approximately 16 mi (26 km) southwest of the SEZ at the point of closest approach. The ACEC encompasses the Pinyon Hills, Flattop, nearby hills, and the lower slopes of some of these hills. The ACEC also encompasses the San Luis Hills WSA, and both the ACEC and the WSA were designated in part for their scenic values and opportunities for solitude. The ACEC provides panoramic views of the San Luis Valley and the surrounding mountain ranges. Views toward the SEZ include agricultural areas with center-pivot irrigation circles, other agricultural fields, roads, scrub, and wetlands.

  The SEZ viewshed includes the northeast-facing slopes of the Pinyon Hills and Flattop. The area of the ACEC within the 650-ft (198.1-m) viewshed of the SEZ includes 5,956 acres (24.10 km^2), or 15% of the total ACEC acreage. The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 4,214 acres (17.05 km^2), or 11% of the total ACEC acreage. The portions of the ACEC with potential visibility of solar facilities in the SEZ extend to approximately 21.3 mi (34.3 km) from the SEZ.

  The upper slopes and peaks of the Pinyon Hills and Flattop are sparsely vegetated, have relatively open views of the SEZ, but are far enough away from the SEZ that the SEZ occupies a very small portion of the field of view. At the highest elevations within the ACEC, the angle of view is great enough that the tops of solar collector arrays might be visible. The angle of view is not so high, however, that the arrays would not repeat the line of the plain in which the SEZ is located, tending to reduce apparent visual contrast.

  Where visible, any operating power tower receivers within the SEZ would be seen as distant points of light at the base of the Sangre de Cristo Range, just east of the Great Sand Dunes dune field. At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that could be visible from the ACEC, although light from other sources in the San Luis Valley would likely be visible as well.

Under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would be expected to create minimal to weak visual contrasts as viewed from the ACEC, and contrast levels would generally be expected to be lower for viewpoints in the southern part of the ACEC.

Special Recreation Management Areas

- *Blanca Wetlands*—The 8,599-acre (34.8-km^2) Blanca Wetlands SRMA/ACEC comprises two separate units. The southern unit is located 0.5 mi (0.8 km) from the western edge of the SEZ at the point of closest approach. The northern unit is located 1.8 mi from the northwest corner of the SEZ. The area of the SRMA/ACEC within the 650-ft (198.1-m) viewshed of the SEZ includes all 8,598 acres (34.79 km^2), or 100% of the total SRMA acreage, including 7,452 acres (30.16 km^2) within the BLM foreground-middleground distance of 5 mi (8 km). The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 7,907 acres (32.00 km^2), or 92% of the total SRMA acreage. The SEZ is visible from within the SRMA at distances between 0.5 and 6.7 mi (0.8 and 10.7 km).

  The Blanca Wetlands SRMA/ACEC was designated to protect both wildlife and recreation resources. The area that is a designated Watchable Wildlife Area contains wetland habitats important for waterfowl, shorebirds, and other wildlife and a day-use recreation area with restroom facilities and an interpretive loop trail; it is seasonally open to fishing and waterfowl hunting. The SRMA has seasonal public closures to allow for water bird production. The area is relatively flat and is composed of sparsely vegetated sand dunes. In 2004, 4,500 vehicles were recorded visiting the SRMA.

  Elevations within the SRMA range from approximately 5 to 70 ft (2 to 21 m) lower than in the SEZ; thus the angle of view would be very low. The land between the SRMA and the SEZ is grazing land with few cultural disturbances visible except unpaved roads and fences. Solar collector arrays and other low-height components of solar facilities within the SEZ would be viewed edge-on and so would tend to repeat the strong horizontal line of the plain in which the SRMA and the SEZ are located, and this would tend to reduce visual contrast. Less reflective objects, such as PV panel arrays, might be difficult to distinguish against the background. Power towers, transmission towers, and other power block facilities and plumes would likely be visible above the collector arrays, creating contrasts in form, line, and potentially color, depending on the mitigation measures employed.

  At locations within the SRMA nearest to the SEZ, facilities in the western portions of the SEZ could be close enough that they would extend across the entire horizontal field of view and could potentially create strong visual contrasts. Facilities would be viewed against the backdrop of Blanca Peak, which has high scenic value and is a strong focal point for views in the entire area. Structural details of some facility components might be visible at the closest ranges. There would be proportionally smaller visual impacts for facilities located farther from the western boundary of the SEZ and for viewpoints further west in the SRMA.

Figure 10.3.14.2-10 is a three-dimensional perspective visualization created with Google Earth depicting the SEZ as it would be seen from the closest point on a road within the SRMA's southern unit, 0.5 mi (0.8 km) due west of the SEZ. The viewpoint is about 60 ft (18 m) lower in elevation than 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 distance from the viewpoint to the closest edge of the heliostat field is approximately 1.4 mi (2.3 km).

The visualization suggests that solar energy facilities within the SEZ would occupy most of the horizontal field of view of viewers looking toward Blanca Peak and would be expected to dominate their views in that direction.

Because the viewpoint is lower than the SEZ, the vertical angle of view would be very low, so that collector/reflector arrays of solar facilities within the SEZ would be seen edge-on. This would make the large areal extent and regular geometry of the arrays less apparent, and they would appear as thin lines on the horizon. Nevertheless, if very close to the viewpoint, their forms and structural details could be evident, thereby increasing contrasts. Taller ancillary facilities, such as transmission components, cooling towers, and others, would likely be visible projecting above the arrays, and could contrast in form, line, and possibly color with the very regular and strongly horizontal collector/reflector arrays.

Operating power towers within the nearest portions of the SEZ would likely appear as brilliant white non-point (i.e., with a visible cylindrical or rectangular shape) light sources atop clearly discernable tower structures. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the towers. When operating, the power towers would likely strongly attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be very conspicuous from this viewpoint, although light from other sources in the San Luis Valley and other light associated with solar facilities in the SEZ would likely be visible as well.

Potential visual contrasts observed in the SRMA arising from solar energy development within the SEZ would depend on viewer and project location,

FIGURE 10.3.14.2-10 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Blanca Wetlands SRMA

project technology, and other visibility factors. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to cause weak to strong visual contrasts with the generally natural-appearing surroundings, as seen from the SRMA.

- *Rio Grande Corridor*—The Rio Grande Corridor SRMA is a 4,368-acre (17.67-km^2) BLM-designated SRMA that follows the Rio Grande for 22 mi (35.4 km), beginning just south of La Sauses Cemetery in Colorado and extending to the New Mexico state line. It is located 18.0 mi (29.0 km) southwest of the SEZ at the point of closest approach. The area of the SRMA within the SEZ 25-mi (40-km) viewshed extends from the northern-most portion of the ACEC south for approximately 1.9 mi (3.1 km). It encompasses 324 acres (1.31 km^2) in the 650-ft (198.1-m) viewshed, or 7% of the total SRMA acreage. Portions of the SRMA within the 24.6-ft (7.5-m) viewshed include approximately 20 acres (0.08 km^2), or 0.5% of the total SRMA acreage.

  The Rio Grande Corridor SRMA encompasses the Rio Grande River Corridor ACEC and is nearly identical in size and affected lands to the ACEC. Impacts on the SRMA are the same as those on the ACEC (see description above under *ACECs Designated for Outstanding Scenic Qualities*).

- *Zapata Falls*—The 3,702-acre (14.98-km^2) Zapata Falls SRMA is located 4.6 mi (7.4 km) from the northeast corner of the SEZ at the point of closest approach. As shown in Figure 10.3.14.2-2, the SRMA consists of three separate land parcels part way up the western slope of Blanca Peak. The area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ includes 22,338 acres (9.461 km^2), or 63% of the total SRMA acreage, including 104 acres (0.421 km^2) within the BLM foreground-middleground distance of 5 mi (8 km). The area within the 24.6-ft (7.5-m) viewshed of the SEZ includes 1,715 acres (6.940 km^2), or 46% of the total SRMA acreage. The visible area extends from the point of closest approach to 7.0 mi (11.3 km) from the SEZ.

  The Zapata Falls SRMA is primarily a day-use area that provides picnic and restroom facilities and an interpretive area. The area provides overnight parking facilities for visitors to the Sangre de Cristo WA. Activities and attractions include viewing Zapata Falls and surrounding scenery, hiking, mountain biking, and horseback riding. Because of its proximity to the Great Sand Dunes National Park, visitation is high, with up to 70,000 vehicle visits recorded in 2004. The highlights of the site are a 50-ft (15-m) waterfall in a narrow canyon and the scenic vistas of the San Luis Valley and the Sangre de Cristo mountains, particularly at sunrise and sunset. Zapata Falls is managed as a VRM Class II area by BLM.

  Views of the SEZ from much of the SRMA, including the trail to Zapata Falls and the falls themselves, are screened by landform or vegetation. However, where not screened by vegetation, the SEZ is visible from nearly the entire access road that leads to the parking area and from ridge tops throughout the SRMA. At these locations, the elevated viewpoint and relatively close proximity of the SEZ result in a high viewing angle, and the tops of solar collectors would be visible depending on their orientation. A larger portion of the solar facilities would be visible relative to low-angle views, increasing potential visual contrasts from the facilities. The high viewing angle would also make the regular geometry of visible solar facilities more apparent, and it would generally be inconsistent with the natural background in terms of form, line, and texture, and possibly color, depending on mitigation employed.

Figure 10.3.14.2-11 is a Google Earth visualization depicting the SEZ as it would be seen from the access road to Zapata Falls, 0.25 mi (0.4 km) southwest of the parking lot, approximately 5.8 mi (9.4 km) north–northeast of the SEZ's northeast corner. The SEZ area is depicted in orange; the heliostat fields in blue.

The visualization shows that nearly the entire SEZ is visible from this location and that the viewing angle is high enough that the tops of collector/reflector arrays of solar facilities in the SEZ would be visible, which would make the large areal extent and regular geometry of the arrays apparent, and thereby likely increasing contrasts with the more natural-appearing surroundings. Note that the visualization does not show the height of foreground vegetation, which in this area provides screening of views of the SEZ from much (but not all) of the access road.

Taller ancillary facilities, such as transmission components, cooling towers, and others, would likely be visible projecting above the arrays and could contrast in form, line, and possibly color with the arrays' very regular and strongly horizontal geometry.

Operating power towers within the nearest portions of the SEZ would likely appear as very bright light sources atop discernable tower structures. They would likely attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from this viewpoint, although light from other sources in the San Luis Valley and other light associated with solar facilities in the SEZ could be visible as well.

From many viewing locations within the Zapata Falls SRMA, the SEZ would occupy enough of the visual field that given the potential levels of contrast likely to occur under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would likely attract attention but would be unlikely to dominate the view. Visual contrasts associated with solar energy

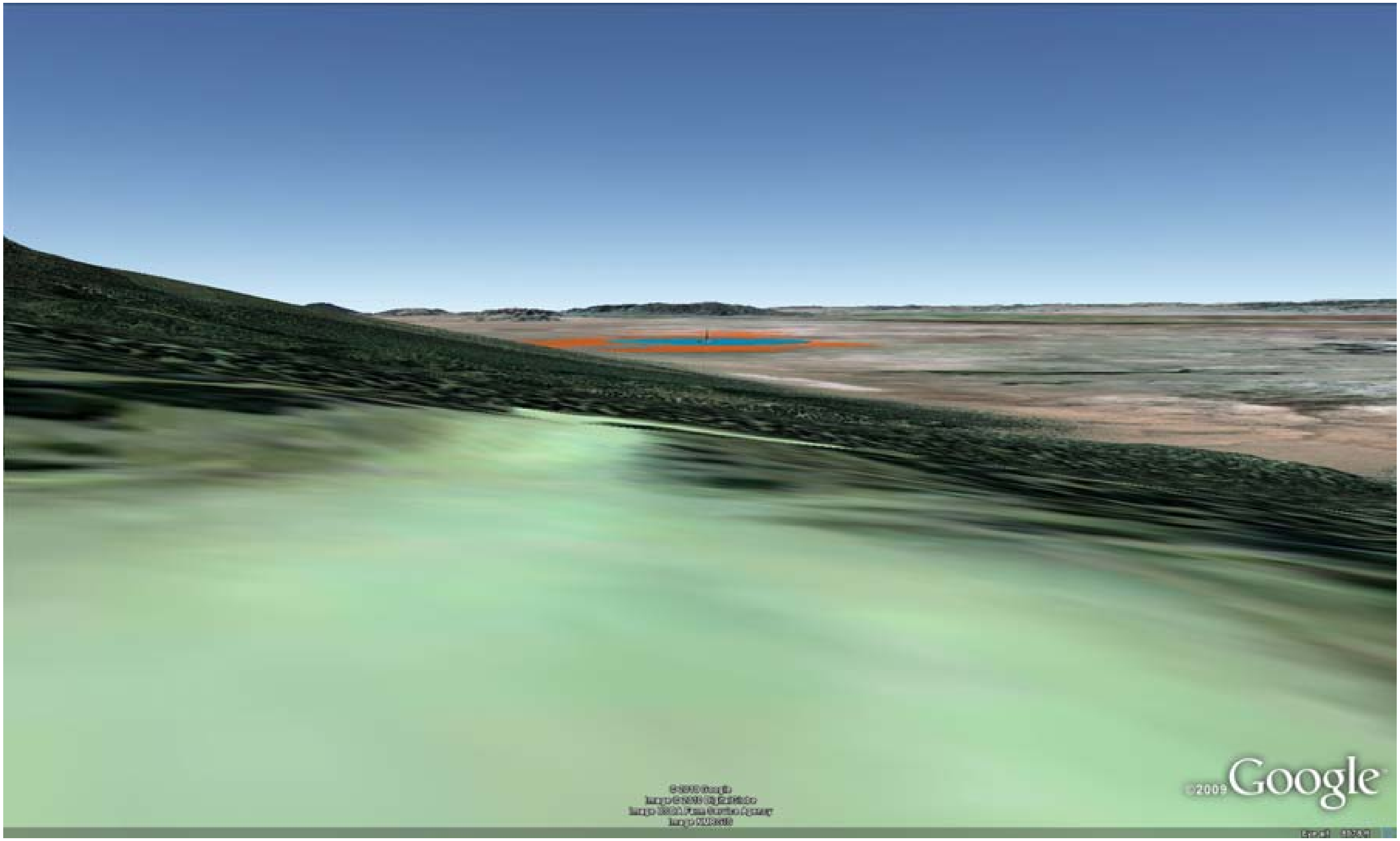

FIGURE 10.3.14.2-11 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Zapata Falls SRMA Access Road

development within the SEZ would be expected to create weak to moderate contrasts, as seen from visible locations within the SRMA.

Scenic Highways/Byways

- *Los Caminos Antiguos*—The Los Caminos Antiguos Scenic Byway is a state- and BLM-designated scenic byway that runs through a large section of the San Luis Valley and is located in close proximity to several of the proposed SEZs, including Fourmile East, which it intersects. The byway is an important tourist attraction, and in addition to scenic views of the San Luis Valley and surrounding mountain ranges, it provides access to numerous historic sites and cultural attractions.

  As shown in Figure 10.3.14.2-2, approximately 71 mi (114 km) of the byway is within the calculated 650-ft (198.1-m) viewshed of the SEZ. Undulations in topography, roadside trees, and other vegetation, as well as buildings in local communities screen views of much or all of the SEZ from many locations along the byway. However, there are many open views of the SEZ from the byway, and the byway actually passes through the far eastern portion of the SEZ for a distance of 1.0 mi (1.6 km) and is immediately adjacent to the SEZ for an additional 1.5 mi (2.4 km). The course of the byway takes it around or through the SEZ in every direction but southwest, so it can be thought of as "looping around" the SEZ.

  Due south of the SEZ, elevations along the byway are higher than the SEZ, but the distance is large enough (19 mi+ [31 km+]) that the angle of view is still very low. At the long distances involved, vegetative and other screening would be very likely to make low-height solar facilities not visible to byway travelers, with a slight chance that power tower receivers within the SEZ would be visible as distant points of light on the horizon. Visual contrasts from solar energy development within the SEZ would be expected to be minimal to weak until byway travelers going northward on the byway pass through the community of Blanca on U.S. 160.

  Just west of Blanca, the byway turns northwest and heads generally toward the SEZ. As travelers approach the SEZ, solar development within the SEZ would occupy more of the field of view, with increasing levels of visual contrast apparent. Approximately 4 mi (7 km) northwest of Blanca, the byway turns due west for a short distance, so that the SEZ would become more prominent on the right side of the byway.

  Just beyond the eastern boundary of the SEZ, the byway turns north onto CO 150. At this point, northward-bound travelers would be heading straight north, approaching the far eastern portion of the SEZ, with the SEZ spreading out across the full field of view toward the northwest. Solar facilities within the SEZ would be in full view, and facilities located within the southeastern portion of the SEZ would strongly attract the eye, likely dominating views from the byway. Views of the San Luis Valley to the west and northwest would be completely or partially screened by solar facilities, and views north toward Great Sand Dunes National Park and Preserve could be fully or near fully screened as well, depending on the layout of solar facilities within the SEZ. Because of the very short distance from the byway, strong visual contrasts could result, depending on solar project characteristics and location within the SEZ.

If power tower facilities were located in the SEZ, when operating, the receivers could appear as brilliant cylindrical or rectangular light sources atop very tall tower structures west of the byway and would strongly attract views, likely dominating views to the west. Looking down the byway towards Great Sand Dunes National Park and Preserve, if solar facilities were located on both the east and west sides of the byway, the banks of solar collectors on both sides of the byway could form a visual “tunnel” that travelers would pass through briefly (about 1 minute at highway speeds). After passing through the section of SEZ, travelers would still see the SEZ immediately adjacent to the byway on one or the other side of the highway for about 1 minute (for motorized vehicles at highway speed), with contrast levels dependent on the presence of solar facilities in areas near the byway and on solar facility characteristics.

As byway travelers approach and pass through the SEZ, depending on the solar technologies present, facility layout, and mitigation measures employed, there would be the potential for significant levels of glint and glare from reflective surfaces. These potential impacts could be reduced by siting reflective components away from the byway, employing various screening mechanisms, and/or adjusting the mirror operations to reduce potential impacts; however, because of the height of power towers, the light from the receivers likely could not be screened from the roadway.

Figure 10.3.14.2-12 is a Google Earth visualization of the SEZ as seen from Los Caminos Antiguos Scenic Byway on State Route 150, 1.0 mi (1.6 km) south of the intersection of the byway and the SEZ, facing northwest toward the center of the SEZ. The viewpoint is only a few feet (less than 1 m) higher than the nearest point in the SEZ.

The SEZ area is depicted in orange; the heliostat fields in blue. The power tower receiver visible is approximately 2.3 mi (3.7 km) northwest of the viewpoint.

The visualization suggests that because the SEZ is so close to the viewpoint, the SEZ is too large to be encompassed in one view. Viewers would need to turn their heads to scan across the whole SEZ. Under the 80% development

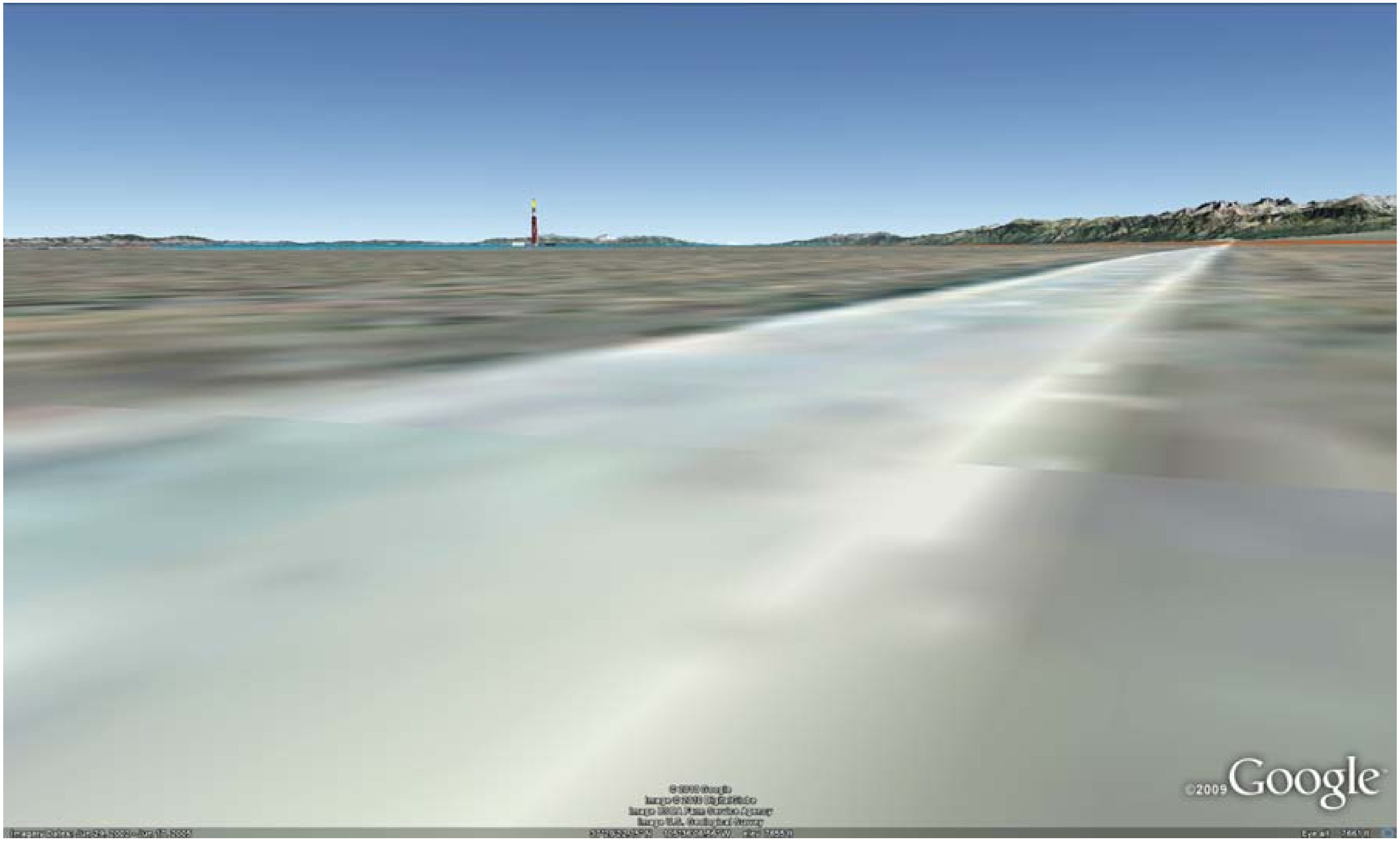

FIGURE 10.3.14.2-12 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Los Caminos Antiguos Scenic Byway One Mile South of the SEZ

scenario analyzed in the PEIS, solar facilities within the SEZ would likely dominate the view from this location.

Because the viewpoint is at essentially the same elevation as the SEZ, the vertical angle of view would be very low, so that collector/reflector arrays of solar facilities within the SEZ would be seen edge-on. This would make the large areal extent and regular geometry of the arrays less apparent, and they would appear as thin lines on the horizon. Nevertheless, if the arrays were very close to the viewpoint, their forms and structural details could be evident, thereby increasing contrasts. Taller ancillary facilities, such as transmission components, cooling towers, and others would likely be visible projecting above the arrays and could contrast strongly in form, line, and possibly color with the very regular and strongly horizontal collector/reflector arrays.

If power tower facilities were located in the SEZ, when operating, the receivers could appear as brilliant cylindrical or rectangular light sources atop very tall tower structures west of the byway and would strongly attract views, likely dominating views to the west. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the towers. Looking down the byway towards Great Sand Dunes National Park and Preserve, if solar facilities were located on both the east and west sides of the byway, the banks of solar collectors on both sides of the byway could form a visual “tunnel” that travelers would pass through briefly (about 1 minute at highway speeds). After passing through the section of SEZ, travelers would still see the SEZ immediately adjacent to the byway on one side or the other of the highway for about 1 minute (for motorized vehicles at highway speed), with contrast levels dependent on the presence of solar facilities in areas near the byway and on solar facility characteristics.

As byway travelers approached and passed through the SEZ, depending on the solar technologies present, facility layout, and mitigation measures employed, the potential would exist for significant levels of glint and glare from reflective surfaces. These potential impacts could be reduced by siting reflective components away from the byway, employing various screening mechanisms, and/or adjusting the mirror operations to reduce potential impacts. Nevertheless, because of the height of power towers, the light from the receivers likely could not be screened from the roadway.

Potential visual contrasts from solar energy development within the SEZ as seen from this viewpoint would depend on project location, project technology, and other visibility factors. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to cause strong visual contrasts with the generally natural-appearing surroundings.

North and west of the SEZ, the byway is much farther from the SEZ, and while the SEZ would be visible from many locations along the byway, the angle of view would be low and the SEZ distant, so that visual contrast levels would be expected to range from minimal to weak.

Byway travelers heading south on the byway would in general be subjected to the same types of visual contrasts, but the order would be reversed, and this could change the perceived impact levels, partly because of different expectations about the visual experience of traveling the byway. For example, heading south from Great Sand Dunes National Park and Preserve on the byway, travelers would be going away from Great Sand Dunes, having already seen or visited it and would therefore not see visible solar facilities as spoiling much anticipated views of the park; this could result in lower perceived visual impacts.

In summary, the range of impacts experienced by byway travelers would be highly dependent on viewer location, project types, locations, sizes, and layouts, as well as the presence of screening. Under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would have little visual effect on much of the byway, but could dominate views (if screening was absent) from some locations close to the SEZ. At and near the point of intersection of the byway and the SEZ, solar energy development within the SEZ could potentially create strong visual contrasts as viewed from the byway.

Additional scenic resources exist at the national, state, and local levels, and impacts may occur on both federal and nonfederal lands, including sensitive traditional cultural properties important to Tribes. In addition to the resource types and specific resources analyzed in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation areas, other sensitive visual resources, and communities close enough to the proposed project to be affected by visual impacts. Selected other lands and resources are included in the discussion below.

In addition to impacts associated with the solar energy facilities themselves, the SEZ, surrounding lands, and sensitive visual resources within the project's viewshed could be affected by facilities that would be built and operated in conjunction with the solar facilities. With respect to visual impacts, the most important associated facilities would be access roads and transmission lines, the precise location of which cannot be determined until a specific solar energy project is proposed. There is currently no transmission line within the SEZ, so construction and operation of a transmission line both inside and outside the SEZ will be required; however, an existing transmission line is located within 2.3 mi (3.7 km) of the southern boundary of the SEZ. If this transmission line can be utilized for the project, visual impacts associated with transmission line construction and operation would likely be smaller than if construction of a longer line was required. Note that depending on project- and site-specific conditions, visual impacts associated with access roads, and particularly transmission lines, could be large. Detailed information about visual impacts associated with transmission lines is presented in Section 5.7.1 of this PEIS. A detailed site-specific NEPA analysis would be required to determine visibility and associated impacts precisely for any future solar projects, based on more precise knowledge of facility location and characteristics.

Impacts on Selected Other Lands and Resources

West Fork of the North Branch of the Old Spanish Trail. As shown in Figure 10.3.14.2-2, approximately 3.8 mi (6.1 km) of the West Fork of the North Branch of the Old Spanish Trail is also within the western portion of the viewshed of the Fourmile East SEZ; however, this portion of the trail has yet to receive congressional designation. The visible portion of the trail within the 25-mi (40-km) limit of analysis for visual impacts is just under 25 mi (40 km) from the SEZ. Because both the SEZ and the trail in this area are located on the valley floor, the angle of view between them is extremely low, and at the very long distance involved, minimal visual impacts on trail users would be expected.

Blanca Peak. Blanca Peak is a 14,000-ft+ (4,267-m+) peak that dominates views in much of the San Luis Valley and is located approximately 7 mi (11 km) northeast of the SEZ. The area is of special significance to the Navajo Tribe, and the surrounding area is used for recreation, such as hiking and mountain climbing.

Blanca Peak is just outside the boundary of the Sangre de Cristo WA and only a short distance from Ellingwood Point, a prominent peak within the WA. Figure 10.3.14.2-6 is a Google Earth visualization of the SEZ as seen from Ellingwood Point. The view of the SEZ from Blanca Peak would be very similar but would have full visibility of the SEZ, because there is no intervening landform.

As seen from Blanca Peak, the SEZ would occupy a substantial part of the observer's field of view, which would tend to increase the observed visual contrast levels. The visualization also shows that in addition to the Fourmile East SEZ, both the Antonito Southeast and Los Mogotes East SEZs would be visible from Blanca Peak, although the much greater distance to these SEZs and the resultant lower viewing angle suggest much smaller visual impacts from solar energy development in these SEZs. Under the 80% development scenario analyzed in this PEIS, solar energy development within the Fourmile East SEZ would be likely to attract attention, though it would not be expected to dominate the view and would thus be expected to create moderate levels of visual contrasts as seen from Blanca Peak.

Communities of Alamosa, Blanca, and Mosca. As shown in Figure 10.3.14.2-2, the viewshed analyses indicate visibility of the SEZ from the communities of Alamosa (approximately 11.8 mi [18.9 km] west-southwest of the SEZ), Blanca (approximately 6.4 mi [10.3 km] southeast of the SEZ), and Mosca (approximately 15.1 mi [24.3 km] west-southwest of the SEZ). However, a site visit in July 2009 indicated at least partial screening of ground-level views of the SEZ from these communities, because of either slight variations in topography, vegetation, or both. A detailed future site-specific NEPA analysis is required to determine visibility precisely; however, note that 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 screening and could in some cases cause visual impacts on these communities.

The elevation in Alamosa is slightly lower than that in the SEZ, so there is a low angle of view between Alamosa and the SEZ. In Alamosa, where screening was absent, because of the low angle of view and distance to the SEZ, minimal to weak visual contrasts would be expected.

Blanca is also lower in elevation than the SEZ and so would have a low angle of view; however, because of intervening terrain, low-height solar facilities within the SEZ might not be visible from some locations in Blanca. From unscreened locations within Blanca, power tower receivers within the SEZ could be visible and would be seen as bright points of light against a sky backdrop. Because of the low angle of view and distance to the SEZ, weak visual contrasts would be expected.

Mosca is also at a slightly lower elevation than the SEZ, but is just over 15 mi (24 km) distant. Where screening was absent, because of a low angle of view and the long distance to the SEZ, minimal to weak visual contrasts would be expected.

Regardless of visibility from within these communities, residents, workers, and visitors to the area would be likely to experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads, including State Route 150 and U.S. 160.

Nearby Residents. As noted above, there are scattered ranches and other residences on private lands immediately adjacent or close to the SEZ and within the SEZ viewshed. Depending on technology- and project-specific factors, because of the close proximity and large size of likely developments, these residents could be subjected to large visual impacts from solar energy development within the SEZ. These impacts would be determined in the course of a site-specific environmental impact analysis.

Rio Grande Scenic Railroad. The Rio Grande Scenic Railroad is a privately run scenic/historic train service that is an important tourist destination within the San Luis Valley. The rail line serves Alamosa, passes within 2.3 mi (3.7 km) of the southern boundary of the SEZ, and is within the SEZ viewshed. A site visit in July 2009 indicated there may be at least partial screening of ground-level views of the SEZ from some portions of the rail line, because of either slight variations in topography, vegetation, or both; however, there are clear views of the SEZ from much of the rail line in the area.

Figure 10.3.14.2-13 is a Google Earth visualization of the SEZ as seen from the Rio Grande Scenic Railroad, 2.6 mi (4.2 km) south of the SEZ, facing north toward the center of the SEZ. The viewpoint is about 20 ft (6 m) higher than the nearest point in the SEZ. The viewpoint

FIGURE 10.3.14.2-13 Google Earth Visualization of the Proposed Fourmile East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Rio Grande Scenic Railway

is about 20 ft (6 m) higher in elevation than the nearest point in the SEZ. The power tower model in the visualization is about 5 mi (8 km) from the viewpoint.

The angle of view between the SEZ and the railroad is very low, but the distance (near the point of closest approach) is less than half the BLM foreground-middleground distance (5 mi [8 km]). Although the ground surface is partially screened from view in the visualization, all of the railroad line south of the SEZ is within the SEZ 24.6-ft (7.5-m) viewshed, and in fact, under the 80% development scenario analyzed in the PEIS, solar facilities in the SEZ could occupy most of the horizontal field of view to the north.

Because the viewpoint is only slightly elevated above the SEZ, the vertical angle of view would be very low, so that collector/reflector arrays of solar facilities within the SEZ would be seen edge-on. This would make the large areal extent and regular geometry of the arrays less apparent, and they would appear as thin lines on the northern horizon. Taller ancillary facilities, such as transmission components and cooling towers, would likely be visible projecting above the arrays and could contrast strongly in form, line, and possibly color with the very regular and strongly horizontal collector/reflector arrays.

If power tower facilities were located in the SEZ, when operating, the receivers could appear as very bright non-point (i.e., cylindrical or rectangular) light sources atop clearly discernable tower structures, and would strongly attract views.

Potential visual contrasts from solar energy development within the SEZ as seen from this viewpoint would depend on project location, project technology, and other visibility factors. Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to cause strong visual contrasts with the generally natural-appearing surroundings. Because this viewpoint is near the closest point on the railroad to the SEZ, other potential viewpoints on the railroad would be subject to similar or lower contrast levels.

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) as they travel area roads. The range of impacts experienced would be highly dependent on viewer location and 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.

10.3.14.2.3 Summary of Visual Resource Impacts for the Proposed Fourmile East SEZ

Under the 80% development scenario analyzed in this PEIS, there could be multiple solar facilities within the Fourmile East SEZ, a variety of technologies employed, and a range of supporting facilities (such as transmission towers and lines, substations, power block components, and roads) that would contribute to visual impacts. 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, with major cultural disturbances already present in and around the SEZ. Visitors to the area, workers, and residents of nearby areas may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads.

Utility-scale solar energy development within the proposed Fourmile East SEZ is likely to result in strong visual contrasts for some viewpoints in the Sangre de Cristo WA, which is located 2.8 mi (4.5 km) northeast of the SEZ.

Nearly 50 mi (80.5 km) of the Old Spanish NHT, including 25 mi (40 km) of a high-potential segment, fall within the SEZ 25-mi (40-km) viewshed. Trail users would be expected to observe strong visual contrasts from solar energy development within the SEZ at some points on the trail.

Strong visual contrast levels would be expected for some viewpoints in the Blanca Wetlands SRMA/ACEC, located about 0.5 mi (0.8 km) from the western edge of the SEZ.

Moderate visual contrast levels would be expected for some viewpoints in the Zapata Falls SRMA, located about 4.6 mi (7.4 km) northeast of the SEZ.

Moderate visual contrast levels would be expected for some viewpoints on Blanca Peak, located about 7 mi (11 km) northeast of the SEZ.

Almost 71 mi (114 km) of Los Caminos Antiguos Scenic Byway are within the Fourmile East SEZ viewshed. Travelers on the byway would be likely to observe strong visual contrasts from solar energy development within the SEZ at some locations on the byway.

Portions of the Rio Grande Scenic Railway are within the SEZ viewshed. Railroad passengers would be likely to observe strong visual contrasts from solar energy development within the SEZ at some points on the railroad.

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.

10.3.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

The presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into nonindustrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be mitigated substantially. However, the implementation of required programmatic design features presented in Appendix A, Section A.2.2, would reduce the magnitude of visual impacts experienced. While the applicability and appropriateness of some design features would depend on site- and project-specific information that would be available only after a specific solar energy project had been proposed, some SEZ-specific design features can be identified for the Fourmile East SEZ at this time, as follows:

- The development of power tower facilities should be prohibited within the SEZ.

- Within the SEZ, in areas visible from and within 0.25 mi (0.4 km) of the Los Caminos Antiguos Scenic Byway, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives (see Table 10.3.14.3.-1), as experienced from key observation points on the byway.

- Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the centerline of the high-potential segment of the Old Spanish National Historic Trail, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives, as experienced from key observation points on the high-potential segment of the Old Spanish National Historic Trail. Within the SEZ, in areas visible from and between 3 mi (4.8 km) and 5 mi (8 km) of the centerline of the high-potential segment of the Old Spanish National Historic Trail, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives, as experienced from key observation points on the high-potential segment of the Old Spanish National Historic Trail.

- Within the SEZ, in areas visible from and within 3 mi (4.8 km) of the Sangre de Cristo WA, visual impacts associated with solar energy project operation should be consistent with VRM Class II management objectives, as experienced from key observation points within the WA. Within the SEZ, in areas visible from and between 3 mi (4.8 km) and 5 mi (8 km) of the Sangre de Cristo WA, visual impacts associated with solar energy project operation should be consistent with VRM Class III management objectives, as experienced from key observation points within the WA.

Areas within the SEZ affected by these design features are shown in Figure 10.3.14.3-1. The VRM Class II consistency design feature would apply to 1,578 acres (6.39 km^2), or 41% of the SEZ. The VRM Class III consistency design feature would apply to 1,647 additional acres (6.67 km^2), or 42% of the SEZ.

Application of the SEZ-specific design features would substantially reduce visual impacts associated with solar energy development within the SEZ.

TABLE 10.3.14.3-1 VRM Management Class Objectives

	Description
Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Source: BLM (1986b).

The height of solar power tower receiver structures, combined with the intense light generated by the receivers atop the towers, would be expected to create strong visual contrasts that could not be effectively screened from view for most areas surrounding the SEZ, given the broad, flat, and generally treeless expanse of the San Juan Valley. In addition, for power towers exceeding 200 ft (61 m) in height, hazard navigation lighting that could be visible for very long distances would likely be required. Prohibiting the development of power tower facilities would remove this source of impacts, thus substantially reducing potential visual impacts on the Old Spanish National Historic Trail; Sangre de Cristo WA; Los Caminos Antiguos Scenic Byway; the other sensitive visual resource areas identified above; the communities of Alamosa, Blanca, and Mosca; and other residents of and visitors to the San Luis Valley, a regionally important tourist destination.

Application of the distance-based design feature to restrict allowable visual impacts associated with solar energy project operations to within 5 mi (8 km) of the high-potential segment of the Old Spanish National Historic Trail and the Sangre de Cristo WA would substantially reduce potential visual impacts on those resources by limiting impacts within the BLM-defined foreground of the viewshed of the trail, where potential visual impacts would be greatest. In addition, this measure would also substantially reduce potential visual impacts on the other sensitive visual resource areas identified above and on other residents of and visitors to the San Luis Valley.

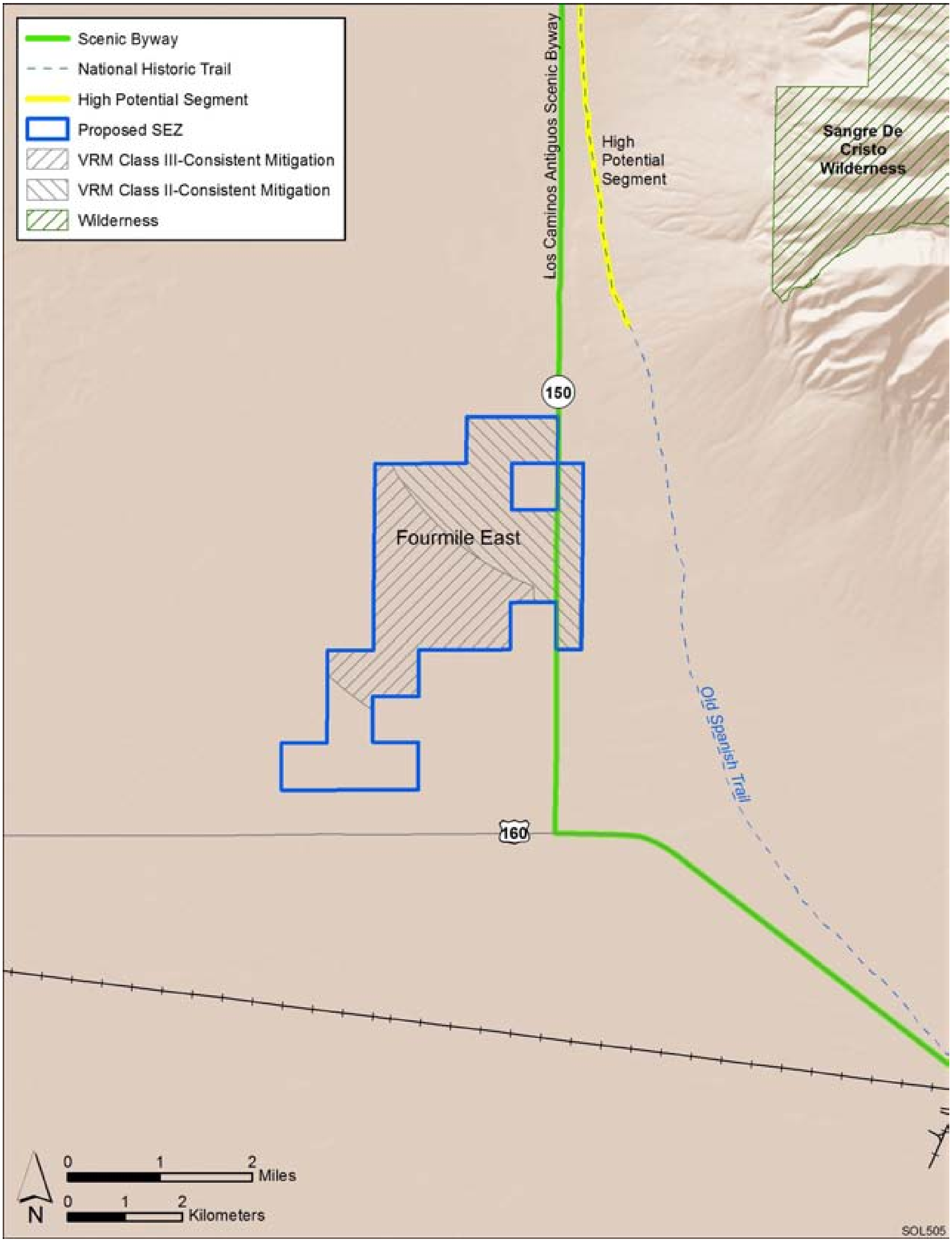

FIGURE 10.3.14.3-1 Areas within the Proposed Fourmile East SEZ Affected by SEZ-Specific Distance-Based Visual Impact Design Features

Application of the distance-based design feature to restrict allowable visual impacts associated with solar energy project operations to within 0.25 mi (0.4 km) of the Los Caminos Antiguos Scenic Byway would substantially reduce potential visual impacts on the byway by restricting visual intrusions in the immediate foreground of the byway, where potential visual impacts would be greatest, and would reduce the visual “tunnel” effect that could result if solar collector arrays were placed on both sides of and immediately adjacent to the byway.

Implementation of the programmatic and SEZ-specific design features intended to reduce visual impacts (described in Appendix A, Section A.2.2 of this PEIS) would be expected to reduce visual impacts associated with utility-scale solar energy development within the SEZ; however, the degree of effectiveness of these design features can be assessed only at the site- and project-specific level. Given the large scale reflective surfaces and strong regular geometry of utility-scale solar energy facilities and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive visual resource areas and other sensitive viewing areas would be the primary means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would generally be limited.

10.3.15 Acoustic Environment

10.3.15.1 Affected Environment

The proposed Fourmile East SEZ is in the southeastern portion of Alamosa County in south-central Colorado, which has no quantitative noise-level regulations. The State of Colorado, however, has established the 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. 160 lies about 0.5 mi (0.8 km) to the south of the Fourmile East SEZ, and State Highway 150 runs through the east side of the SEZ. Three county roads also provide good access to the SEZ. The nearest railroad runs as close as about 2.3 mi (3.7 km) to the south. The nearest airport is Blanca Airport, about 6.5 mi (10.5 km) southeast of the SEZ. Other nearby airports include San Luis Valley Regional Airport, Monte Vista Municipal Airport, and McCullough Airport, which are located about 12 mi (19 km) west–southwest, about 21 mi (34 km) west, and 24 mi (39 km) west–northwest of the SEZ, respectively. Developed small-scale irrigated agricultural activities occur about 1 mi (1.6 km) to the south; large-scale agricultural activities occur beyond about 4 mi (6 km) to the southeast around Blanca. Active cattle grazing occurs on-site, but no industrial activities exist around the SEZ. No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist around the proposed Fourmile East SEZ. The nearest residence from the boundary of the SEZ is located about 0.8 mi (1.3 km) to the southwest. The closest population center with schools or town infrastructure is Alamosa, which is located about 12 mi (19 km) west of the SEZ. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, and animal noise. Another noise source is hunting on-site. The proposed Fourmile East 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 Fourmile East SEZ. On the basis of the population density, the day-night average sound level (L_{dn} or DNL) is estimated to be 35 dBA for Alamosa County, the low end of 33 to 47 dBA L_{dn}, which is typical of a rural area[10] (Eldred 1982; Miller 2002).

10.3.15.2 Impacts

Potential noise impacts associated with solar projects in the proposed Fourmile East SEZ would occur during all phases of the projects. During the construction phase, potential noise impacts associated with the operation of heavy equipment and vehicular traffic on the nearest residence (within 0.8 mi [1.3 km] from the SEZ boundary) would be anticipated, albeit of short duration. During the operations phase, potential impacts on nearby residences would be anticipated, depending on the solar technologies employed. Noise impacts shared by all solar technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the Fourmile East SEZ are presented in this

[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.

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 10.3.15.3). This section primarily addresses potential noise impacts on humans, although potential impacts on wildlife at nearby sensitive areas are discussed. Additional discussion on potential noise impacts on wildlife is presented in Section 5.10.2.

10.3.15.2.1 Construction

The proposed Fourmile East 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. Considering geometric spreading and ground effects, 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 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 distances somewhat shorter than the aforementioned distances. If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur at about 1,200 ft (370 m) from the power block area, which would be well within the facility boundary. For construction activities occurring near the residence closest to the southwestern SEZ boundary, estimated noise levels at this residence would be about 44 dBA, which is somewhat higher than a typical daytime mean rural background level of 40 dBA. However, estimated 43 dBA L_{dn}[11] at this residence falls well below the EPA guideline of 55 dBA L_{dn} for residential areas.

In addition, noise levels were estimated at the specially designated areas within a 5-mi (8-km) range of the Fourmile East SEZ, which is the farthest distance that noise (except extremely loud noise) would be discernable. The Blanca Wetlands SRMA/ACEC and Old Spanish National Historic Trail, which lie as close as 0.5 mi (0.8 km) to the west and 0.9 mi (1.4 km) to the east of the SEZ boundary, are within the range where noise might be an issue. For construction activities occurring near the western SEZ boundary, the estimated noise level at the

[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.

Blanca Wetlands SRMA/ACEC would be about 50 dBA, which is higher than the typical daytime mean rural background level of 40 dBA. However, construction noise from the SEZ is not likely to adversely affect wildlife at the Blanca Wetlands SRMA/ACEC (Manci et al. 1988), as discussed in Section 5.10.2. For construction activities occurring near the eastern SEZ boundary, the estimated noise level at the Old Spanish National Historic Trail would be about 43 dBA, which is a little higher than the typical daytime mean rural background level of 40 dBA. Accordingly, construction occurring near the eastern SEZ boundary could result in minor 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 the installation of solar dish engines. However, the pile drivers to be used, such as vibratory or sonic drivers, would be relatively small and quiet as opposed 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 0.8 mi [1.3 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 southwestern 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.

It is assumed that a transmission line would need to be constructed to connect to the nearest existing regional 69-kV line located about 2 mi (3 km) south of the Fourmile East SEZ. Because of the short distance to the regional grid, such construction could be performed in a short time period (likely a few months). Construction sites along a new transmission line ROW would move continuously, and thus, no particular area would be exposed to noise for a prolonged period. The potential noise impacts on nearby residences along the transmission line ROW would therefore be minor and temporary in nature.

10.3.15.2.2 Operations

Noise sources common to all or most types of solar technologies include equipment motion from solar tracking; maintenance and repair activities (e.g., washing of mirrors or replacement of 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 southwestern boundary of the SEZ, the predicted noise level from the power block would be around 42 dBA at the nearest residence, located 0.8 mi (1.3 km) from the SEZ boundary,[12] which is a little higher than the typical daytime mean rural background level of 40 dBA. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only[13]), the EPA guideline of 55 dBA (as L_{dn} for residential areas) would occur at about 1,370 ft (420 m) from the power block, and thus would not be exceeded outside of the proposed SEZ boundary. At the nearest residence, about 43 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 Fourmile East 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] at all, within 1 or 2 mi (1.6 or 3 km) of the source, in the presence of a strong temperature inversion (Beranek 1988). In particular, such conditions

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[12] The nearest residence is located near the southwestern panhandle area of the SEZ, which does not have enough area for the 0.5-mi (0.8-km) buffer to the site boundary. In reality, this residence would be located more than 1.3 mi (2.1 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.

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 sound level (L_{dn}), 6-hour nighttime generation with TES is assumed after 12-hour daytime generation. For nighttime hours under temperature inversion, 10 dB is added to noise levels estimated from the uniform atmosphere (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 southwestern SEZ boundary) would be about 52 dBA, which is higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 53 dBA L_{dn}, which is lower than EPA guideline of 55 dBA L_{dn} for residential areas. The assumptions are conservative in terms of operating hours, and no credit was given to other attenuation mechanisms. Thus it is likely that noise levels would be lower than 53 dBA L_{dn} at the nearest residence, even if TES were used at a solar facility. Consequently, operating parabolic trough or power tower facilities using TES and located near the southwestern 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 western SEZ boundary, estimated daytime and nighttime noise levels at the Blanca Wetlands SRMA/ACEC would be about 45 and 55 dBA, respectively, which are higher than typical daytime and nighttime mean rural background levels of 40 and 30 dBA. However, operation noise from the SEZ is not likely to adversely affect wildlife at the Blanca Wetlands SRMA/ACEC (Manci et al. 1988). For a solar facility located near the eastern boundary, estimated daytime and nighttime noise levels at the Old Spanish National Historic Trail would be about 41 and 51 dBA, respectively, which are comparable to and higher than typical daytime and nighttime mean rural background levels of 40 and 30 dBA. Accordingly, a solar facility located near the eastern 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 Fourmile East SEZ, assuming a dish engine facility of up to 345 MW capacity (covering 80% of the total area or 3,105 acres [12.6 km^2]), up to 13,800 25-kW dish engines could be employed. Also, for a large dish engine facility, a couple of hundred step-up transformers would be embedded in the dish engine solar field, along with a substation; the noise from these sources, however, would be masked by dish engine noise.

The composite noise level of a single dish engine would be about 88 dBA at a distance of 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA (typical of the mean rural daytime environment) within 320 ft (100 m). However, the combined noise level from tens of thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility, for example, about 48 dBA at 1.0 mi (1.6 km) and 43 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; both values are higher than the typical daytime mean rural background level of 40 dBA. However, these levels would occur at somewhat shorter distances than the aforementioned distances, considering noise attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate noise levels at the nearest residence, it was assumed that dish engines were placed all over the Fourmile East SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest residence, about 0.8 mi (1.3 km) from the SEZ boundary, would be about 44 dBA, which is somewhat higher than the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 43 dBA L_{dn} at this residence is well below 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 adversely affect the nearest residence, depending on background noise levels and meteorological conditions.

For dish engines placed all over the SEZ, the estimated noise levels would be about 49 and 46 dBA at the Blanca Wetlands SRMA/ACEC and Old Spanish National Historic Trail, which are higher than the typical daytime mean rural background level of 40 dBA. Dish engine noise from the SEZ is not likely to adversely affect wildlife at the Blanca Wetlands SRMA/ACEC (Manci et al. 1988) but is likely to have potential 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 proposed Fourmile East 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 nearby residences, assuming a 1.3-mi (2.1-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and another 0.8 mi [1.3 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 that 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 Fourmile East SEZ is located in an arid desert environment, and incidents of corona discharge are infrequent. Therefore, potential impacts associated with transmission lines on nearby residents along the transmission lines ROW would be negligible.

10.3.15.2.3 Decommissioning/Reclamation

Decommissioning/reclamation requires many of the same procedures and equipment used in traditional construction. Decommissioning/reclamation would include dismantling of solar facilities, 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.

10.3.15.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from the development and operation of solar energy facilities. While some SEZ-specific design features are best established when specific project details are being considered, measures that can be identified at this time include the following:

- Noise levels from cooling systems equipped with TES should be managed so that levels at the nearest residence to the southwest of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.

- Dish engine facilities within the Fourmile East SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearest residence located to the southwest of the SEZ (i.e., the facilities should be located in the central or northern portion 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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10.3.16 Paleontological Resources

The paleontological conditions of the San Luis Valley, which encompasses the proposed Fourmile East proposed SEZ, are described in Section 10.1.16.

10.3.16.1 Affected Environment

The proposed Fourmile East SEZ is composed entirely (100%) of unclassified Quaternary surface deposits (classified as QTsa on geologic maps) overlying the Alamosa Formation. The PFYC (as discussed in Section 4.14) for QTsa is Class 4/5 (on the basis of the PFYC map from the Colorado State Office; see Murphey and Daitch 2007), although no known paleontological resources from these deposits in the San Luis Valley have been recorded (Lindsey 1983). The nearest identified exposures of the Alamosa Formation are located at Hansen's Bluff, southwest of the Fourmile East SEZ. Areas immediately adjacent to the SEZ are also composed of QTsa and are likewise also classified as PFYC 4/5.

10.3.16.2 Impacts

On the basis of the PFYC classification for this area, there could be impacts on significant paleontological resources in the proposed Fourmile East SEZ, although the presence of such resources is currently unknown. A more detailed look at the geological deposits of the SEZ and their depth is needed, as well as a possible paleontological survey prior to development, as per BLM IM2008-009 and IM2009-011 (BLM 2007, 2008). If significant paleontological resources are found to be present within the Fourmile East SEZ during a paleontological survey, Section 5.14 discusses the types of impacts that could occur. Because it is also possible that no significant paleontological resources are present within the SEZ, there may not be any impacts on this resource as a result of construction and operation of a solar facility. Programmatic design features (as described in Section A.2.2) assume that any necessary surveys would occur.

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 have been assessed for the proposed SEZ, assuming existing roads would be used and no new areas of potential paleontological interest would be opened to increased access; impacts on paleontological resources related to the creation of a new corridor would be evaluated at the project-specific level if new road construction was to occur. However, construction of approximately 2 mi (3 km) of transmission line is anticipated to connect to the nearest existing line. The ROW would occur in areas classified as PFYC Class 4/5, and therefore impacts on significant paleontological resources are possible. A detailed look at the geological deposits and their depth and a paleontological survey may be needed along the ROW, and implementation of the design features assumes that the prerequisite survey may occur.

The 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 modifications to the project footprint. Since the SEZ is located in an area classified as PFYC 4/5, it is recommended that a stipulation be included in the permitting document to alert the solar energy developer that there is the possibility of a delay if paleontological resources are uncovered during surface-disturbing activities.

10.3.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features, including a stop-work stipulation in the event that paleontological resources are encountered during construction, as described in Appendix A, Section A.2.2. SEZ-specific design features include:

- The depth to the Alamosa Formation within the proposed Fourmile East SEZ should be determined to identify what design features, might be needed in that area if solar energy development occurs.

10.3.17 Cultural Resources

The general culture history of the San Luis Valley, which encompasses the proposed Fourmile East SEZ, is described in Section 10.1.17.

10.3.17.1 Affected Environment

Although only a few archaeological sites have been reported from within the proposed Fourmile East SEZ, the presence of important archaeological resources in adjacent areas indicates a high potential for archaeological sites within the SEZ. No systematic cultural resource surveys are known to have been conducted in the SEZ according to the Colorado SHPO GIS data files. However, the same files indicate that six archaeological sites have been recorded within the SEZ (Colorado SHPO 2009). The SHPO GIS files associate these sites with the BOR's Closed Basin Project, which began archaeological surveys in 1976 for a water conveyance system. Most survey locations from the GIS that are associated with that project are identified to the west of the Fourmile East SEZ. All six of the sites are prehistoric open camps containing fire cracked rock, various tools and tool fragments, and debitage (lithic flakes created during tool manufacturing). The largest of the six sites also appears to contain two hearth features. None of the sites have been evaluated for listing in the NRHP. Numerous sites associated with the Blanca Wetlands are recorded west of the SEZ. Within a 5-mi (8-km) radius of the proposed Fourmile East SEZ, 113 site points are recorded in the Colorado SHPO's GIS, including 37 isolated finds, 8 isolated features, 41 open camps (one with a burial), 14 open lithic sites, 4 homesteads, 1 historic cemetery, 1 human burial site, 1 historic trash scatter, and 3 irrigation ditches (3 sites had no information for site type). Nearly half of these sites (55 sites) were recorded as part of the BOR's Closed Basin Project. A map of historic trails in the area indicates the possibility that a stage road may also have gone through the proposed SEZ (Scott 2001).

None of the 14 properties currently listed in the NRHP for Alamosa County are located within the SEZ. Nine listed properties are located approximately 11 mi (18 km) or more from the SEZ to the west in the town of Alamosa, Colorado, and one is located 20 mi (32 km) northwest in the town of Hooper. The remaining four properties are north of the SEZ. They consist of the Superintendent's Residence at the Great Sand Dunes National Park and Preserve 13 mi (21 km) north of the SEZ, Zapata Ranch Headquarters less than 8 mi (13 km) north of the SEZ, Medano Ranch Headquarters (12 mi [19 km]), and Trujillo Homestead (15 mi [24 km]). One of the important San Luis Valley Folsom bison kill sites (the Linger Site) is located within the Zapata Ranch property, as well as another Folsom site (the Zapata Site) and two mammoth sites (one with associated Paleoindian artifacts). Zapata Ranch (including Medano Ranch on its north end) is part of a Nature Conservancy Preserve with a working cattle, bison, and guest ranch. In adjacent Costilla County, the NRHP-listed sites of the San Luis Southern Railway Trestle and Fort Garland are located approximately 8 and 11 mi (13 and 18 km) to the southeast of the SEZ, respectively.

No traditional cultural properties have been identified within the SEZ during government-to-government consultations, nor have concerns been raised to date for traditional cultural properties or sacred areas located in the vicinity of the SEZ, including Blanca Peak, the Great Sand Dunes, and the San Luis Lakes (see also Section 10.3.18).

The proposed Fourmile East SEZ has the potential to contain significant cultural resources. The potential for finding significant Paleoindian sites exists throughout the entire valley. Well-known Folsom sites, such as the Reddin, Linger, Stewart's Cattleguard, and Zapata sites, are located in deflated dune areas north of the project area. Late Archaic sites have also been recorded near the Blanca Wetlands. The Great Sand Dunes National Park abuts the base of the Sangre de Cristo Mountains north of Fourmile East. Native American burials have been encountered in the National Park as a result of shifting dunes. They have also been noted in the northern portion of the valley, including in at least six locations in the vicinity of the Fourmile East SEZ (to the west and north) (Martorano et al. 1999). Past research suggests that prehistoric sites are likely to be encountered in the Fourmile East SEZ, in the semidune environment near the Blanca Wetlands. The large number of archaeological sites and isolated finds currently recorded in this vicinity, even with a small number of surveys completed, implies that the location has a high potential for containing significant cultural resources. Blowout areas within the SEZ yielded some artifacts during the preliminary site visit, such as a projectile point fragment and a possible fragment of a shell or bone bead.

The East Fork of the North Branch of the Old Spanish National Historic Trail is located within 1 mi (1.6 km) of the eastern edge of the SEZ. The mapped location of the congressionally designated trail is considered approximate, as the precise location of this segment of trail has not been ground-truthed. 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. The segment to the north, where the trail follows along the base of the Sangre de Cristo Mountains and across the Great Sand Dunes, has been designated a high-potential segment, because it retains its historical character. A Class III cultural resources inventory was recently conducted by RMC Consultants, Inc., on six parcels of BLM-administered lands adjacent to or containing segments of this high-potential segment to the north. Preliminary results include the recording of three new sites, one of which is potentially associated with the trail, two isolated finds, and the relocation of a previously known site that is also potentially associated with the trail; the report has not yet been submitted to the BLM. The BLM and USFS are in the process of determining a management approach for addressing the high-potential segments.

The proposed Fourmile East SEZ is also the closest of the four Colorado SEZs to Blanca Peak and the San Luis Lakes, although the peak can be seen from all four of the SEZs. As stated above, no issues have been identified during scoping or government-to-government consultations with the Navajo, several northern Pueblos, the Ute, the Jicarilla Apache, or any other Native American governments pertaining to these areas and solar energy development (see Appendix K and Section 10.3.18).

10.3.17.2 Impacts

Direct impacts on significant cultural resources could occur in the proposed Fourmile East SEZ and are highly likely given the number of sites present in the surrounding areas, despite minimal survey coverage; further investigation is needed. A cultural resource survey of the entire area of potential effect would be required to identify archaeological sites, historic structures or features, and traditional cultural properties, and an evaluation would follow to determine which recorded sites meet the criteria for eligibility 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 to the extent possible 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 would occur.

Required surveys would also include a survey of the Old Spanish National Historic Trail in the vicinity of the SEZ to determine its location relative to the SEZ and the integrity of the trail segment, as well as the presence of associated artifacts and features. It is already known that the southern end of a high-potential segment is located approximately 1 mi (2 km) northeast of the SEZ and is within the viewshed if a solar facility was to be installed, regardless of technology type[15] (see viewshed analysis for the proposed Fourmile East SEZ in Section 10.3.1.4.2 and Figures 10.3.14.2-7 and 10.3.14.2-8). The high-potential segment would be adversely affected by solar energy development resulting from visual impacts on the resource. If additional portions of the trail to the south of the high-potential segment are also determined to be significant as a result of future survey, these portions would also be adversely affected, with possible reductions in level of impact the farther the significant portions of the trail are from the SEZ. Previous surface disturbances within and adjacent to the proposed SEZ that contribute to the visual landscape include an unpaved road network, active grazing, and State Highway 150, which is the main road to the Great Sand Dunes National Park and Preserve entrance.

Indirect impacts on cultural resources located outside of the SEZ boundary (including along ROWs) as a result of erosion are unlikely, assuming design features to reduce water runoff and sedimentation are implemented (as described in Section A.2.2). Two unevaluated archaeological open camp sites[16] and four isolated finds were recorded during a survey of U.S. 160 very near (within 0.5 mi [0.8 km]) to a reasonable location for a new transmission line to connect a potential solar facility in the SEZ to an existing 69-kV line. These, or similar types of sites that could be encountered during an archaeological survey for the transmission ROW, could be directly affected during construction, depending on the location of the ROW. Indirect impacts are possible from unauthorized surface collection depending on the proximity of the ROW to the sites. No new roads have been assessed for the proposed SEZ, assuming existing roads would be used and no new areas of potential cultural significance would be opened to increased access; impacts on cultural resources related to the creation of a new corridor would be evaluated at the project-specific level if new road construction was to occur.

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[15] 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.

[16] Site location information from Colorado SHPO (2009).

10.3.17.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

Even assuming the implementation of design features, adverse effects on historic properties in the proposed Fourmile East SEZ are likely to occur. Three factors lead to this conclusion: (1) the area's high potential to contain significant cultural sites, including Native American human remains and associated cultural items; (2) its proximity (and visual impacts) to at least three areas previously identified as traditionally significant to the Navajo and the Tewa Clans of the Upper Rio Grande Pueblos, and possibly the Ute and Jicarilla Apache (i.e., the Great Sand Dunes, San Luis Lakes, and Blanca Peak), and (3) its proximity to a congressionally designated route of the Old Spanish National Historic Trail, such that solar energy development would result in visual impacts on a high-potential segment of the trail.

Ongoing consultation with the Colorado SHPO and the appropriate Native American governments would be conducted during the development of the proposed Fourmile East SEZ. It is likely that some 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 significant resources are avoided entirely. SEZ-specific design features could include:

- Development of a Programmatic Agreement (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) also should be included in the development of that PA. See also Section 10.3.18.3.

- Because of the possibility of encountering Native American human remains in the vicinity of the proposed Fourmile East SEZ, it is recommended that, for surveys conducted in the SEZ, consideration be given to including Native American participation in the development of survey designs and historic property treatment and monitoring plans.

10.3.18 Native American Concerns

10.3.18.1 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 Fourmile East SEZ, Section 10.3.17 discusses archaeological sites, structures, landscapes, trails, and traditional cultural properties, and Section 10.1.17 describes the general cultural history of the San Luis Valley; Section 10.3.9.1.3 discusses water rights and water use; Section 10.3.10 discusses plant species; 10.3.11 discusses wildlife species, including wildlife migration patterns; Sections 10.3.19 and 10.3.20 discuss socioeconomics and environmental justice, respectively; and issues of human health and safety are discussed in Section 5.21.

Historically, the valley was predominantly used by Tribes for hunting and trading rather than long-term settlement. The nearest Tribal land claims (judicially established as traditional tribal territory) to the proposed Fourmile East SEZ are for the Jicarilla Apache, approximately 25 mi (40 km) to the south, and the Cheyenne and Arapaho, Northern Cheyenne, and Northern Arapaho, approximately 60 mi (97 km) to the north of the SEZ.

Consultation for the Colorado SEZs has been initiated by the BLM with the Tribes[17] shown in Table 10.3.18.1-1. Details on government-to-government consultation efforts are presented in Chapter 14 and Appendix K. Plants and other resources of potential importance within the San Luis Valley are discussed in Sections 10.1.18.1.1 and 10.1.18.1.2.

10.3.18.2 Impacts

To date, no comments have been received from the Tribes referencing the proposed Fourmile East 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 judicially established Tribal land claims or 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 (Section 10.3.17) or on the valley as a whole as consultation continues and additional analyses are undertaken. It is also highly likely that archaeological sites are present within the Fourmile East SEZ (Section 10.3.17). While it is not known whether any sites will be considered significant to the Tribes, Tribes typically regard prehistoric archaeological sites as the remains of their ancestors and consider them culturally important. Given the location of the SEZ relative to previous finds of Native American human remains and

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[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 10.3.18.1-1 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

associated cultural items, it is also possible that Native American burials are present. 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 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 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.

Whether there are any specific issues relative to socioeconomics, environmental justice, or health and safety relative to Native American populations is yet to be determined.

Possible impacts from solar energy development on resources of concern that are encountered within the SEZ, as well as general mitigation measures, are described in more detail in Section 5.16.

10.3.18.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features, such as avoidance of sacred sites, water sources, and tribally important plant and animal species described in Appendix A, Section A.2.2. Programmatic design features require that the necessary surveys, evaluations, and consultations would occur. The Tribes would be notified regarding the results of archaeological surveys, and they would be contacted immediately upon any discovery of Native American human remains and associated cultural items.

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 10.3.18.1-1.

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10.3.19 Socioeconomics

10.3.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the ROI surrounding the proposed Fourmile East SEZ. The ROI is a four-county area composed of Alamosa, Conejos, Costilla, 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 nonpayroll expenditures from the construction, operation, and decommissioning phases of the proposed SEZ facility are expected to take place.

10.3.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 18,645 (Table 10.3.19.1-1). Over the period 1999 to 2008, annual average employment growth rates were higher in Rio Grande County (2.4%) than elsewhere in the ROI, while employment in Conejos County (–0.3%) declined over this period. At 0.7%, growth rates in the ROI as a whole were lower than the average rate for Colorado (1.5%).

In 2006, agriculture provided the highest percentage of employment in the ROI at 35.5%, followed by the service sector (34.6%) and wholesale and retail trade (18.5%) (Table 10.3.19.1-2). Smaller employment shares were held by finance, insurance, and real estate (5.4%) and by construction (4.4%). Within the ROI, the distribution of employment

TABLE 10.3.19.1-1 ROI Employment for the Proposed Fourmile East SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Alamosa County	7,885	7,935	0.1
Conejos County	3,498	3,402	–0.3
Costilla County	1,234	1,268	0.3
Rio Grande County	4,784	6,040	2.4
ROI	17,401	18,645	0.7
Colorado	2,269,668	2,596,309	1.5

Sources: U.S Department of Labor (2009a,b).

TABLE 10.3.19.1-2 ROI Employment by Sector for the Proposed Fourmile East SEZ, 2006[a]

	Alamosa County		Conejos County		Costilla County	
	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,470	22.4	488	42.8	484	77.0
Mining	10	0.2	10	0.9	0	0.0
Construction	324	4.9	39	3.4	14	2.2
Manufacturing	93	1.4	60	5.3	10	1.6
Transportation and public utilities	201	3.1	100	8.8	10	1.6
Wholesale and retail trade	1,300	19.8	159	14.0	90	14.3
Finance, insurance, and real estate	434	6.6	41	3.6	10	1.6
Services	2,752	41.9	299	26.3	114	18.1
Other	9	0.1	0	0.0	10	1.6
Total	6,575		1,139		631	

	Rio Grande County		ROI	
	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,763	41.9	4,207	35.5
Mining	0	0.0	20	0.2
Construction	179	4.3	556	4.4
Manufacturing	79	1.9	242	1.9
Transportation and public utilities	70	1.7	381	3.0
Wholesale and retail trade	769	18.3	2,318	18.5
Finance, insurance, and real estate	197	4.7	682	5.4
Services	1,172	27.9	4,337	34.6
Other	10	0.2	29	0.2
Total	4,207		12,552	

[a] Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009).

across sectors varied somewhat compared with the ROI as a whole, with a higher percentage of employment in agriculture in Conejos (42.8%), Costilla (77.0%), and Rio Grande (41.9%) Counties than in Alamosa County (22.4%). The first three counties had lower shares of employment in services compared with the ROI as a whole.

10.3.19.1.2 ROI Unemployment

Unemployment rates have varied across the three counties in the ROI. Over the period 1999 to 2008, the average rate in Costilla County was 9.2% and in Conejos County, 6.9%, with rates exceeding 5% in all counties except Alamosa County over this period (Table 10.3.19.1-3). Rates have fallen over the period; in 1999, for example, Conejos experienced rates higher than 11%. The average rate in the ROI over this period was 5.8%, higher than the average rate for Colorado (4.5%). Unemployment rates for the first five months of 2009 contrast with rates for 2008 as a whole; in Costilla County the unemployment rate increased to 11.1%, while rates reached 9.9% and 8.1% in Conejos and Rio Grande Counties, respectively. The average rates for the ROI (8.4%) and for Colorado (7.5%) were also higher during this period than the corresponding average rate for 2008.

10.3.19.1.3 ROI Urban Population

The population of the ROI in 2008 was 16% urban, with two larger towns, Alamosa, which had an estimated 2008 population of 8,746, and Monte Vista (4,015) (Table 10.3.19.1-4). In addition, there are eight smaller towns in the ROI with 2008 population of less than 1,500.

TABLE 10.3.19.1-3 ROI Unemployment Rates (%) for the Proposed Fourmile East SEZ

Location	1999–2008	2008	2009[a]
Alamosa County	5.0	5.3	7.6
Conejos County	6.9	7.5	9.9
Costilla County	9.2	7.6	11.1
Rio Grande County	5.6	5.8	8.1
ROI	5.8	6.0	8.4
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 10.3.19.1-4 ROI Urban Population and Income for the Proposed Fourmile East 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
Monte Vista	4,529	4,015	–1.5	36,556	NA	NA
Manassa	1,042	936	–1.3	29,731	NA	NA
La Jara	877	784	–1.4	31,115	NA	NA
Antonito	873	776	–1.5	24,727	NA	NA
Sanford	817	733	–1.3	32,993	NA	NA
San Luis	739	641	–1.8	18,299	NA	NA
Blanca	391	343	–1.6	29,452	NA	NA
Romeo	375	340	–1.2	24,857	NA	NA
Hooper	123	125	0.2	41,154	NA	NA

[a] Data are averages for the period 2006 to 2008.

Source: U.S. Bureau of the Census (2009b-d).

Population growth rates in the ROI have varied over the period 2000 to 2008 (Table 10.3.19.1-4). Alamosa grew at an annual rate of 1.2%, while the remaining towns experienced lower growth rates between 2000 and 2008, with majority of these cities experiencing negative growth rates during this period.

10.3.19.1.4 ROI Urban Income

Median household incomes vary across urban areas in the ROI. No data are available for cities in the ROI for 2006 to 2008. In 2000, none of the towns in the ROI had median incomes that were higher than the average for Colorado ($56,574) (Table 10.3.19.1-4).

10.3.19.1.5 ROI Population

Table 10.3.19.1-5 presents recent and projected populations in the ROI and states as a whole. Population in the ROI stood at 39,759 in 2008, having grown at an average annual rate of 0.1% since 2000. Growth rates for the ROI were lower than the rate for Colorado (1.9%) over the same period.

Population in Alamosa County grew by 0.7% between 2000 and 2008, while the remaining counties saw declines in population of less than 1.0%. The ROI population is expected to increase to 47,895 by 2021 and to 49,117 by 2023.

TABLE 10.3.19.1-5 ROI Population for the Proposed Fourmile East SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Alamosa County	14,966	15,783	0.7	20,210	20,943
Conejos County	8,400	8,232	–0.3	9,322	9,453
Costillao County	3,663	3,465	–0.7	3,898	3,945
Rio Grande County	12,413	12,279	–0.1	14,465	14,776
ROI	39,442	39,759	0.1	47,895	49,117
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).

10.3.19.1.6 ROI Income

Personal income in the ROI stood at $1.0 billion in 2007 and has grown at an annual average rate of 0.9% over the period 1998 to 2007 (Table 10.3.19.1-6). ROI per-capita income also rose over the same period at a rate of 0.5%, increasing from $24,465 to $25,622. Per-capita incomes were higher in Rio Grande ($27,814) and Alamosa ($27,238) Counties in 2007 than elsewhere in the ROI. For per-capita income, the growth rate in Costilla County was higher than the state rate; per-capita incomes, however, were significantly lower in all counties than for Colorado as a whole ($41,955).

Median household income over the period 2006 to 2008 varied between $25,146 in Costilla County and $40,989 in Rio Grande County (U.S. Bureau of the Census 2009d).

10.3.19.1.7 ROI Housing

In 2007, almost 19,700 housing units were located in the four ROI counties, with more than 66% of these located in Alamosa and Rio Grande Counties (Table 10.3.19.1-7). 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 Costilla County (31.7%) than elsewhere in the ROI. With an overall vacancy rate of 19.5% in the ROI in 2007, there were 3,831 vacant housing units, of which 1,124 are estimated to be rental units that would be available to construction workers. There were 1,827 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

Housing stock in the ROI as a whole grew at an annual rate of 1.2% over the period 2000 to 2007, with 1,519 new units added to the existing housing stock in the ROI (Table 10.3.19.1-7).

TABLE 10.3.19.1-6 ROI Personal Income for the Proposed Fourmile East 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
Conejos County			
Total income[a]	0.2	0.2	0.9
Per-capita income	18,795	20,161	0.7
Costilla County			
Total income[a]	0.1	0.1	0.9
Per-capita income	20,755	23,273	1.2
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]	0.9	1.0	0.9
Per-capita income	24,465	25,622	0.5
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).

The median value of owner-occupied housing in 2006 to 2008 varied between $58,980 in Costilla County and $90,953 in Alamosa County (U.S. Bureau of the Census 2009g).

10.3.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 10.3.19.1-8. There are no Tribal governments located in the ROI, although there are members of other Tribal groups located in the ROI whose Tribal governments are located in adjacent counties or states.

TABLE 10.3.19.1-7 ROI Housing Characteristics for the Proposed Fourmile East 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
Conejos County		
Owner-occupied	2,347	2,590
Rental	633	699
Vacant units	906	1,000
Seasonal and recreational use	544	NA
Total units	3,886	4,289
Costilla County		
Owner-occupied	1,175	1,230
Rental	328	343
Vacant units	699	732
Seasonal and recreational use	447	NA
Total units	2,202	2,305
Rio Grande County		
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	10,343	11,210
Rental	4,308	4,657
Vacant units	3,528	3,831
Seasonal and recreational use	1,827	NA
Total units	18,179	19,698

[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 10.3.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Fourmile East SEZ

Governments	
City	
Alamosa	Manassa
Antonito	Monte Vista
Blanca	Romeo
Hooper	San Luis
La Jara	Sanford
County	
Alamosa County	Costilla County
Conejos County	Rio Grande County
Tribal	
None	

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

10.3.19.1.9 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 37 public and private elementary, middle, and high schools (NCES 2009). Table 10.3.19.1-9 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 Costilla County schools (11.1) is slightly lower than that for schools in the remaining three counties, while the level of service is highest in Conejos County (15.4) and lowest in Alamosa County (10.5).

Health Care

While Alamosa County has a much larger number of physicians (41), the number of doctors per 1,000 population is also significantly higher than that in the remaining counties in the ROI (Table 10.3.19.1-10). The smaller number of health care professionals in Conejos and Costilla Counties may mean that residents of these counties have poorer access to health care; a substantial number of county residents might also travel to other counties in the ROI for their medical care.

TABLE 10.3.19.1-9 ROI School District Data for the Proposed Fourmile East 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
Conejos County	1,830	129	14.2	15.4
Costilla County	535	48	11.1	13.6
Rio Grande County	2,272	170	13.4	13.5
ROI	7,120	513	13.9	12.7

[a] Number of teachers per 1,000 population.

Source: NCES (2009).

TABLE 10.3.19.1-10 Physicians in the ROI for the Proposed Fourmile East SEZ, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Alamosa County	41	2.6
Conejos County	8	1.0
Costilla County	3	0.8
Rio Grande County	13	1.0
ROI	65	1.6

[a] Number of physicians per 1,000 population.

Source: AMA (2009).

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI (Table 10.3.19.1-11). Conejos County has seven officers and would provide law enforcement services to the SEZ; there are 34 officers in the remainder of the ROI counties. Currently, there are no professional firefighters in the ROI; the majority of firefighting services are provided by volunteers. The level of service of police protection in Costilla County (1.4) and in Alamosa County (1.3) is higher than that in the remaining counties of the ROI and is lowest in Rio Grande County (0.6).

TABLE 10.3.19.1-11 Public Safety Employment in the ROI for the Proposed Fourmile East SEZ

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service
Alamosa County	21	1.3	0	0.0
Conejos County	7	0.8	0	0.0
Costilla County	5	1.4	0	0.0
Rio Grande County	8	0.6	0	0.0
ROI	41	1.0	0	0.0

[a] 2007 data.

[b] Number per 1,000 population.

[c] 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2008); Fire Departments Network (2009).

10.3.19.1.10 ROI Social Structures and Social Change

Community social structures and other forms of social organization within the ROI are related to various factors, including historical development, major economic activities and sources of employment, income levels, race and ethnicity, and forms of local political organization. Although an analysis of the character of community social structures is beyond the scope of the current programmatic analysis, project-level NEPA analyses would include a description of ROI social structures, contributing factors, their uniqueness, and, consequently, the susceptibility of local communities to various forms of social disruption and social change.

Various energy development studies have suggested that once the annual growth in population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Tables 10.3.19.1-12 and 10.3.19.1-13 present data for a number of indicators of social change, including violent and property crime rates, alcoholism and illicit drug use, mental health, and divorce, that might be used to indicate social change.

There is some variation in the level of crime across the ROI, with higher rates of violent crime in Alamosa County (4.1 per 1000 population) than in Rio Grande County (2.1) (Table 10.3.19.1-12). Property-related crime rates were much higher in Alamosa County (30.2) than in Rio Grande County (11.3); that is, overall crime rates in Alamosa County were almost twice the rate for the ROI as a whole. No crime rates were reported for Conejos County and Costilla County.

TABLE 10.3.19.1-12 County and ROI Crime Rates for the Proposed Fourmile East SEZ[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
Location	Offenses	Rate	Offenses	Rate	Offenses	Rate
Alamosa County	65	4.1	477	30.2	542	34.3
Conejos County	NA[d]	NA	NA	NA	NA	NA
Costilla County	NA	NA	NA	NA	NA	NA
Rio Grande County	26	2.1	139	11.3	165	13.4
ROI	91	2.3	616	15.5	707	17.8

[a] Rates are the number of crimes per 1,000 population.

[b] Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

[c] Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

[d] NA = data not available.

Source: U.S. Department of Justice (2009a,b).

Other measures of social change—alcoholism, illicit drug use, and mental health—are not available at the county level but are presented for the region in which the ROI is located (Table 10.3.19.1-13). Divorce rates for Colorado as a whole are also presented.

10.3.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for a range of activities, including hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These activities are discussed in Section 10.3.5.

Because the number of visitors using state and federal lands for recreational activities is not available from the various administering agencies, the value of recreational resources in these areas, based solely on the number of recorded visitors, is likely to be an underestimation. In addition to visitation rates, the economic valuation of certain natural resources can also be assessed in terms of the potential recreational destination for current and future users, that is, their nonmarket value (see Section 5.17.1.1.1).

TABLE 10.3.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the ROI for the Proposed Fourmile East SEZ[a]

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health	Divorce[b]
Colorado Region 4 (includes Alamosa County, Conejos County, Costilla County, and Rio Grande County)	9.7	3.1	10.2	–[d]
Colorado				4.4

[a] Data for alcoholism, drug use, represent percentage of the population over 12 years of age with dependence or abuse of alcohol, illicit drugs. Data are averages for 2004 to 2006.

[b] Data for mental health represent percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

[c] Divorce rates are the number of divorces per 1,000 population. Data are for 2004.

[d] A dash indicates not applicable.

Sources: SAMHSA (2009); CDC (2009).

Another method is to estimate the economic impact of the various recreational activities supported by natural resources on public land in the vicinity of the proposed solar facilities, by identifying sectors in the economy in which expenditures on recreational activities occur. Not all activities in these sectors are directly related to recreation on state and federal lands, with some activity occurring on private land (e.g., dude ranches, golf courses, bowling alleys, and movie theaters). Expenditures associated with recreational activities form an important part of the economy of the ROI. In 2007, 1,509 people were employed in the ROI in the various sectors identified as recreation, constituting 7.9% of total ROI employment (Table 10.3.19.1-14). Recreation spending also produced almost $26.4 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

10.3.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including common impacts on recreation, social change, and livestock grazing. These impacts would occur regardless of the solar technology developed in the SEZ. Impacts associated with the construction of off-site transmission lines are described next. Finally, impacts of facilities employing various solar energy technologies are analyzed in detail in subsequent sections.

10.3.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed Fourmile East SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of

TABLE 10.3.19.1-14 Recreation Sector Activity in the Proposed Fourmile East SEZ ROI, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	56	1.0
Automotive rental	2	0.1
Eating and drinking places	1,046	15.6
Hotels and lodging places	229	4.1
Museums and historic sites	1	0.2
Recreational vehicle parks and campsites	64	1.2
Scenic tours	69	3.4
Sporting goods retailers	42	0.7
Total ROI	1,509	26.4

Source: MIG, Inc. (2010).

expenditures of wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as 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 facilities are discussed in detail in Section 5.17. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits). 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 3.8% in ROI population during construction of the trough technology, with smaller increases for the power tower, dish engine, and PV technologies, and during the operation of each technology. While it is possible that some construction and operations workers will choose to locate in communities closer to the SEZ, the lack of available housing to accommodate all in-migrating workers and families in smaller rural communities in the ROI and the insufficient range of housing choices to suit all solar occupations make it likely that many workers will commute to the SEZ from larger communities elsewhere in the ROI, 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 development are likely to be required to adapt to a different quality of life, with a transition away from a more traditional lifestyle involving ranching and taking place in small, isolated, close-knit, homogenous communities with a strong orientation toward personal and family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing dependence on formal social relationships within the community.

Livestock Grazing Impacts

*C*attle ranching and farming supported 847 jobs, and was responsible for $5.0 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed SEZ could result in a decline in the amount of land available for livestock grazing, resulting in the loss of a total (direct plus indirect) of 20 jobs and $0.3 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 $35 annually on land dedicated to solar developments in the SEZ.

Transmission Line Impacts

Construction. The impacts of transmission line construction could include the addition of 9 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 10.3.19.2-1). Construction activities would constitute less than 0.1% of total ROI employment. A transmission line would also produce $0.4 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million.

Given the likelihood of local worker availability in the required occupational categories, construction of a transmission line would mean that some in-migration of workers and their families from outside the ROI would be required, with 11 persons in-migrating into the ROI.

TABLE 10.3.19.2-1 Proposed Fourmile East SEZ ROI Socioeconomic Impacts of Transmission Line Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	4	<1
Total	9	<1
Income[b]		
Total	0.4	<0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	11	<1
Vacant housing[c] (no.)	5	<1
Local community service employment		
Teachers (no.)	<1	<1
Physicians (no.)	<1	<1
Public safety (no.)	<1	<1

[a] Construction impacts assume 2 mi (3 km) of transmission line is required to connect SEZ solar facilities to the grid. Construction impacts were assessed for a single representative year, 2021.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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 five rental units expected to be occupied in the ROI. This occupancy rate would represent less than 0.1% of the vacant rental units expected to be available in the ROI.

No new community service employment would be required in order to meet existing levels of service in the ROI.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a transmission line would be less than one job (Table 10.3.19.2-2) and would produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million.

Operation of a transmission line would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no new community service employment would be required in order to meet existing levels of service in the ROI.

Access Road Impacts

Construction of an access road to connect to the Bullard Wash SEZ could include the addition of 59 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 10.3.19.2-2). Construction activities in the peak year would constitute less than 1% of total ROI employment. Access road construction would also produce $1.8 million in ROI income. Direct sales taxes and direct income taxes would each be less than $0.1 million.

Total operations (maintenance) employment impacts in the ROI (including direct and indirect impacts) of an access road would be less than 1 job during the first year of operation (Table 10.3.19.2-2) and would also produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million in the first year, with direct income taxes of less than $0.1 million.

Construction and operation of an access road would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no new community service employment would be required in order to meet existing levels of service in the ROI.

10.3.19.2.2 Technology-Specific Impacts

The economic impacts of solar energy development in the proposed SEZ were measured in terms of employment, income, state tax revenues (sales and income), BLM acreage rental and

TABLE 10.3.19.2-2 ROI Socioeconomic Impacts of an Access Road Connecting the Proposed Fourmile East SEZ[a]

Parameter	Maximum Annual Construction Impacts	Operations
Employment (no.)		
Direct	35	<1
Total	59	<1
Income[b]		
Total	1.8	<0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	0	0
Vacant housing[c] (no.)	0	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts assume 3 mi (5 km) of access road are required for the SEZ. Construction impacts are assessed for the peak year of construction.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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 on the ROI (including direct and indirect impacts) from the use of solar trough technologies would be 2,804 jobs (Table 10.3.19.2-3), assuming that one 600-MW facility was constructed. Construction activities would constitute 12.5% of total ROI employment. A solar development would also produce $152.6 million in income. Direct sales taxes would be $0.1 million, and direct income taxes, $5.9 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 1,827 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary 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 914 rental units expected to be occupied in the ROI. This occupancy rate would represent 66.9% 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 employment (education, health, and public safety). An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 25 new teachers, 3 physicians, and 2 public safety employees (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 3.8% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts on the ROI (including direct and indirect impacts) of a build-out using solar trough technologies would be 203 jobs (Table 10.3.19.2-3). Such a solar development would also produce $6.6 million in income. Direct sales taxes would be $0.1 million, and direct income taxes, $0.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $4.1 million.

TABLE 10.3.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ with Trough Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	1,641	135
Total	2,804	203
Income[b]		
Total	152.6	6.6
Direct state taxes[b]		
Sales	0.1	0.1
Income	5.9	0.2
BLM Payments[b]		
Rental	NA[c]	0.2
Capacity[d]	NA	4.1
In-migrants (no.)	1,827	86
Vacant housing[e] (no.)	914	78
Local community service employment		
Teachers (no.)	25	1
Physicians (no.)	3	0
Public safety (no.)	2	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 621 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.

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 86 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 78 owner-occupied units expected to be occupied in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (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.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technologies would be 1,117 jobs (Table 10.3.19.2-4), assuming that one 333-MW facility was constructed. Construction activities would constitute 5.0% of total ROI employment. Such a solar development would also produce $60.8 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $2.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 728 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 364 rental units expected to be occupied in the ROI. This occupancy rate would represent 26.6% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 10 new teachers, 1 physician, and 1 public safety employee (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 1.5% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts on the ROI (including direct and indirect impacts) of a build-out using power tower technologies would be 97 jobs

TABLE 10.3.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ with Power Tower Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	654	70
Total	1,117	97
Income[b]		
Total	60.8	3.0
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	2.4	0.1
BLM payments[b]		
Rental	NA[c]	0.2
Capacity[d]	NA	2.3
In-migrants (no.)	728	45
Vacant housing[e] (no.)	364	40
Local community service employment		
Teachers (no.)	10	1
Physicians (no.)	1	0
Public safety (no.)	1	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] NA = not applicable.

[d] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

[e] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

(Table 10.3.19.2-4). Such a solar development would also produce $3.0 million in income. Direct sales taxes would be less than $0.1 million and direct income taxes, $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $2.3 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 45 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 40 owner-occupied units expected to be required in the ROI.

In addition to the potential impact on housing markets, in-migration would also affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI.

Dish Engine

Construction. Total construction employment impacts on the ROI (including direct and indirect impacts) from the use of dish engine technologies would be 454 jobs (Table 10.3.19.2-5), assuming that one 333-MW facility was constructed. Construction activities would constitute 2.0% of total ROI employment. Such a solar development would also produce $24.7 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $1.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 296 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 148 rental units expected to be occupied in the ROI. This occupancy rate would represent 10.8% 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, 4 new teachers and 1 physician would be required in the ROI. This increase would represent 0.6% of total ROI employment expected in this occupation.

TABLE 10.3.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ with Dish Engine Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	266	68
Total	454	94
Income[b]		
Total	24.7	2.9
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	1.0	0.1
BLM payments[b]		
Rental	NA[c]	0.2
Capacity[d]	NA	2.3
In-migrants (no.)	296	43
Vacant housing[e] (no.)	148	39
Local community service employment		
Teachers (no.)	4	1
Physicians (no.)	1	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 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.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using dish engine technologies would be 94 jobs (Table 10.3.19.2-5). Such a solar development would also produce $2.9 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $2.3 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 43 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 39 owner-occupied units expected to be required in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI.

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of PV technologies would be 212 jobs (Table 10.3.19.2-6), assuming that one 333-MW facility was constructed. Construction activities would constitute 0.9% of total ROI employment. Such a solar development would also produce $11.5 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 138 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 69 rental units expected to be occupied in the ROI. This occupancy rate would represent 5.1% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly,

TABLE 10.3.19.2-6 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ with PV Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	124	7
Total	212	9
Income[b]		
Total	11.5	0.3
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	0.4	<0.1
BLM payments[b]		
Rental	NA[c]	0.2
Capacity[d]	NA	1.8
In-migrants (no.)	138	4
Vacant housing[e] (no.)	69	4
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] NA = not applicable.

[d] The BLM annual capacity payment was based on a fee of $5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), assuming full build-out of the site.

[e] Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

two new teachers would be required in the ROI. This increase would represent 0.3% 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 9 jobs (Table 10.3.19.2-6). Such a solar development would also produce $0.3 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $1.8 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 4 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 4 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.

10.3.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Fourmile East SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for socioeconomic impacts during all project phases.

10.3.20 Environmental Justice

10.3.20.1 Affected Environment

On February 11, 1994, the President signed E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which formally requires federal agencies to incorporate environmental justice as part of their missions (*Federal Register*, Volume 59, page 7626, Feb. 11, 1994). Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the CEQ's *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description of the geographic distribution of low-income and minority populations in the affected area is undertaken; (2) an assessment is conducted to determine whether 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 to the location of low-income and minority populations.

The analysis of environmental justice issues associated with the development of solar facilities considered impacts within the SEZ and an associated 50-mi (80-km) radius around the boundary of the SEZ. A description of the geographic distribution of minority and low-income groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau of the Census 2009k,l). The following definitions were used to define minority and low-income population groups:

- **Minority.** Persons are included in the minority category if they identify themselves as belonging to any of the following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

  Beginning with the 2000 Census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origin. In addition, persons who classify themselves as being of multiple racial origins may choose up to six racial groups as the basis of

their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or "Other Race" (U.S. Bureau of the Census 2009k).

The CEQ guidance proposed that minority populations should be identified where either (1) the minority population of the affected area exceeds 50% or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

This PEIS applies both criteria in using the Census Bureau data for census block groups, wherein consideration is given to the minority population that is both 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 10.3.20.1-1 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 in Colorado, 42.2% of the population is classified as minority, while 17.7% is classified as low-income. 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 radius, meaning that there are no minority or low-income populations in the Colorado portion of the 50-mile area based on 2000 Census data and CEQ guidelines.

Within the 50-mi (80-km) radius in New Mexico, 55.6% of the population is classified as minority, while 17.4% is classified as low-income. Although the number of minority individuals does not exceed the state average by 20 percentage points or more, the number of minority individuals exceeds 50% of the total population in the radius area, meaning that there are minority populations in the 50-mi (80-km) radius based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total population in the radius, meaning that there are no low-income populations in the New Mexico portion of the 50-mile area.

TABLE 10.3.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Fourmile East SEZ

Parameter	Colorado	New Mexico
Total population	68,522	9,859
White, non-Hispanic	39,581	4,374
Hispanic or Latino	26,562	5,147
Non-Hispanic or Latino minorities	2,379	338
One race	1,485	171
Black or African American	405	18
American Indian or Alaskan Native	679	93
Asian	269	30
Native Hawaiian or other Pacific Islander	26	3
Some other race	106	27
Two or more races	894	167
Total minority	28,941	5,485
Low-income	12,116	1,720
Percentage minority	42.2	55.6
State percentage minority	25.5	55.3
Percentage low-income	17.7	17.4
State percentage low-income	9.3	18.4

Source: U.S. Bureau of the Census (2009k,l).

Figures 10.3.20.1-1 and 10.3.20.1-2 show the locations of minority and low-income population groups in the 50-mi (80-km) radius around the boundary of the SEZ.

In the Colorado portion of the 50-mi (80-km) radius, more than 50% of the population in all but one of the block groups in Conejos County is made up of minority population groups, together with all of the block groups in adjacent Costilla County. Block groups in the cities of Alamosa (Alamosa County), Monte Vista and Del Norte (both in Rio Grande County), Center (Saguache County), and Walsenburg (Huerfano County) are also more than 50% minority. In the New Mexico portion of the radius, Rio Arriba County has one block group in which the minority population is more than 20 percentage points higher than the state average, while there are two block groups with more than 50% minority in Taos County.

Low-income populations in the 50-mi (80-km) radius are limited to two block groups in the Colorado portion, in the cities of San Luis (Costilla County) and Alamosa, both of which have low-income population shares that are more than 20 percentage points higher than the state average.

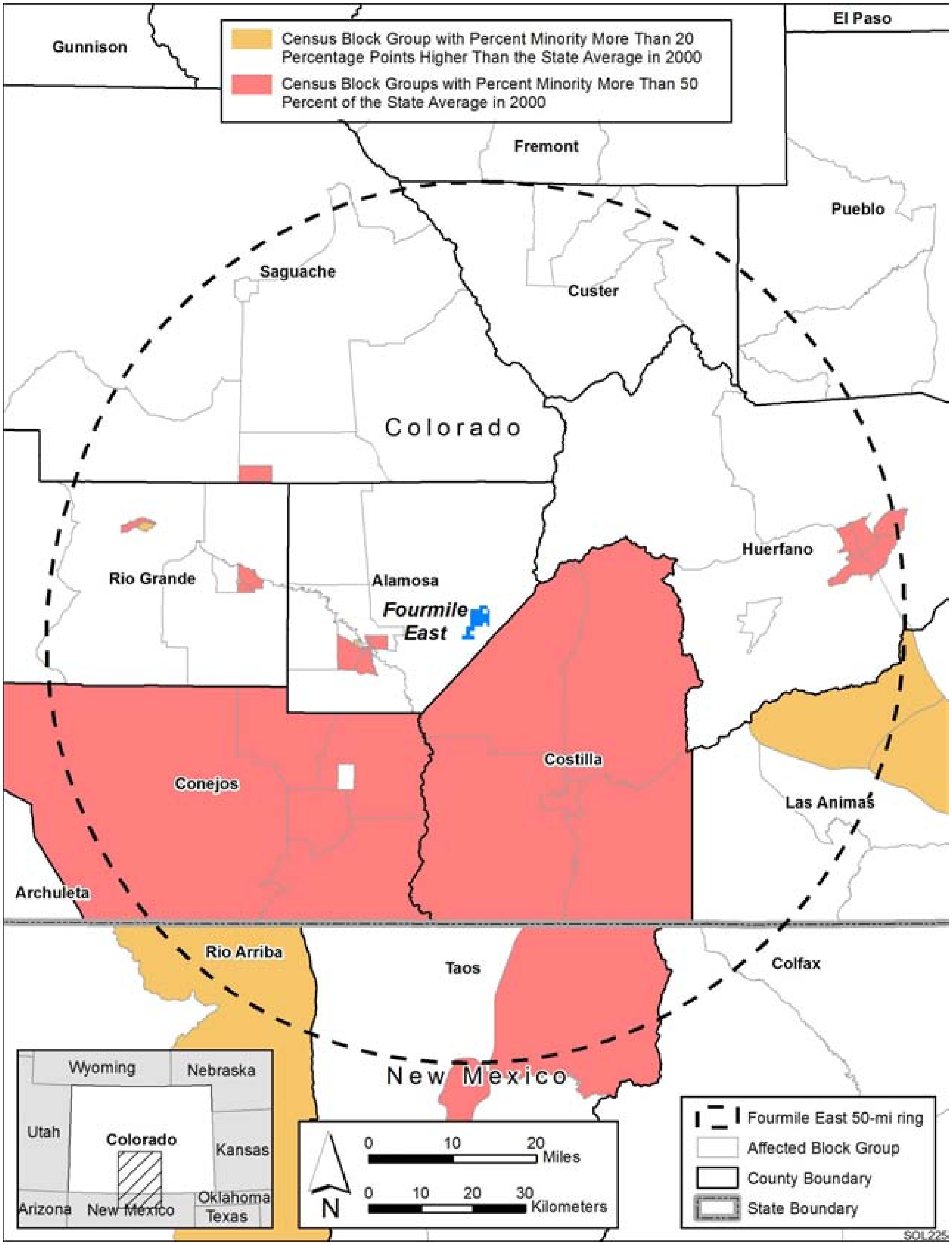

FIGURE 10.3.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Fourmile East SEZ

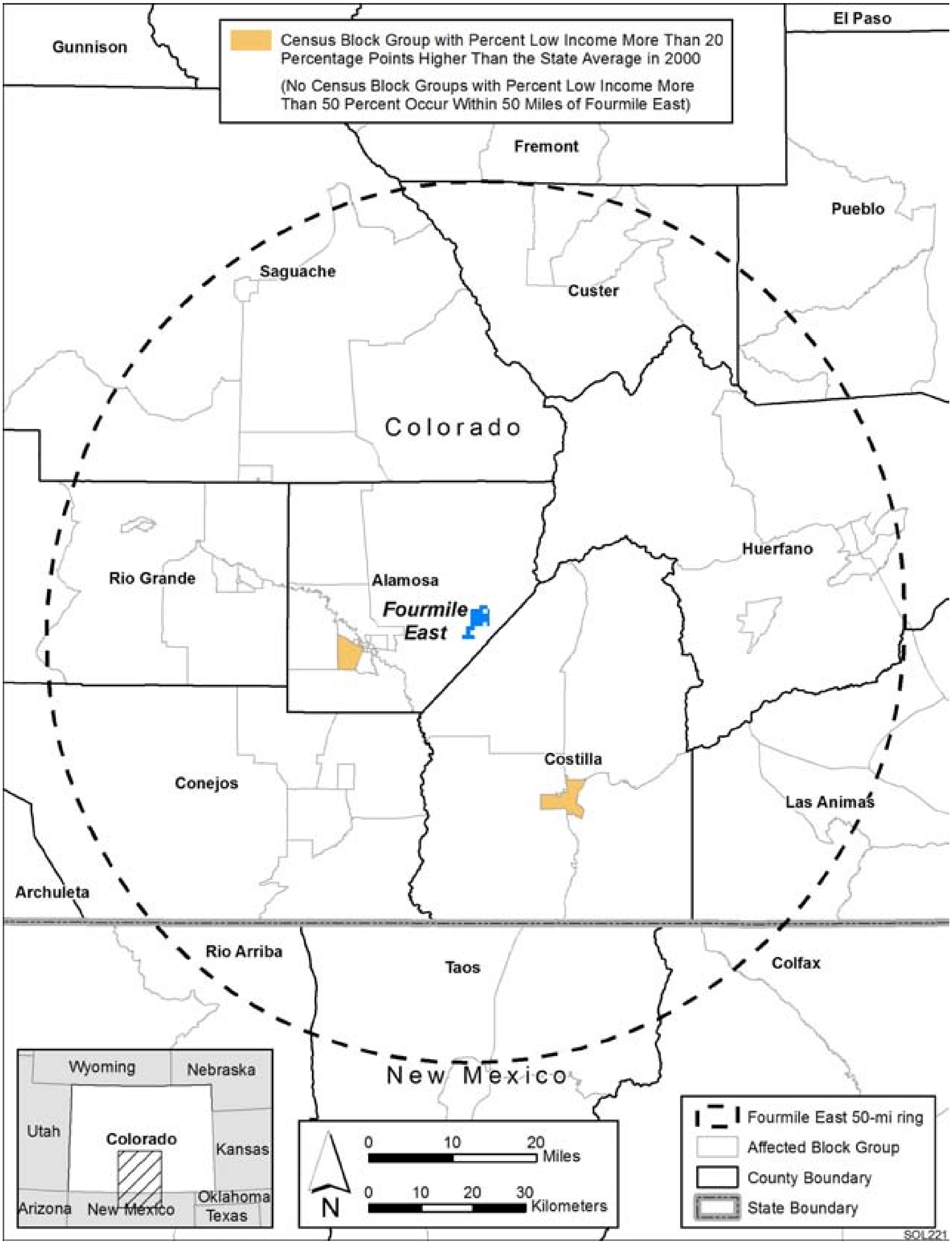

FIGURE 10.3.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Fourmile East SEZ

10.3.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy facilities are described in detail in Section 5.18. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2, which address the underlying environmental impacts contributing to the concerns. The analysis of impacts considered noise and dust during the construction of solar facilities; noise and EMF effects associated with solar project operations; the visual impacts of solar generation and auxiliary facilities, including transmission lines; access to land used for economic, cultural, or religious purposes; and effects on property values as areas of concern that might potentially affect minority and low-income populations.

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar facilities involving each of the four technologies. Although impacts are likely to be small, there are minority populations defined by CEQ guidelines (Section 10.3.20.1) within the New Mexico portion of the 50-mi (80-km) radius around the boundary of the SEZ; thus any adverse impacts of solar projects would disproportionately affect minority populations. Because there are also low-income populations within the 50-mi (80-km) radius, according to CEQ guidelines, there would also be impacts on low-income populations.

10.3.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing environmental justice impacts have been identified for the proposed Fourmile East 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.

10.3.21 Transportation

The proposed Fourmile East SEZ is accessible by road and rail networks. One U.S. highway and one regional railroad serve the area. A small regional airport is located 12 mi (19 km) west of the SEZ. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

10.3.21.1 Affected Environment

U.S. 160, a two-lane highway, passes near the southern border of the proposed Fourmile East SEZ, as shown in Figure 10.3.21.1-1. The small town of Blanca is located a few miles to the southeast of the SEZ along U.S. 160, and Alamosa is located 10 mi (16 km) to the west along U.S. 160. CO 150 runs north-south through the eastern portion of the SEZ and joins U.S. 160 to the south (Figure 10.3.21.1-1). A number of local roads cross the SEZ. Annual average traffic volumes for the major roads for 2008 are provided in Table 10.3.21.1-1.

The SLRG Railroad serves the area (SLRG 2009). This regional railroad has rail stops in the towns of Blanca and Fort Garland, approximately 8 and 14 mi (13 and 23 km), respectively, to the east-southeast of the SEZ along U.S. 160. A freight dock and warehouse are also available to the west 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 San Luis Valley Regional Airport located 12 mi (19 km) west of the SEZ in Alamosa along U.S. 160. The airport has two runways, one of which is restricted to light aircraft. One regional airline provides daily scheduled service to Denver. No commercial cargo shipped to or from the airport has been reported by the BTS, and about 7,800 passengers departed from or arrived at the airport in 2008 (BTS 2008).

10.3.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. U.S. 160 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). Some parts of U.S. 160 could experience approximately a 50% increase in the daily traffic load, as summarized in Table 10.3.21.1-1, and the amount of traffic currently using CO 150 could increase approximately threefold. Local road improvements would be necessary in any portion of the SEZ along U.S. 160 that might be developed so as not to overwhelm the local roads near any site access point(s). CO 150 and any other access roads connected to it would require road improvements to handle the additional traffic.

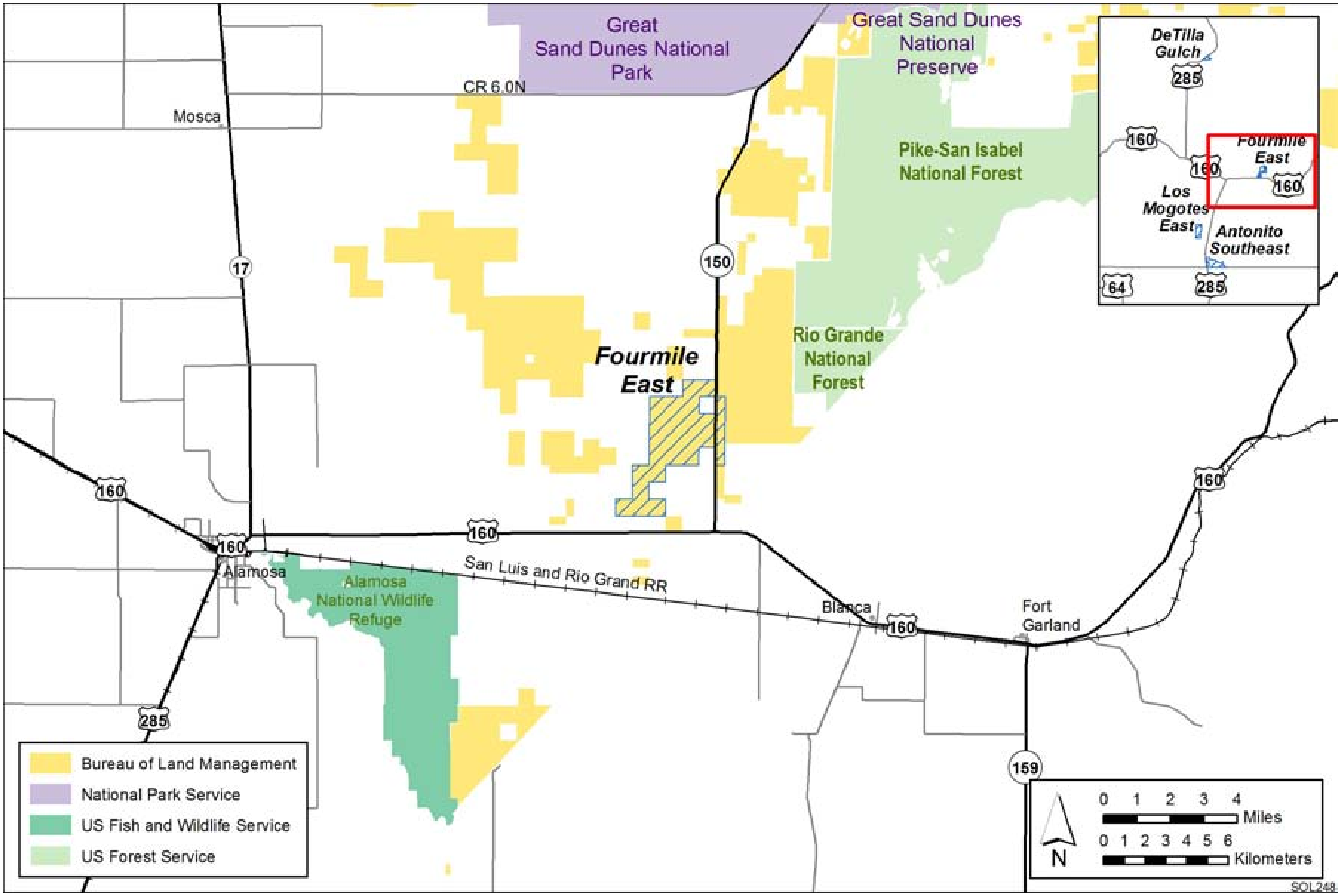

FIGURE 10.3.21.1-1 Local Transportation Network Serving the Proposed Fourmile East SEZ

TABLE 10.3.21.1-1 Annual Average Daily Traffic (AADT) on Major Roads near the Proposed Fourmile East SEZ, 2008

Road	General Direction	Location	AADT (Vehicles)
U.S. Highway 160	East-west	West side of Alamosa Junction with Craft Drive	19,100
		Junction with State Avenue in central Alamosa	14,300
		East side of Alamosa; junction with El Rancho Lane	3,600
		Junction with CO 150, south of the SEZ	3,700
		Junction with Broadway Avenue in Blanca	5,000
		Junction with CO 159 in Fort Garland	3,500
CO 150	North-south	North of junction with U.S. 160	610

Source: CDOT (undated).

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If such routes were identified during project-specific analyses, they would be re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

10.3.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the Fourmile East SEZ. The programmatic design features described in Appendix A, Section A.2.2, including local road improvements, multiple site access locations, staggered work schedules, and ride sharing, would all provide some relief to traffic congestion on local roads leading to the site. Depending on the locations of solar facilities within the SEZ, more specific access locations and local road improvements could be implemented.

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10.3.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Fourmile East SEZ in the eastern 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 Fourmile East SEZ is located about 12 mi (19 km) east of Alamosa, Colorado, in Alamosa County. It is located on the east side of the San Luis Valley and is in an area predominantly surrounded by private lands where there is a scattering of home sites and land that has been subdivided, although the overall character of the area is rural. Some irrigated agriculture occurs on private lands to the southeast of the SEZ. To the west of the SEZ are two blocks of BLM-administered land that are designated as the Blanca Wetlands Area, and about 2 mi (3 km) to the east is the San Isabel National Forest. The area is located within the boundaries of the Sangre de Cristo NHA and is located near Blanca Peak, which is sacred to some Native American Tribes. CO 150, which is designated as the Los Caminos Antiguos Scenic Byway, passes through the SEZ and is a major access route to the Great Sand Dunes National Park. The area is part of a grazing allotment and is being actively grazed. There are no active mining claims or active or closed oil and gas leases in the vicinity of the SEZ. The SEZ is within a DoD airspace consultation area (BLM and USFS 2009).

The geographic extent of cumulative impact analyses for potentially affected resources near the Fourmile East SEZ is identified in Section 10.3.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 10.3.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 10.3.22.3. Cumulative impacts for each resource area are discussed in Section 10.3.22.4.

10.3.22.1 Geographic Extent of the Cumulative Impacts Analysis

Table 10.3.22.1-1 presents the geographic extent of the cumulative impacts analysis for potentially affected resources evaluated near the Fourmile East SEZ. These geographic areas define the geographic boundaries of areas encompassing potentially affected resources. Their extent may vary on the basis of the nature of the resource being evaluated and the distance at which an impact may occur (thus, for example, the evaluation of air quality may have a greater regional extent of impact than visual resources). Lands around the SEZ are privately owned, or administered by the USFS, NPS, or the BLM. The BLM administers approximately 11% of the lands within a 50-mi (80-km) radius of the Fourmile East SEZ.

TABLE 10.3.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Fourmile East SEZ

Resource Area	Geographic Extent
Lands and Realty	East Central San Luis Valley
Specially Designated Areas and Lands with Wilderness Characteristics	East Central San Luis Valley
Rangeland Resources	East Central San Luis Valley
Recreation	East Central San Luis Valley
Military and Civilian Aviation	East Central San Luis Valley
Soil Resources	Areas within and adjacent to the Fourmile East SEZ
Minerals	East Central San Luis Valley
Water Resources	
Surface Water	Ute Creek, Sangre de Cristo Creek, Smith Reservoir, Trinchera Creek, and Rio Grande
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 Fourmile East SEZ, including Alamosa, Conejos, Costilla, Rio Grande, Saguache, Custer, Huerfano, and Las Animas Counties, Colorado; Rio Arriba and Taos Counties, New Mexico.
Air Quality and Climate	San Luis Valley and beyond
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Fourmile East SEZ
Acoustic Environment (noise)	Areas adjacent to the Fourmile East SEZ
Paleontological Resources	Areas within and adjacent to the Fourmile East SEZ
Cultural Resources	Areas within and adjacent to the Fourmile East SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Fourmile East 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 Fourmile East SEZ
Socioeconomics	Alamosa, Conejos, Costilla, and Rio Grande Counties
Environmental Justice	Alamosa, Conejos, Costilla, Rio Grande, Saguache, Custer, Huerfano, and Las Animas Counties, Colorado; Rio Arriba and Taos Counties, New Mexico
Transportation	U.S. 160 and CO 150

10.3.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions

The future actions described below are those that are "reasonably foreseeable"; that is, they have already occurred, are ongoing, are funded for future implementation, or are included in firm near-term plans. Types of proposals with firm near-term plans 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 10.3.22.2.1), and (2) other ongoing and reasonably foreseeable actions, including those related to mining and mineral processing, grazing management, transportation, recreation, water management, and conservation (Section 10.3.22.2.2). Together, these actions and trends have the potential to affect human and environmental receptors within the San Luis Valley over the next 20 years.

10.3.22.2.1 Energy Production and Distribution

Reasonably foreseeable future actions related to energy development and distribution within the San Luis Valley are identified in Table 10.3.22.2-1 and are described in the following sections. Figure 10.3.22.2-1 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 10.3.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Fourmile East 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 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 Fourmile East 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 De Tilla Gulch SEZ (1,522 acres [6.2 km^2]), and the Los Mogotes SEZ (5,918 acres [23.9 km^2]) (Figure 10.3.22.2-1). 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 40 mi (70 km) and 30 mi (48 km), respectively, to the southwest of the Fourmile East SEZ, and the De Tilla Gulch SEZ is about 50 mi (80 km) to the northwest.

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 CO 17 near Mosca in Alamosa County, the facility consists of three different solar technologies, including an array of PV panels, a PV system of single-axis trackers, and a system of CSP units. It generates power for distribution both within the San Luis Valley and outside the region.

- *Alamosa Solar Energy Project.* The 30-MW PV project will be located near Mosca, just west of CO 17 and 8 Mile Lane North, on private land currently being used for agriculture. The facility is being built by Iberdrola Renewables in two 15-MW phases and will connect to the San Luis Valley Substation, about 4.5 mi (7.2 km) to the west of the project site. A Special Use and Site Plan application was submitted to Alamosa County in July 2009; the first half of the facility is scheduled to begin operations in early 2011.

- *Greater Sandhill Solar Project.* Located on 200 acres (0.8 km^2) to the east of CO 17 near Mosca (across from the Xcel Energy/Sun Edison Project), the 17-MW PV facility to be built by Xcel Energy and SunPower has been approved by the Colorado Public Utilities Commission and will begin operations in 2011.

- *San Luis Valley Solar Project.* Tessera Solar North America submitted a Final 1041 Permit Application to Saguache County in June 2010 for a 200-MW dish engine solar facility to be built on a 1,525-acre (6.2-km^2) site near Saguache. The facility would employ 8,000 SunCatcher dish engines and cost \$300 to \$500 to build. It would use only 10 ac-ft/yr (12,335 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

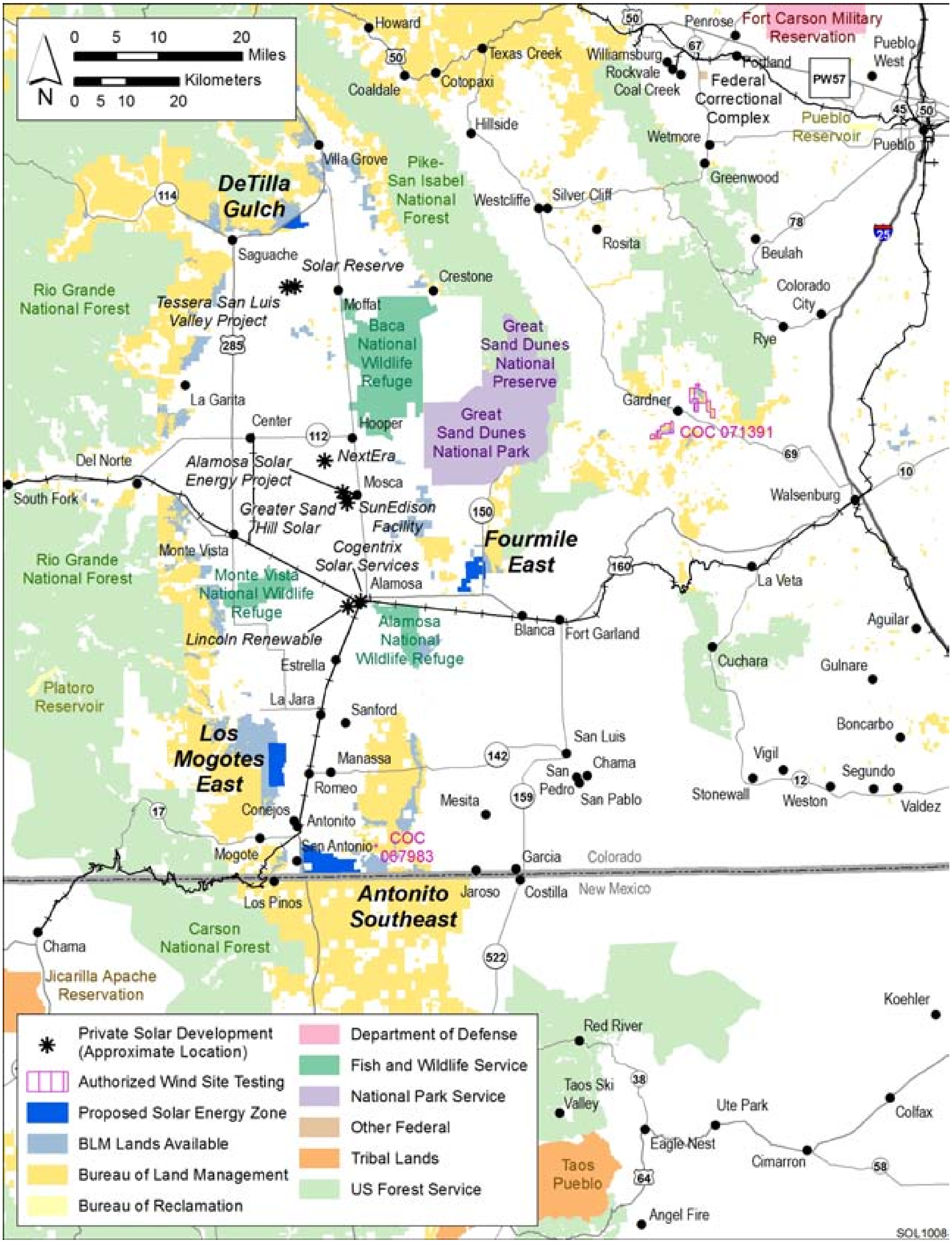

FIGURE 10.3.22.2-1 Existing and Proposed Energy Development Projects within the San Luis Valley

facility on visual resources and 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 km2) 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 1,200 ac-ft/yr (1.48 million m^3/yr). An on-site switchyard would connect to an existing 230-kV line crossing the site. Construction would start in 2011 and operation in June 2013, employing 250 and 50 workers on average, respectively (Solar Reserve 2010).

- *Cogentrix Solar Services.* 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 during construction and 5 to 10 during operation, which would begin 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).

10.3.22.2.2 Other Actions

Other ongoing and reasonably foreseeable future actions within the San Luis Valley are identified in Table 10.3.22.2-2 and are described in the following sections.

TABLE 10.3.22.2-2 Reasonably Foreseeable Future Actions near the Proposed Fourmile East 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
Recreation			
Rio Grande Scenic Railroad	Ongoing	Visual, ecological resources, socioeconomics	San Luis Valley, including routes adjacent to the Fourmile East SEZ (Alamosa County)
Zapata Falls Campground Construction (BLM)	Proposed	Land use	North of Fourmile East SEZ
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 east of the Fourmile SEZ)
Sangre de Cristo National Heritage Area	Ongoing	Cultural, visual resources	San Luis Valley (areas along the east side)
South San Luis Lakes Wetlands Restoration Project	EA issued Oct 2009	Wildlife, aquatic biota, vegetation, cultural resources, land use	About 8 mi (13 km) northwest of the Fourmile East SEZ

Mining and Mineral Processing

The nearest mining activity is an active sand and gravel pit on the east side of State Highway 150, about 3 mi (5 km) north of the northern border of the Fourmile East SEZ. There are no other mining or mineral processing activities in the immediate vicinity of the 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 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) was designated as "OHV Open." The proposed ROD was signed on June 4, 2009 (BLM and USFS 2009).

Recreation

Planned and ongoing recreation activities include the following:

- *Rio Grande Scenic Railroad.* Operated by the SLR&G Railroad, the scenic railroad has about 17,600 visitors each year. Scenic routes run between Alamosa and La Veta, Alamosa and Monte Vista, and Alamosa and Chama (New Mexico) via Antonito. The route between Alamosa and La Veta is especially famous for traversing over the historic La Veta Pass, the highest point (at 9,242 ft [2,817 m]) that standard gauge track crosses the Rocky Mountains (RGSR 2009).

- *Zapata Falls* Campground *Construction.* The campground construction project near Zapata Falls (Sangre de Cristo Mountains) is to be completed by the BLM with ARRA funds. An EA for the action is underway.

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 River at the Colorado–New Mexico state line (as measured at the Lobatos gauging station) less quantities available for depletion from the Rio Grande River 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 PVC-lined conveyance channel with a design capacity of 45 to 160 ft^3s (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 Wildlife Habitat Area, 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 River, its tributaries, and senior water rights holders. An amended plan was accepted by the State Engineer's office in May 2009 (Hildner 2009b).

Conservation

There are several conservation-related projects and plans being implemented in the San Luis Valley. There include 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 NHA was designated 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 (Antonito Southeast, Fourmile East, and

Los Mogotes East) are within the Sangre de Cristo NHA; the De Tilla Gulch SEZ is about 15 mi (24 km) to the north.

South San Luis Lakes Wetlands Restoration Project. The San Luis Valley BLM La Jara Field Office is proposing to restore up to 1,330 acres (5.4 km^2) of wetlands within the South San Luis Lakes System. The project area includes approximately 534 acres (2.2 km^2) of public land managed by BLM and 1,992 acres (8.1 km^2) of land managed by The Nature Conservancy (TNC) located along the northern boundary of Blanca Wetlands ACEC, which would be expanded by this action. Irrigation water would be pumped from the Franklin-Eddy closed basin canal through a system of ditches and dikes designed to direct flow. An environmental assessment (EA) was issued in October 2009 (BLM 2009c) for irrigating approximately 342 acres (1.4 km^2) of BLM lands and 988 acres (4.0 km^2) of TNC lands in South San Luis Lakes. Ditch and dike construction would disturb no more than 5 acres (0.02 km^2) within the first two years and no more than one acre (0.004 km^2) per year thereafter. The project would provide habitat for shorebirds during migration and nesting seasons in concert with the Blanca Wetland's core area and replace habitat that is being dried in that area to aid wetland function (BLM 2009c).

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 Fourmile East SEZ.

10.3.22.3 General Trends

Table 10.3.22.3-1 lists general trends within the San Luis Valley with the potential to contribute to cumulative impacts; the trends are discussed in the following sections.

10.3.22.3.1 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 10.3.22.3-2). The growth rate in Alamosa County over the same 6-year period was 5.3%. Alamosa County has the highest concentration of population in the San Luis Valley, with about 54% in the town of Alamosa. 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

TABLE 10.3.22.3-1 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

TABLE 10.3.22.3-2 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).

rate of 1.0% (2006 to 2011) and 1.5% (2012 to 2016). In the 10-year period between 2006 and 2016, population growth within Alamosa County is projected to be 16.2% (SLV Development Resources Group 2007).

10.3.22.3.2 Energy Demand

The growth in energy demand is related to population growth through increases in housing, commercial floorspace, transportation, manufacturing, and services. Given that population growth is expected in 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 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).

10.3.22.3.3 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 10.3.22.3-3 compares daily water use by sector. Total daily water withdrawals and consumptive use are highest in Conejos County, a county that has a large share of its crops in alfalfa (accounting for 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

TABLE 10.3.22.3-3 Daily Water Use by Sector in Colorado, 1995

Region	Withdrawals						Consumptive Use (Mgal)
	Total (Mgal)	Percent Groundwater	Sector (Mgal)				
			Irrigation	Public Supply	Industrial		
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] Number in parentheses represents 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).

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 10.3.22.3-3). 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).

10.3.22.3.4 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 two 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 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 (Backlund et al. 2008; GAO 2007; NSTC 2008).

[18] The effects of climate change are not as well studied in the Rio Grande Basin as in the Upper Colorado River Basin.

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.

10.3.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Fourmile East 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 3,105 acres (12.6 km^2) (80% of the entire proposed SEZ). For purposes of analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. In addition, about 2 mi (3.2 km) of new transmission line will be needed to reach the nearest existing line, a 69-kV transmission line located to the south of the Fourmile East SEZ. Another alternative would be connecting to a 230-kV transmission line about 8 mi (13 km) to the north of the SEZ. The cumulative impacts discussions in this section include the impacts that would be associated with these potential transmission line connections. The SEZ would most likely be accessed from existing CO 150 running within the eastern boundary of the SEZ, and therefore, no 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 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.

10.3.22.4.1 Lands and Realty

The area covered by the proposed Fourmile East SEZ is largely undeveloped and is rural in nature. There is currently a proposed transmission corridor that fully covers 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, and additional solar energy facilities may be built outside of the SEZ on private lands. Development of the SEZ could introduce a highly contrasting industrialized land use into areas that are largely rural. Consequently, the contribution to cumulative impacts of utility-scale solar projects on public lands on and around the Fourmile East SEZ could be significant, particularly if the SEZ is fully developed with solar projects.

10.3.22.4.2 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 within the viewshed of the SEZ. These areas include the BLM-administered Zapata Falls SRMA and Blanca Wetlands SRMA/ACEC, Sangre de Cristo Wilderness, and Great Sand Dunes National Park. In addition, several scenic byways and a National Historic Trail (the Old Spanish National Historic Trail) pass nearby 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 and lands with wilderness character. 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 and lands with wilderness character.

10.3.22.4.3 Rangeland Resources

The SEZ includes portions of two grazing allotments. If utility-scale solar facilities are constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. Depending on the number and size of potential projects, the impact on one of the rangers who currently utilize the same lands could be significant. If water rights supporting agricultural use are purchased to support solar development, some areas that are currently farmed by using that water would be converted to dryland uses.

Because 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.

10.3.22.4.4 Recreation

It is likely that limited outdoor recreation (e.g., backcountry driving, OHV use, 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 and lands with wilderness character (Section 10.3.22.4.2). 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.

10.3.22.4.5 Military and Civilian Aviation

The SEZ is located under an MTR. The San Luis Valley Regional airport is located near Alamosa, about 12 mi (19 km) west-southwest of 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 10.3.22.2, the cumulative impacts on military and civilian aviation from the solar energy development in the proposed SEZ would be small.

10.3.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project, including any associated transmission lines, would contribute to the soil loss due to wind erosion. Construction of new roads within the SEZ, or improvements to existing roads would also contribute to soil erosion. During construction, operations, and decommissioning of the solar facilities, travel back and forth by the workers at the facilities, visitors and delivery personnel to the facilities, or waste haulers from the facilities would also contribute to soil loss. These losses would be in addition to losses occurring as a result of disturbance caused by other users in the area, including from construction of other renewable energy facilities, recreational users, and agricultural users. Erosion of exposed soils could also lead to the generation of fugitive dust, which could affect local air quality (see Section 10.3.22.4.12). 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.

10.3.22.4.7 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 are there any known or expected future development of geothermal resources in the same area.

10.3.22.4.8 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 10.3.9.2. It is stated that if the SEZ was to be fully developed over 80% of its available land area, the amount of water needed during the peak construction year for all evaluated solar technologies would be 686 to 964 ac-ft (846,200 to 1.2 million m^3). During operations, the amount of water needed would be a strong function of the cooling technology employed, ranging from 17 ac-ft/yr (21,000 m^3/yr) for PV systems to as high as 9,325 ac-ft/yr (11.5 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 835 ac-ft/day (305,017 ac-ft/yr) in Alamosa 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 (0.006 to 3%, the ratio of the annual operations water requirement to the annual amount withdrawn in Alamosa County). However, as discussed in Sections 10.3.9.1.3, 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 10.3.9.1.3 and 10.3.9.2.4). 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 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 9 to 74 ac-ft (11,100 to 91,300 m^3) during the peak construction year and would range from less than 1 to 9 ac-ft/yr (up to 11,100 m^3/yr) during operations. Because of the small quantity, the sanitary wastewater generated by the solar energy facilities would not be expected to put undue strain on available sanitary wastewater treatment facilities in the general area of the SEZ. For technologies that rely on conventional wet or dry-cooling systems, there would also be from 98 to 176 ac-ft/yr (120,900 to 217,100 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.

10.3.22.4.9 Vegetation

The proposed Fourmile East SEZ is located within the Salt Flats ecoregion, which supports shrubland plant communities. 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.

10.3.22.4.10 Wildlife and Aquatic Biota

As discussed in Section 10.3.11, a number of amphibian, reptile, bird, and mammal species occur in and around the proposed Fourmile East SEZ. The construction of utility-scale solar energy projects in the SEZ and any associated transmission lines and roads in or near the SEZ would affect wildlife through habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, and wildlife injury or mortality. Unless mitigated, these impacts, when added to impacts that would result from other activities in the general area, could be moderate to large. In general, impacted species with broad distributions and occurring in a variety of habitats would be less affected than species with a narrowly defined habitat within a restricted area. Implementation of programmatic and SEZ-specific design features would reduce the severity of impacts on wildlife. The design features include pre-disturbance biological surveys to identify key habitat areas used by wildlife followed by avoidance or minimization of disturbance to those habitats.

The proposed Fourmile SEZ is quite distant from the other three proposed SEZs in the San Luis Valley. These developments are likely too far away from the Fourmile SEZ to have cumulative impacts on wildlife and aquatic biota. 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 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 10.3.22.2) 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 Fourmile East SEZ would encompass an area of severe winter range for elk. The implementation of programmatic and SEZ-specific design features would reduce the impacts from solar energy projects and thus reduce the overall cumulative impacts on wildlife.

There are no permanent water bodies or perennial streams within the boundaries of the proposed SEZ or within the potential transmission line connections. A small number of palustrine wetlands with emergent plant communities have been identified at or just outside the western boundary of the SEZ (Section 10.3.11.4). 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 net groundwater use should not change because of regulations governing use in the San Luis Valley, cumulative impacts on aquatic biota and habitats from groundwater drawdown should not occur. Programmatic and SEZ-specific design features to prevent erosion and sedimentation could reduce cumulative impacts on stream habitat and aquatic biota.

10.3.22.4.11 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 occurs on or near the proposed Fourmile East SEZ. Two species occurring on or in the vicinity of the SEZ are listed as threatened or endangered by the State of Colorado (southwestern willow flycatcher and bald eagle). In addition, 15 species are listed as sensitive by the BLM. The impacts of full-scale solar energy development on threatened, endangered, and sensitive species would be minimized if design features were implemented, including avoidance of habitat and minimization of erosion, sedimentation, and dust deposition; avoidance of occupied areas; and translocation of individuals. This approach would also minimize the contribution of potential solar energy projects to cumulative impacts on protected species.

Solar facilities in the proposed De Tilla Gulch, Antonito Southeast, and Los Mogotes SEZs, are likely too far away from the Fourmile East 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.

10.3.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuels, the site preparation and construction activities associated with solar energy facilities would be responsible for some amount of air pollutants. Most of the emissions would be particulate matter (fugitive dust) and emissions from vehicles and construction equipment. When these emissions are combined with those from other projects near solar energy development or when they are added to natural dust generation from winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency, or road paving or treatment.

Other planned energy production and distribution activities in the San Luis Valley include construction and operation of two smaller (less than 300 acres [1.2 km^2]) PV facilities near the Fourmile East SEZ, and construction of a power line running east from Alamosa to Walsenburg. In addition, a 30-MW PV facility is being constructed in Colfax County in northeastern New Mexico. 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 10.3.13, 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, VOC, 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 Fourmile East SEZ was fully developed with solar facilities up to 80% of its size, the quantity of pollutants avoided could be as large as 2.3% of all emissions from the current electric power systems in Colorado.

10.3.22.4.13 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, the site is within the viewshed of the Los Caminos Antiguos Scenic Byway, the Old Spanish National Historic Trail, lands with wilderness characteristics, and several other 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 projects. 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 a high-potential segment of the Old Spanish National Historic Trail, the Sangre de Cristo Wilderness, Blanca Wetlands Area, and the Los Caminos Antiguos Scenic Byway.

Visual impacts resulting from solar energy development within the SEZ would be in addition to impacts caused by other potential projects in the area such as other solar facilities on private lands, transmission lines, and other renewable energy facilities, like wind mills. The presence of new facilities would normally be accompanied by increased numbers of workers in the area, traffic on local roadways, and support facilities, all of which would add to cumulative visual impacts.

In addition to cumulative visual impacts associated with views of particular future development, as additional facilities are added, several projects might become visible from one location, or in succession, as viewers move through the landscape, such as driving on local roads. In general, the new facilities 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.

10.3.22.4.14 Acoustic Environment

The areas around the proposed Fourmile East SEZ and in the San Luis Valley area, in general, are relatively quiet. The existing noise sources include road traffic, railroad traffic, aircraft flyover, agricultural activities, and animal noise along with hunting. 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 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.

10.3.22.4.15 Paleontological Resources

Little surveying for paleontological resources has been conducted in the San Luis Valley. For reasons described in Section 10.3.16, 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 the BLM, and any paleontological resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. No significant cumulative impacts on paleontological resources are expected.

10.3.22.4.16 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. The area occupied by the proposed SEZ has not been surveyed for cultural resources, although six archaeological sites have been recorded within the SEZ. The area has a high potential for containing archaeological sites, including a potential for human burials, In addition, a high-potential segment of the congressionally designated Old Spanish National Historic Trail, which follows a north-south direction to the northeast of the Fourmile East SEZ, is located approximately 1 mi (1.6 km) from the SEZ. Development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, would contribute cumulatively to cultural resource impacts on archaeological sites and visual impacts on traditionally significant cultural properties (Blanca Peak, San Luis Lakes and Great Sand Dunes) and the congressionally designated National Historic 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 many adverse effects on significant resources in the San Luis Valley could be mitigated to some degree; however some adverse effects may not be mitigable.

10.3.22.4.17 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 Fourmile East SEZ have been raised to the BLM. The Jicarilla Apache have judicially established Tribal land claims south of the SEZ, and 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, these claims do not appear to include any portions of the SEZ and should not contribute to any impacts on those claims. 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 Clans of the Upper Rio Grande

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 Fourmile East 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, as well as to additional cultural resource impacts on archaeological sites of interest to the Tribes, especially to any human burials encountered. 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.

10.3.22.4.18 Socioeconomics

Solar energy development projects in the proposed Fourmile East 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 development in the area, including other renewable energy development. The number of workers involved in the construction of solar projects in the peak construction year could range from about 120 to 1,600 depending on the technology being employed, with solar PV facilities at the low end and solar trough facilities at the high end. The total number of jobs created in the area could range from approximately 210 (solar PV) to as high as 2,800 (solar trough). Construction of transmission line connections would only add a minimal number of workers in the ROI; with approximately two workers directly involved in the construction of transmission lines and five total additional jobs created in the general vicinity. 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 facilities in the area. The number of workers needed at the solar facilities would be in the range of 7 to 135, with approximately 9 to 203 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.

10.3.22.4.19 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 and low-income populations. If needed, mitigation measures can be employed to reduce the impacts on the population in the vicinity of the SEZ, including the minority and low-income populations. As the overall scale and environmental impacts from potential development within the ROI are expected to be generally low, it is not expected that the proposed Fourmile East SEZ would contribute to cumulative impacts on minority and low-income populations.

10.3.22.4.20 Transportation

A two-lane highway (U.S. 160) passes near the southern border of the proposed Fourmile East SEZ. State Route 150 runs north-south through the eastern portion of the SEZ and joins U.S. 160 to the south. The SLRG Railroad also serves the area. The AADT on these highways currently ranges from about 600 on State Route 150 to 19,000 on U.S. 160 near Alamosa. During construction activities, there could be up to 1,000 workers commuting to the construction site at the SEZ, which could increase the AADT on these highways by 2,000 vehicles. This increase in highway traffic from construction workers could have moderate cumulative impacts in combination with existing traffic levels and increases from additional future development in the area. State Route 150 and any site access roads connected to it would require road improvements 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.

10.3.23 References

Note to Reader: This list of references identifies Web pages and associated URLs where reference data were obtained for the analyses presented in this PEIS. It is likely that at the time of publication of this PEIS, some of these Web pages may no longer be available or their URL addresses may have changed. The original information has been retained and is available through the Public Information Docket for this PEIS.

AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project Design Refinements*. Available at http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf. Accessed Sept. 2009.

Alamosa-La Jara Water Users Protection Association v. Gould, 1983, 674 P.2d 914, 931 Colo.

AMA (American Medical Association), 2009, *Physician Characteristics and Distribution in the U.S.*, Chicago, Ill. Available at http://www.ama-assn.org/ama/pub/category/2676.html.

Backlund, P., et al., 2008, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*, Synthesis and Assessment Product 4.3, U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C., May. Available at http://www.sap43.ucar.edu/documents/SAP_4.3_6.18.pdf. Accessed July 2008.

Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*, submitted to the California Energy Commission, March. Available at http://www.energy.ca.gov/sitingcases/beacon/index.html.

Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control Engineering, Washington, D.C.

BLM (Bureau of Land Management), 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal*, Denver, Colo.

BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program,* Colorado State Office, Denver, Colo., Jan.

BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28, U.S. Department of the Interior, Jan.

BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Jan.

BLM, 1991, *San Luis Resource Area*, *Proposed Resource Management Plan and Final Environmental Impact Statement,* U.S. Department of the Interior, Sept.

BLM, 1996, *White River Resource Area Proposed Resource Management Plan and Final Environmental Impact Statement*, Colorado State Office, White River Resource Area, Craig District, Colo., June.

BLM, 2001, *Colorado Water Rights Fact Sheet*. Available at http://www.blm.gov/nstc/WaterLaws/colorado.html. Accessed Nov. 2009.

BLM, 2007, *Proposed Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado, Utah, and Wyoming and Programmatic Environmental Impact Statement,* FES 08-2, Sept.

BLM, 2008*, Assessment and Mitigation of Potential Impacts to Paleontological Resources*, Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.

BLM, 2009a*, Rangeland Administration System*. Available at http://www.blm.gov/ras/index.htm. Last updated Aug. 24, 2009. Accessed Nov. 24, 2009.

BLM, 2009b, *Environmental Assessment, Zapata Falls Campground Construction Project,* MT-DOI-BLM-CO-140-2009-017-EA, Dec. 7.

BLM, 2009c, *South San Luis Lakes Wetland Restoration Project Environmental Assessment,* DOI-BLM-CO-140-2010-009-EA, Oct. 28.

BLM, 2010a, *San Luis Valley Resource Area Noxious and Invasive Species Management Environmental Assessment*, DOI-BLM-CO-140-2009-004-EA.

BLM, 2010b, *Solar Energy Interim Rental Policy,* U.S. Department of the Interior. Available at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html.

BLM, 2010c, *Visual Resource Inventory,* prepared for the U.S. Department of the Interior, Bureau of Land Management, La Jara Field Office, San Luis Valley Public Lands Center, Monte Vista, Colo., Oct.

BLM and USFS, 2009, *GeoCommunicator—NILS National Integrated Land System Interactive Maps*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed Nov. 15, 2009.

BLM and USFS, 2010a, *GeoCommunicator—Mining Claim Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

BLM and USFS, 2010b, *GeoCommunicator—Energy Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

Blume, F., and A.F. Sheehan, 2002, *Quantifying Seismic Hazard in the Southern Rocky Mountains through GPS Measurements of Crustal Deformation—Abstract*, Paper No. 227-5, The Geological Society of America, 2002 Annual Meeting, Denver, Colo.

BOR (Bureau of Reclamation), 2009, "San Luis Valley Project, Closed Basin Division, Colorado," prepared by BOR Alamosa Field Division, Alamosa, Colo., for *Geologic Excursions to the Rocky Mountains and Beyond, Field Trip Guidebook*, Geological Society of America-Colorado Geological Survey. Available at http://www.nps.gov/archive/grsa/resources/docs/TOC.PDF. Accessed Nov. 10, 2009.

Brendle, D.L., 2002, *Geophysical Logging to Determine Construction, Contributing Zones, and Appropriate Use of Water Levels Measured in Confined-Aquifer Network Wells, San Luis Valley, Colorado*, *1998–2000*, U.S. Geological Survey, Water Resources Investigations Report 02–4058.

Brister, B.S., and R.R. Gries, 1994, *Tertiary Stratigraphy and Tectonic Development of the Alamosa Basin (Northern San Luis Basin), Rio Grande Rift, South-Central Colorado*, Geological Society of America Special Paper 291.

BTS (Bureau of Transportation Statistics), 2008, *Air Carriers: T-100 Domestic Segment (All Carriers)*, Research and Innovative Technology Administration, Bureau of Transportation Statistics, U.S. Department of Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311. Accessed June 23, 2009.

Burnell, J.R., et al., 2008, *Colorado Mineral and Energy Industry Activities, 2007*, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

Burroughs, R.L., 1974, *Neogene Volcanism in the Southern San Luis Basin*, *New Mexico,* Geological Society Guidebook, 25th Field Conference, Ghost Ranch (Central-Northern New Mexico). Available at http://nmgs.nmt.edu/publications/guidebooks/downloads/25/25_p0291_p0294.pdf. Accessed Jan. 20, 2010.

Burroughs, R.L., 1981, *A Summary of the Geology of the San Luis Basin, Colorado–New Mexico with Emphasis on the Geothermal Potential for the Monte Vista Graben*, Special Publication 17, DOE/ET/28365-10, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

CDA (Colorado Department of Agriculture), 2010, *Colorado Department of Agriculture, Noxious Weed Management Program, Noxious Weed List*. Available at http://www.colorado.gov/cs/Satellite?c=Page&cid=1174084048733&pagename=Agriculture-Main%2FCDAGLayout. Accessed Jan. 22, 2010.

CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995, 1999–2007*. Available at http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf.

CDOT (Colorado Department of Transportation), undated, *Traffic Information for Conejos County*. Available at http://www.dot.state.co.us/App_DTD_DataAccess/Traffic/index.cfm?fuseaction=TrafficMain&MenuType=Traffic. Accessed June 20, 2009.

CDOW (Colorado Division of Wildlife), 2008, *Natural Diversity Information Source Data*, Denver, Colo. Available at http://ndis.nrel.colostate.edu/ftp/ftp_response.asp. Accessed Oct. 21, 2009.

CDOW, 2009, *Natural Diversity Information Source, Wildlife Species Page,* Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlife.asp. Accessed Aug. 29, 2009.

CDPHE (Colorado Department of Public Health and Environment), 2008a, *Colorado 2007 Air Quality Data Report*, Air Quality Control Division, Denver, Colo., July. Available at http://www.colorado.gov/airquality/documents/2007AnnualDataReport.pdf. Accessed Sept. 2, 2009.

CDPHE, 2008b, *Colorado's Stormwater Program Fact Sheet*. Available at http://www.cdphe.state.co.us/wq/permitsunit.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec. Available at http://www.whitehouse.gov/CEQ.

CGS (Colorado Geological Survey), 2001, "When the Ground Lets You Down—Ground Subsidence and Settlement Hazards in Colorado," in *Rock Talk*, Vol. 4, No. 4, Oct.

Chapman, S.S., et al., 2006, *Ecoregions of Colorado* (color poster with map, descriptive text, summary tables, and photographs; map scale 1:1,200,000), U.S. Geological Survey, Reston, Va.

Chick, N., 2009, personal communication from Chick (Colorado Department of Public Health and Environment, Denver, Colo.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.), Sept. 4.

CNHP (Colorado Natural Heritage Program), 2009, *Colorado Natural Heritage Program*. Available at http://www.cnhp.colostate.edu. Accessed Sept. 9, 2009.

Colorado District Court, 2004, *Case Number 2004CW24, Concerning the Matter of the Rules Governing New Withdrawals of Ground Water in Water Division No. 3 Affecting the Rate or Direction of Movement of Water in the Confined Aquifer System*, District Court, Water Division No. 3.

Colorado District Court, 2010, *Case Number 06CV64 & 07CW52, In the Matter of the Rio Grande Water Conservation District, in Alamosa County, Colorado and Concerning the Office of the State Engineer's Approval of the Plan of Water Management for Special Improvement District No. 1 of the Rio Grande Water Conservation District*, District Court, Water Division No. 3.

Colorado DWR (Division of Water Resources), 2005, *Water Well Construction Rules*, 2 CCR 402-2.

Colorado DWR, 2008, *Guide to Colorado Well Permits, Water Rights, and Water Administration*, Jan.

Colorado DWR, 2010a, *Edge of the Confining Clays of the San Luis Valley*. Available at http://www.water.state.co.us/wateradmin/SanLuisValley/Tab%20D%20-%20Map%20of%20the%20San%20Luis%20Valley.pdf. Accessed Feb. 10, 2010.

Colorado DWR, 2010b, *History of Water Rights in Colorado*. Available at http://water.state.co.us/org/history.asp. Accessed Aug. 3, 2010.

Colorado DWR, 2010c, *Draft: Ground Water Rules for Division 3*, July 27.

Colorado Governor's Energy Office, 2007, *Connecting Colorado's Renewable Resources to the Markets—Report of the Colorado Senate Bill 07-091 Renewable Resource Generation Development Areas Task Force*, Denver, Colo.

Colorado SHPO (Colorado State Historic Preservation Office), 2009, Data on file at the Colorado State Historic Preservation Office, Denver, Colo.

Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008, U.S. Environmental Protection Agency, Research Triangle Park, N.C.

Diefenbach, A.K., et al., 2009, *Chronology and References of Volcanic Eruptions and Selected Unrest in the United States, 1980-2008*, U.S. Geological Survey Open File Report 2009-1118.

DOE (U.S. Department of Energy), 2009, *Report to Congress, Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation*, Jan. 13.

EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections to 2030*, DOE/EIA-0383, March.

Eldred, K.M., 1982, "Standards and Criteria for Noise Control—An Overview," *Noise Control Engineering* 18(1)16–23.

Emery, P.A., 1979, "Geohydrology of the San Luis Valley, Colorado, USA," IAHS-AISH Publication No. 128 in *The Hydrology of Areas of Low Precipitation—L'Hydrologie des Régions à Faibles Precipitations*, Proceedings of the Canberra Symposium (Actes du Colloque de Canberra), Dec.

Emery, P.A., 1994, *Hydrogeology of the San Luis Valley, Colorado, An Overview—National Park Service*, Field Trip 20, Section 2, Paper 3. Available at www.nps.gov/archive/grsa/resources/docs/Trip2023.pdf. Accessed June 29, 2009.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA-550/9-74-004, Washington, D.C., March. Available at http://www.nonoise.org/library/levels74/levels74.htm. Accessed Nov. 17, 2008.

EPA, 2009a, *Energy CO_2 Emissions by State*. Available at http://www.epa.gov/climatechange/emissions/state_energyco2inv.html, last updated June 12, 2009. Accessed June 23, 2009.

EPA, 2009b, *AirData: Access to Air Pollution Data*. Available at http://www.epa.gov/oar/data/. Accessed Sept. 12, 2009.

EPA, 2009c, *Preferred/Recommended Models—AERMOD Modeling System.* Available at http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.

EPA, 2009d, *eGRID.* Available at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, last updated Oct. 16, 2008. Accessed Jan. 12, 2009.

EPA, 2010, *National Ambient Air Quality Standards (NAAQS)*. Available at http://www.epa.gov/air/criteria.html, last updated June 3, 2010. Accessed June 4, 2010.

FEMA (Federal Emergency Management Agency), 2009, *FEMA Map Service Center*. Available at http://www.fema.gov. Accessed Nov. 20, 2009.

Fire Departments Network, 2009, *Fire Departments by State*. Available at http://www.firedepartments.net.

GAO (Government Accounting Office), 2007, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, Report to Congressional Requesters, GAO-07-863, Aug.

Gibson 2010, personal communication from Gibson (San Luis Valley Water Conservancy District, Alamosa, Colo.) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., May. Available at http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.

Heide, R., 2009, *National Heritage Area in the Works*. Available at http://www.coloradopreservation.org/news/articlesHeritage_Area_04.doc. Accessed Oct. 19, 2009.

Hildner, M., 2009a, "Plan to Reduce Groundwater Pumping Could Cost $125.8 Million," in *Pueblo Chieftain*, Feb. 14.

Hildner, M., 2009b, "Court Hearing Next for Valley Water Project—State Engineer Signs Off On Amendments to a Groundwater Management Proposal," in *Pueblo Chieftain*, May 20.

Hinderlider, M.C., et al., 1939, *Rio Grande Compact, with Amendments,* adopted Dec. 19. Available at http://wrri.nmsu.edu/wrdis/compacts/Rio-Grande-Compact.pdf. Accessed Nov. 10, 2009.

Joe, T., 2008, personal communication from Joe (Program Manager for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to S. Sierra (State Director, Bureau of Land Management, Salt Lake City, Utah), July 3.

Joe, T.H., Jr., 2009, personal communication from Joe (Supervisory Anthropologist for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to S. Borchard (California Desert District Manager, Bureau of Land Management, Riverside, Calif.), July 3.

Kenny, J.F, et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological Survey, Circular 1344. Available at http://pubs.usgs.gov/circ/1344. Accessed Jan. 4, 2010.

Kirkham, R.M. (compiler), 1998, "Fault Number 2315, Faults near Monte Vista," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Kirkham, R.M., and W.P. Rogers, 1981, "Earthquake Potential in Colorado," *Colorado Geological Survey Bulletin 43*.

Laney, P., and J. Brizzee, 2005, *Colorado Geothermal Resources*, INEEL/MIS-2002-1614, Rev. 1, prepared for U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Geothermal Technologies Program, Nov.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

Leonard, G.J., and K.R. Watts, 1989, *Hydrogeology and Simulated Effects of Ground-Water Development on an Unconfined Aquifer in the Closed Basin Division, San Luis Valley*, *Colorado*, U.S. Geological Survey, Water Resources Investigations Report 87-4284, Denver, Colo.

Lindsey, K.D., 1983, *Paleontological Inventory and Assessment of the San Luis Resource Area,* prepared by Denver Museum of Natural History for U.S. Department of the Interior, Bureau of Land Management, Canon City District, Dec. 31.

Lipman, P.W., 2006, *Geologic Map of the Central San Juan Caldera Cluster, Southwestern Colorado*, U.S. Geological Survey pamphlet to accompany Geologic Investigations Series I-2799.

Lipman, P.W., and H.H. Mehnert, 1979, "The Taos Plateau Volcanic Field, Northern Rio Grande Rift, New Mexico," in *Rio Grande Rift: Tectonics and Magmatism*, R.E. Riecker (editor), American Geophysical Union.

Lipman, P.W., et al., 1970, *Volcanic History of the San Juan Mountains, Colorado, as Indicated by Potassium-Argon Dating*, Geological Society of America Bulletin, Vol. 81.

Mackelprang, C.E., 1983, *Results of a Detailed Gravity Survey in the Alamosa Area, Alamosa County, Colorado*, University of Utah Research Institute, Earth Science Laboratory Report No. ESL-126, DOE/ID/12079-109.

Martorano, M.A, et al., 1999, *Colorado Prehistory: A Context for the Rio Grande Basin*, Colorado Council of Professional Archaeologists.

Mayo, A.L., et al., 2007, "Groundwater Flow Patterns in the San Luis Valley, Colorado, USA Revisited: An Evaluation of Solute and Isotopic Data," *Hydrogeology Journal* 15:383–408.

McDermott, P., 2010, personal communication from McDermott (Engineer, Colorado Division of Water Resources, Division 3) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

MIG (Minnesota IMPLAN Group), Inc., 2010, *State Data Files*, Stillwater, Minn.

Miller, N.P., 2002, "Transportation Noise and Recreational Lands," *Proceedings of Inter-Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at http://www.hmmh.com/cmsdocuments/N011.pdf. Accessed Aug. 30, 2007.

Molenar, C.M., 1988, *Petroleum Geology and Hydrocarbon Plays of the Albuquerque-San Luis Rift Basin, New Mexico and Colorado*, U.S. Geological Survey Open-File Report 87-450-S.

Murphey, P.C., and D. Daitch, 2007, "Figure D2, Colorado-PFYC," in *Paleontological Overview of Oil Shale and Tar Sands Areas in Colorado, Utah, and Wyoming*, prepared for U.S Department of the Interior, Bureau of Land Management, Dec.

National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding, Water Science and Technology Board, and Commission on Geosciences, Environment, and Resources, National Academy Press, Washington D.C.

NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life*. Available at http://www.natureserve.org/explorer. Accessed Sept. 9, 2009.

NCDC (National Climatic Data Center), 2009a, *2008 Local Climatological Data Annual Summary with Comparative Data, Alamosa, Colorado (KALS)*, National Oceanic and Atmospheric Administration (NOAA). Available at http://www7.ncdc.noaa.gov/IPS/lcd/lcd.html. Accessed Aug. 26, 2009.

NCDC, 2009b, *Integrated Surface Data (ISD), DS3505 Format*, database, Asheville, N.C. Available at ftp://ftp3.ncdc.noaa.gov/pub/data/noaa. Accessed Aug. 26, 2009.

NCDC, 2009c, *Climates of the States (CLIM60): Climate of Colorado*, National Oceanic and Atmospheric Administration Satellite and Information Service. Available at http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl. Accessed Aug. 26, 2009.

NCDC, 2010, *Storm Events*, National Oceanic and Atmospheric Administration Satellite and Information Service. Available at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms. Accessed Oct. 8, 2010.

NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*, U.S. Department of Education. Available at http://www.nces.ed.gov/ccd/districtsearch.

NMDGF (New Mexico Department of Game and Fish), 2009, *Biota Information System of New Mexico Database Query*, Santa Fe, N.M. Available at http://www.bison-m.org/databasequery.aspx. Accessed Oct. 9, 2009.

NPS (National Park Service), 2008, *National Heritage Areas*, National Heritage Areas Program Office, Washington, D.C. Available at http://www.nps.gov/history/heritageareas.

NPS, 2009, *Sangre de Cristo National Heritage Area*. Available at http://www.nps.gov/grsa/parknews/sangre-de-cristo-nha.htm. Accessed Nov. 10, 2009.

NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO) Database for Alamosa County, Colorado*. Available at http://SoilDataMart.nrcs.usds.gov.

NRCS, 2009, *Custom Soil Resource Report for Alamosa County (covering the proposed Fourmile East SEZ), Colorado*, U.S. Department of Agriculture, Washington, D.C., Aug. 21.

NSTC (National Science and Technology Council), 2008, *Scientific Assessment of the Effects of Global Change on the United States*, A Report of the Committee on Environment and Natural Resources, May.

Pew Center on Global Climate Change, 2009, *Renewable and Alternative Energy Portfolio Standards (with reference to Colorado House Bill 07-1281)*. Available at http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm. Accessed Nov. 4, 2009.

Ray, A.J., et al., 2008, *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation*, Western Water Assessment for the Colorado Water Conservation Board. Available at http://cwcb.state.co.us/NR/rdonlyres/B37476F5-BE76-4E99-AB01-6D37E352D09E/0/ClimateChange_FULL_Web.pdf. Accessed Nov. 2, 2009.

RGSR (Rio Grande Scenic Railroad), 2009, *Rio Grande Scenic Railroad Information Web Site*. Available at http://www.riograndescenicrailroad.com. Accessed Nov. 11, 2009.

RGWCD (Rio Grande Water Conservation District), 2009, *Proposed Plan of Water Management—Special Improvement District 1 (aka Closed Basin Subdistrict)*, May 11, 2009 draft. Available at http://www.rgwcd.org/Pages/Subdistricts/Subdistrict1_1.htm. Accessed Nov. 9, 2009.

RGWCD, 2010, *Draft: San Luis Valley Well and Water-Level Database*. Available at http://www.rgwcd.org/wl. Accessed Aug. 4, 2010.

Ritter, B., Jr., 2007, *Colorado Climate Action Plan: A Strategy to Address Global Warming*, Nov.

Robson, S.G., and E.R. Banta, 1995, *Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah*, U.S. Geological Survey, HA 730-C.

Ruleman, C., and M. Machette, 2007, "An Overview of the Sangre de Cristo Fault System and New Insights to Interactions between Quaternary Faults in the Northern Rio Grande Rift," Chapter J in *2007 Rocky Mountain Section Friends of the Pleistocene Field Trip—Quaternary Geology of the San Luis Basin of Colorado and New Mexico, September 7–9, 2007*, M.N. Machette et al. (editors), U.S. Geological Survey Open-File Report 2007-1193.

SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies, U.S. Department of Health and Human Services. Available at http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage.

Scott, G., 2001, *Historic Trail Map of the Trinidad*, Geological Investigations Series I-2745, U.S. Department of the Interior, U.S. Geological Survey, Denver, Colo. Available at http://pubs.usgs.gov/imap/i-2745/i-2745.pdf. Accessed Oct. 6, 2010.

SES (Sterling Energy Systems) Solar Two, LLC, 2008, Application for Certification, submitted to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission, Sacramento, Calif., June. Available at http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php. Accessed Oct. 2008.

SLRG (San Luis & Rio Grande Railroad), 2009, *San Luis & Rio Grande Railroad.* Available at http://www.sanluisandriogranderailroad.com. Accessed June 25, 2009.

SLV (San Luis Valley) Development Resources Group, 2007, *Comprehensive Economic Development Strategy*, prepared with support from Planning and Assistance Grant 05-83-04371, Alamosa, Colo. Available at http://www.slvdrg.org/ceds.php. Accessed Nov. 3, 2009.

SLV Development Resources Group, 2009, *SLV TIGER Discretionary Grant Application with Appendices (Appendix 1—SLVRMI Map Showing the Sangre de Cristo NHA).* Available at http://slvdrg.org/tigergrant.php. Accessed Nov. 10, 2009.

Smith, M.D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425-450.

Solar Partners I, LLC, 2007, *Application for Certification*, submitted to California Energy Commission, Sacramento, Calif., Aug.

Solar Reserve, 2010, *Saguache Solar Energy Project, Preliminary 1041 Permit Application for Saguache County, Colorado*, July 20, 2010.

State Demography Office, 2009, *Preliminary Population Forecasts for Colorado Counties, 2000–2010*. Available at http://dola.colorado.gov/dlg/demog/population/forecasts/counties1yr.xls.

Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin Company, Boston, Mass.

Stoeser, D.B., et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States: Central States—Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Iowa, Missouri, Arkansas, and Louisiana, Version 1.2*, U.S. Geological Survey Open File Report 2005-1351, updated December 2007.

Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen (Bureau of Land Management, Washington, D.C.), and L. Resseguie (Bureau of Land Management, Washington, D.C.), Sept. 14, 2009.

Strait, R., et al., 2007, *Colorado Greenhouse Gas Inventory and Reference Case Projections 1990–2020*, prepared by Center for Climate Strategies, Washington, D.C., for Colorado Department of Public Health and Environment, Denver, Colo., Jan. Available at http://www.cdphe.state.co.us/ap/down/GHGEIJan07.pdf. Accessed Sept. 11, 2009.

Texas v. Colorado, 1968, 391 U.S. 901, 88 S. Ct. 1649, 20 L. Ed.2d 416 1968.

Thompson, K., 2002, *Dealing with Drought: Part Two*, prepared for Agro Engineering, Inc. Available at http://www.agro.com/WaterResources/Dealingwithdrought2.PDF. Accessed Nov. 9, 2009.

Thompson, R.A., et al., 1991, "Oligocene Basaltic Volcanism of the Northern Rio Grande Rift: San Luis Hills, Colorado," *Journal of Geophysical Research*, Vol. 96, No. B8, July 30.

Topper, R. et al., 2003, *Ground Water Atlas of Colorado*, Colorado Geological Survey, Special Publication 53. Available at http://geosurvey.state.co.us/wateratlas.

Tri-State Generation and Transmission Association, Inc., 2008, *San Luis Valley Electric System Improvement Project Alternative Evaluation and Macro Corridor Study*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State Generation and Transmission Association, Inc., 2009, *San Luis Valley–Calumet–Comanche Transmission Project Alternative Evaluation*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State and Public Service Company of Colorado, 2009, *Southern Colorado Transmission Improvements—Renewable Energy Development.* Available at http://www.socotransmission.com/Purpose/renewables.cfm. Accessed Nov. 4, 2009.

TSNA (Tessera Solar North America), 2010, *San Luis Valley Solar Project Tessera Solar North America 1041 Final Application to Saguache County, Colorado*, June.

Tweto, O., 1979, Geologic Map of Colorado (Scale 1:500,000), U.S. Geological Survey, prepared in cooperation with the Geological Survey of Colorado.

USACE (U.S. Army Corps of Engineers), 2007, *Upper Rio Grande Basin Water Operations Review—Final Environmental Impact Statement Summary*, with the U.S. Department of the Interior, Bureau of Reclamation, and the New Mexico Interstate Stream Commission, FES-07-05, April.

U.S. Bureau of the Census, 2009a, *County Business Patterns, 2006*, Washington, D.C. Available at http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html.

U.S. Bureau of the Census, 2009b, *GCT-T1. Population Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and Families: 2000. Census 2000 Summary File (SF 3) – Sample Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009d, *S1901. Income in the Past 12 Months. 2006-2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009e, *GCT-PH1. Population, Housing Units, Area, and Density: 2000. Census 2000 Summary File (SF 1) – 100-Percent Data.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009f, *T1. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied Housing Units (Dollars). 2006-2008 American Community Survey 3-Year Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000. Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied Housing Units 2006-2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3) – Sample Data.* Available at http://factfinder.census.gov/.

USDA (U.S. Department of Agriculture), 1968, *Soil Survey of Alamosa Area, Colorado*, Soil Conservation Service, Washington, D.C.

USDA, 2004*, Understanding Soil Risks and Hazards—Using Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel (editor).

USDA, 2009, *2007 Census of Agriculture: Colorado State and County Data, Volume 1, Geographic Area Series*, National Agricultural Statistics Service, Washington, D.C. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Colorado/index.asp.

USDA, 2010, *United States Department of Agriculture Plants Database*. Available at http://plants.usda.gov/index.html. Accessed Jan. 25, 2010.

U.S. Department of Commerce, 2009, *Local Area Personal Income*, Bureau of Economic Analysis. Available at http://www.bea.doc.gov/bea/regional/reis.

U.S. Department of the Interior, 2010, *Native American Consultation Database*, National NAGPRA Online Databases, National Park Service. Available at http://grants.cr.nps.gov/nacd/index.cfm.

U.S. Department of Justice, 2008, "Table 80: Full-time Law Enforcement Employees, by State by Metropolitan and Nonmetropolitan Counties, 2007," *2007 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division, Sept. Available at http://www.fbi.gov/ucr/cius2007/data/table_80.html. Accessed June 17, 2010.

U.S. Department of Justice, 2009a, "Table 8: Offences Known to Law Enforcement, by State and City," *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Justice, 2009b, "Table 10: Offences Known to Law Enforcement, by State and by Metropolitan and Non-metropolitan Counties," *2008 Crime in the United States*, Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Labor, 2009a, *Local Area Unemployment Statistics: States and Selected Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual Averages*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau/staadata.txt.

U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates by State*, Bureau of Labor Statistics. Available at http://www.bls.gov/web/laumstrk.htm.

U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau.

U.S. Department of Labor, 2009d, *Consumer Price Index, All Urban Consumers—(CPI-U) U.S. City Average, All Items*, Bureau of Labor Statistics. Available at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt.

USFWS (U.S. Fish and Wildlife Service), 2009, *National Wetlands Inventory,* U.S. Department of the Interior, Washington, D.C. Available at http://www.fws.gov/wetlands.

USFWS, 2010, *Environmental Conservation Online System (ECOS)*. Available at http://www.fws.gov/ecos/ajax/ecos/indexPublic.do. Accessed May 28, 2010.

USGS (U.S. Geological Survey), 2000, *Estimated Use of Water in the United States, County Level Data for 2000*. Available at http://water.usgs.gov/watuse/data/2000. Accessed Oct. 22, 2009.

USGS, 2004, *National Gap Analysis Program, Provisional Digital Land Cover Map for the Southwestern United States*, Version 1.0, RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2005, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—Land Cover Descriptions,* RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2007, *National Gap Analysis Program*, 2007, *Digital Animal-Habitat Models for the Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm. Accessed Jan. 22, 2010.

USGS, 2008, *National Seismic Hazard Maps—Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 Years (Interactive Map)*. Available at http://gldims.cr.usgs.gov/nshmp2008/viewer.htm. Accessed August 4, 2010.

USGS, 2010a, *Water Resources of the United States—Hydrologic Unit Maps*. Available at http://water.usgs.gov/GIS/huc.html. Accessed April 12, 2010.

USGS, 2010b, *National Water Information System*. Available at http://wdr.water.usgs.gov/nwisgmap. Accessed Aug 3.

USGS, 2010a, *National Earthquake Information Center (NEIC)—Circular Area Database Search (within 100-km of the center of the proposed Fourmile East SEZ)*. Available at http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php. Accessed Aug. 5, 2010.

USGS and CGS (U.S. Geological Survey and Colorado Geological Survey), 2009, *Quaternary Fault and Fold Database for the United States*. Available at http://earthquake.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Westerling, A.L., et al., 2006, "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity," *Science* 313: 940–943.

Wolfe, D., 2008, *Order Establishing Advisory Committee for Rules and Regulations Governing the Diversion and Use of Underground Waters in Water Division 3*, Colorado Division of Water Resources, Dec. 31. Available at http://water.state.co.us/SurfaceWater/RulemakingAndAdvising/SLVAC/Pages/SLVNews.aspx.

WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System (EDMS)*. Available at http://www.wrapedms.org/default.aspx. Accessed June 4, 2009.

WRCC (Western Regional Climate Center), 2009, *Western U.S. Climate Historical Summaries.* Available at http://www.wrcc.dri.edu/Climsum.html. Accessed Aug. 21, 2009.

WRCC, 2010a, *Monthly Climate Summary, Blanca, Colorado (050776)*. Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co0776. Accessed July 22, 2010.

WRCC, 2010b, *Monthly Climate Summary, La Vetta Pass, Colorado (054870)*. Available at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co4870. Accessed July 22, 2010.

WRCC, 2010c, *Average Pan Evaporation Data by State*. Available at http://www.wrcc.dri.edu/htmlfiles/westevap.final.html. Accessed Jan. 19, 2010.

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10.4 LOS MOGOTES EAST

10.4.1 Background and Summary of Impacts

10.4.1.1 General Information

The proposed Los Mogotes East SEZ has a total area of 5,918 acres (24 km^2). The SEZ is located in Conejos County in south-central Colorado, about 12 mi (19 km) north of the New Mexico border (Figure 10.4.1.1-1). In 2008, the county population was 8,745, while the four-county region surrounding the SEZ—Alamosa, Conejos, Costilla, and Rio Grande Counties— had a total population of 39,759. The largest nearby town is Alamosa, which had a 2008 population of 8,745, located about 22 mi (35 km) to the northeast on U.S. 285. This highway is located about 3 mi (5 km) east of the SEZ. The town of Romeo is located about 3 mi (5 km) directly to the east of the SEZ on U.S. 285. The SLRG Railroad serves the area. The nearest public airport is San Luis Valley Regional Airport located in Alamosa. Santa Fe, New Mexico, is located about 120 mi (193 km) to the south, and Denver, Colorado, is located about 170 mi (274 km) to the northeast.

An existing 69-kV transmission line runs to the SEZ from the east, ending just inside the SEZ boundary. It is assumed that this existing transmission line could potentially provide access to the transmission grid from the SEZ (see Section 10.4.1.2). As of February 2010, there were no pending solar project applications on the proposed SEZ.

The proposed Los Mogotes East SEZ is located in the southwestern 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 proposed SEZ is located on a flat alluvial fan with no surface water features, except for a shallow drainage system that discharges into Romeo Ditch, an irrigation ditch that serves agricultural areas to the east. There is no development on the land, which is currently used for grazing. 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.

The proposed Los Mogotes East SEZ and other relevant information are shown in Figure 10.4.1.1-1. 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 Los Mogotes East SEZ, other restrictions might be appropriate. The analyses in the following sections address the affected environment and potential impacts associated with utility-scale solar energy

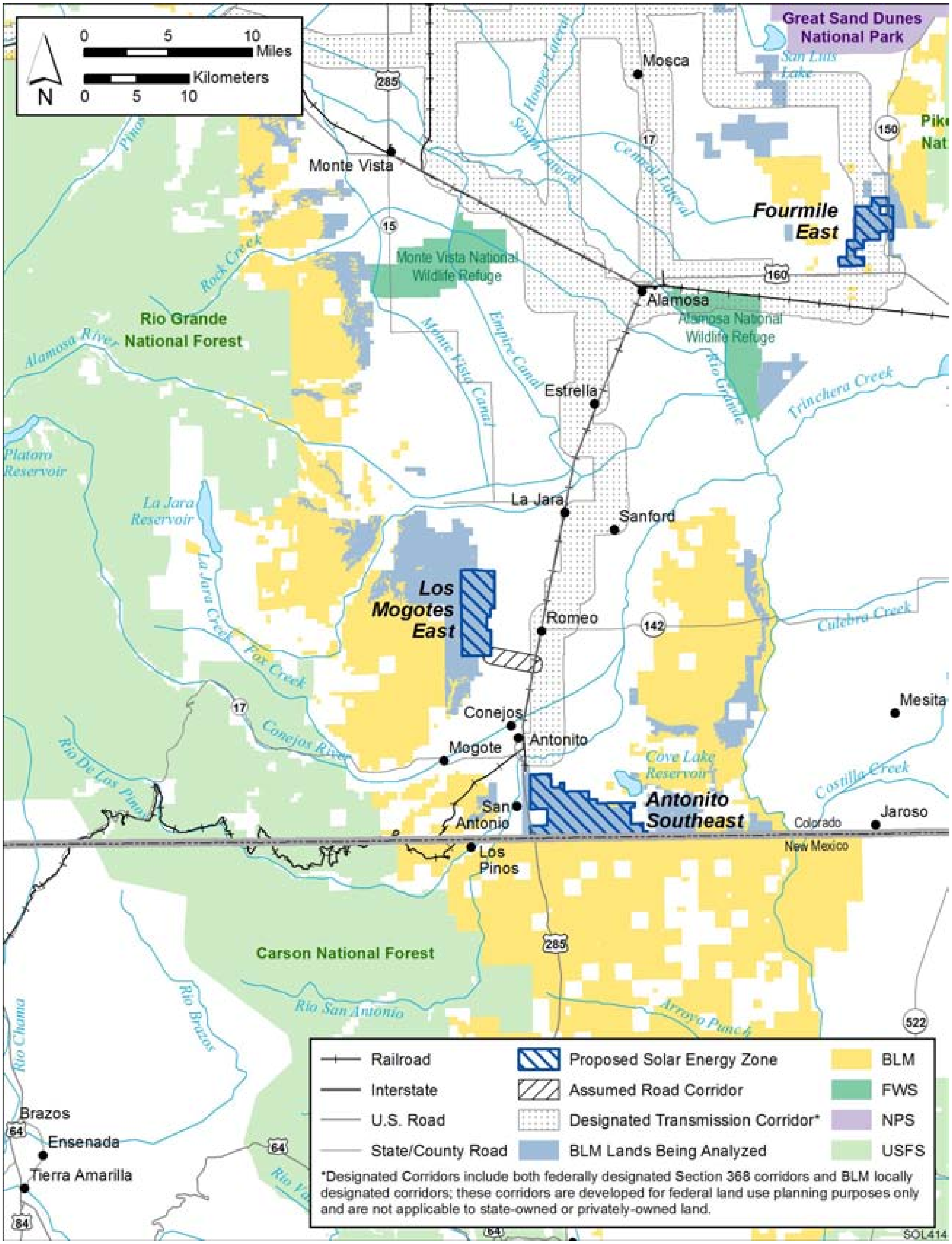

FIGURE 10.4.1.1-1 Proposed Los Mogotes East SEZ

development in the proposed SEZ for important environmental, cultural, and socioeconomic resources.

As initially announced in the *Federal Register* on June 30, 2009, the proposed Los Mogotes East SEZ encompassed 5,909 acres (24 km^2). Subsequent to the study area scoping period, the boundaries of the proposed Los Mogotes East SEZ were altered slightly to include some small higher slope areas internal to and at the borders of the site. Although these higher slope areas would not be amenable to solar development, inclusion in the SEZ would facilitate straightforward administration of the entire area by the BLM. The revised SEZ is approximately 9 acres (0.04 km^2) larger than the original SEZ area as published in June 2009.

10.4.1.2 Development Assumptions for the Impact Analysis

Maximum development of the proposed Los Mogotes East SEZ is assumed to be 80% of the total SEZ area over a period of 20 years, a maximum of 4,734 acres (19 km^2). These values are shown in Table 10.4.1.2-1. Full development of the Los Mogotes East SEZ would allow development of facilities with an estimated total of 526 MW of electrical power capacity if power tower, dish engine, or PV technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 947 MW of power if solar trough technologies were used, assuming 5 acres/MW (0.02 km^2/MW) of land required.

Availability of transmission from SEZs to load centers will be an important consideration for future development in SEZs. The nearest existing transmission line is a 69-kV line adjacent to the SEZ. It is possible that this existing line could be used to provide access from the SEZ to the transmission grid, but the 69-kV capacity of that line would be inadequate for 526 to 947 MW of new capacity (note that a 500-kV line can approximately accommodate the load of one 700-MW facility). At full build-out capacity, it is clear that substantial new transmission and or upgrades of existing transmission lines would be required to bring electricity from the proposed Los Mogotes East SEZ to load centers; however, at this time the location and size of such new transmission facilities are unknown. Generic impacts of transmission and associated infrastructure construction and of line upgrades for various resources are discussed in Chapter 5. Project-specific analyses would need to identify the impacts of new transmission construction and line upgrades for any projects proposed within the 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 69-kV transmission line is located adjacent to the SEZ. Establishing a connection to the existing 69-kV line would not involve the construction of a new transmission line outside of the SEZ. If a connecting transmission line was constructed to a different location in the future, site developers would need to determine the impacts from construction and operation of that line. Additionally, developers would need to determine the impacts of line upgrades if they are needed.

TABLE 10.4.1.2-1 Proposed Los Mogotes East 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[e]
5,918 acres and 4,734 acres[a]	526 MW[b] 947 MW[c]	3 mi[d] (U.S. 285)	Adjacent and 69 kV	0 acres and 22 acres	NA[f]

[a] To convert acres to km^2, multiply by 0.004047.

[b] Maximum power output if the SEZ was 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 was fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km^2/MW) of land required.

[d] To convert mi to km, multiply by 1.609.

[e] BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

[f] NA = no BLM-designated corridor is near the proposed Los Mogotes East SEZ.

U.S. 285 lies about 3 mi (5 km) to the east of the proposed Los Mogotes East SEZ. Assuming construction of new access road to reach U.S. 285 would be needed to support construction and operation of solar facilities, approximately 22 acres (0.09 km^2) of land disturbance would occur (a 60-ft [18.3-m] wide ROW was assumed), as summarized in Table 10.4.1.2-1.

10.4.1.3 Summary of Major Impacts and Proposed SEZ-Specific Design Features

In this section, the impacts and proposed SEZ-specific design features assessed in Sections 10.4.2 through 10.4.21 for the proposed Los Mogotes East SEZ are summarized in tabular form. Table 10.4.1.3-1 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 10.4.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the proposed Los Mogotes East SEZ are included in Sections 10.4.2 through 10.4.21 and in the summary table. The detailed programmatic design features for each resource area required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would also be required for development in this and other SEZs.

TABLE 10.4.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Los Mogotes East SEZ and Proposed SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ (80% of the total area) could disturb up to 4,734 acres (19 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.	None.
	Access to BLM, state, and private lands to the west of the SEZ could be affected by solar energy development if provision is not made to retain public access through the SEZ.	None.
	About 22 acres (0.09 km^2) of private land would be disturbed in construction of a new 3-mi (5-km) road corridor to connect to U.S.285.	None.
Specially Designated Areas and Lands with Wilderness Characteristics	The Los Mogotes ACEC is located within 1 mi (1.6 km) of the SEZ and could be affected by its development, with increased vehicular traffic and disturbance that could impair its value to wildlife.	Impacts on the wildlife values of the Los Mogotes ACEC would likely not be mitigable.
	The Los Caminos Antiguos Scenic Byway passes within 3 mi (5 km) of the SEZ, and about 8 mi (13 km) is within the sensitive visual zone of 1 to 5 mi (0.6 to 8 km). Any impact of development of the SEZ on the byway and byway users is not known, but it would be highly visible.	None.
	The SEZ is located within the recently (2009) designated Sangre de Cristo NHA.	Early consultation should be initiated with the entity responsible for developing the management plan for the Sangre de Cristo NHA to understand how development of the SEZ could be consistent with NHA plans/goals.

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TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Specially Designated Areas and Lands with Wilderness Characteristics *(Cont.)*	The SEZ is within 1 mi (1.6 km) of the route of the West Fork of the North Branch of the Old Spanish Trail, and development of the SEZ would have a major impact on the historic and visual integrity of the trail.	Pending completion of a study on the significance and definition of management needs (if any) of the West Fork of the North Branch of the Old Spanish National Historic Trail, solar development should be restricted to areas that do not have the potential to adversely affect the setting of the trail. After the study is completed, if management actions are warranted for this portion of the trail, solar energy development should be consistent with protection of identified values of the trail.
Rangeland Resources: Livestock Grazing	The Ciscom Flat allotment would likely be cancelled, and the Capulin and Little Mogotes allotments would be reduced, resulting in 475 AUMs being lost. Four grazing permittees would be impacted.	It may be possible to mitigate the loss of livestock grazing from the Capulin and Little Mogotes permits by changing management of the allotments and/or providing new range improvements (e.g., fences, water development) elsewhere in the allotments. It also may be possible to mitigate some or all of the loss by altering allotment boundaries or possibly offering an exchange of allotments with other un-occupied allotments.
Rangeland Resources: Wild Horses and Burros	None.	None.
Recreation	Current recreational users would be displaced from the SEZ but impacts would be minor.	None.
Military and Civilian Aviation	None.	None.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
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) especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.
Water Resources	Ground-disturbance activities could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Construction activities may require up to 964 ac-ft of (1.2 million m^3) of water during peak construction year. Construction activities would generate as high as 74 ac-ft (91,300 m^3) of sanitary wastewater. Assuming full development of the SEZ, normal operations would use the following amounts of water: • For parabolic trough facilities (947-MW capacity), 675 to 1,433 ac-ft/yr (0.8 million to 1.8 million m^3/yr) for dry-cooled systems and 4,747 to 14,216 ac-ft/yr (5.9 million to 17.5 million m^3/yr) for wet-cooled systems; • For power tower facilities (526-MW capacity), 374 to 795 ac-ft/yr (0.5 million to 1.0 million m^3/yr) for dry-cooled systems and	Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures. Land disturbance activities should avoid impacts to the extent possible near ephemeral washes on site and surrounding wetlands. During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as being within a 100-year floodplain. 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.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Water Resources *(Cont.)*	2,636to 7,897 ac-ft/yr (3.2 million to 9.7 million m^3/yr) for wet-cooled systems; • For dish engine facilities (526-MW capacity), 269 ac-ft/yr (331,800 m^3/yr); and • For PV facilities (526-MW capacity), 27 ac-ft/yr (33,300 m^3/yr). Assuming full development of the SEZ, normal operations would generate up to 13 ac-ft/yr (16,000 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 149 to 269 ac-ft/yr (0.2 million to 0.3 million m^3/yr) of cooling system blowdown wastewater.	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.
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 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, construction of access roads 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 semidesert shrub steppe and semidesert grassland habitats and minimize the potential for the spread of invasive species. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides. All dry wash habitats within the SEZ and all wetland and dry wash habitats within the assumed access road corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*		wetlands and dry washes to reduce the potential for impacts on these habitats. Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, or accidental spills, and fugitive dust deposition. Maintaining sediment and erosion controls along drainages would reduce the potential for impacts on wetlands near or downgradient from the SEZ. Appropriate buffers and engineering controls would be determined through agency consultation. Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetlands or springs near or downgradient from the SEZ associated with groundwater discharge, such as the wetlands along the Conejos River.
Wildlife: Amphibians and Reptiles[b]	Small impacts on amphibians and reptiles could occur from development on the SEZ.	Wash habitats within the SEZ should be avoided to the extent practicable. Appropriate engineering controls should be used to minimize impacts on palustrine wetlands surrounding the SEZ resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats. The access road should be sited and constructed to minimize impacts on wetlands (if present within the finalized access road location).

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Wildlife: Birds[b]	Small impacts on landbirds could occur from development on the SEZ. 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. Impacts on the mourning dove would be small. Other upland gamebirds do not occur on 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. The access road should be sited and constructed to minimize impacts on wetlands and riparian areas (if present within the finalized access road location). Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition. If present, prairie dog colonies (which could provide habitat or a food source for some bird species) should be avoided to the extent practicable.
Wildlife: Mammals[b]	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. Loss of overall range of elk, mule deer, and pronghorn would be small.	Prairie dog colonies should be avoided to the extent practicable. This could reduce impacts on species such as the desert cottontail and thirteen-lined ground squirrel. Construction should be curtailed during winter when big game species are present.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Wildlife: Mammals[b] *(Cont.)*	All of the SEZ is within the winter and severe winter range of elk; however, this is a small portion of their range. But because the SEZ is located somewhat centrally within the range, its loss could be considered a small fragmentation impact. The loss of nearly 3.7% of pronghorn severe winter range and 2.8% of a winter concentration area as a result of solar energy development would have a moderate impact on these pronghorn habitats.	Where big game winter ranges intersect or are within close proximity to the SEZ, use of motorized vehicles and other human disturbances should be controlled (e.g., through temporary road closures when big game are present). Development in the 135-acre (0.55 km^2) portion of the SEZ that overlaps the mule deer winter range should be avoided. Loss of pronghorn winter concentration area should be minimized.
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 the nearest wetland habitat is relatively 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. Because there are no permanent water bodies or wetlands within the Los Mogotes East SEZ or in the assumed access road corridor, there would be no direct impacts on aquatic habitats from the construction of solar energy facilities. Withdrawing water from the La Jara Reservoir, La Jara Creek, Fox Creek, Conejos River, or other perennial water features for power plant cooling water, washing mirrors, or other needs, could affect water levels, and as a consequence, aquatic organisms in those water bodies.	Undisturbed buffer areas and sediment and erosion controls should be maintained around drainages associated with wetland areas located in the immediate vicinity of the SEZ

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Special Status Species[b]	Potentially suitable habitat for 51 special status species occurs in the affected area of the Los Mogotes East SEZ. For all special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects.	Pre-disturbance surveys should be conducted within the SEZ and access road corridor to determine the presence and abundance of special status species; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effects (where appropriate); or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that uses one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies. Avoiding or minimizing disturbance of grassland, marsh, meadow, and woodland habitat in the area of direct effects could reduce impacts on 24 special status species. Coordination with the USFWS and CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and northern leopard frog – species that are either candidates or under review for listing under the ESA. Coordination would identify an appropriate survey protocol, avoidance measures, and, potentially, translocation or compensatory mitigation.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		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.
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 Wilderness Area, about 35 mi [57 km] north-northeast 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. *Operations:* Positive impact due to avoided emission of air pollutants from combustion-related power generation: 1.9 to 3.5% of total SO_2, NO_x, Hg, and CO_2 emissions from electric power systems in the state of Colorado (up to 2,194 tons SO_2, 2,529 tons NO_x, 0.014 tons Hg, and 1,639,000 tons CO_2).	None.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
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. Viewshed analyses indicate visibility of power towers from many locations within the San Luis Valley, including residences, businesses, tourist destinations, and historic properties, as well as major and minor roadways, with substantial opportunities for extended viewing duration due to power tower height above potential screening. The SEZ is located 1.0 mi (1.6 km) from the route of the West Fork of the North Branch of the Old Spanish Trail at the point of closest approach. Where screening is absent, because of the short distance, strong visual contrasts could be observed by trail users near the point of closest approach. Minimal to strong visual contrasts could be observed from points on the trail farther from the SEZ. The SEZ is 8.8 mi (14.2 km) at the point of closest approach west-southwest of the San Luis Hills WSA. Weak to moderate visual contrasts could be observed by WSA visitors. The SEZ is 2.6 mi (4.3 km) at the point of closest approach east of the Los Caminos Antiguos Scenic Byway. Where screening is absent, weak to strong visual contrasts could be observed by byway users. The communities of Antonito, Romeo, Sanford, La Jara, and Conejos are located within the viewshed of the SEZ, between 3 and 8 mi (5 and 13 km) from the SEZ although slight variations in topography and vegetation provide full or partial screening in some locations. Where screening is absent, Romeo could experience strong visual contrasts.	The development of power tower facilities should be prohibited within the SEZ.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	Residents, workers, and visitors to these communities may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads, including U.S. 285 and CO 17, portions of which are included in the Los Caminos Antiguos Scenic Byway.	
Acoustic Environment	*Construction:* For construction of a solar facility located near the southeastern SEZ boundary, estimated noise levels at the nearest residence located about 0.4 mi (0.6 km) from the SEZ boundary would be about 52 dBA, which is higher than typical daytime mean rural background level of 40 dBA. In addition, an estimated 49 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 southeastern SEZ boundary, the predicted noise level would be about 45 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 44 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 55 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 57 dBA L_{dn}, which is a little higher than the EPA guideline of 55 dBA L_{dn} for residential areas. If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residence would be about 49 dBA, which is higher than the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 47 dBA L_{dn} at this residence would be below the EPA guideline of 55 dBA L_{dn} for residential areas.	Noise levels from cooling systems equipped with TES should be managed so that levels at nearby residences to the north and east of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from the residences, limiting operations to a few hours after sunset, and/or installing fan silencers. Dish engine facilities within the SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from nearby residences around the SEZ (i.e., the facilities should be located in the 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.

TABLE 10.4.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Los Mogotes East SEZ	SEZ-Specific Design Features
Paleontological Resources	Few, if any, impacts on significant paleontological resources in a large percentage of the Los Mogotes East SEZ are likely to occur. A more detailed look at the geological deposits of the SEZ is needed to verify that a PFYC of Class I is accurate and appropriate for 88% of the SEZ. There could be impacts in the eastern 12% of the SEZ. A more detailed look at the geological deposits and their depth and a paleontological survey may be needed for this portion of the SEZ and any area to the east of the SEZ considered for road access.	Avoidance of PFYC Class 4/5 areas is recommended for development within the SEZ and for access road placement. Where avoidance of these areas is not possible, a paleontological survey may be required.
Cultural Resources	Direct impacts on significant cultural resources could occur; however, a cultural resource survey would need to be conducted within the SEZ and along any proposed access corridors to identify archaeological sites, historic structures or features, and traditional cultural properties and to determine whether any are eligible for listing in the NRHP. Further evaluation is needed to determine the effects of solar energy development on the West Fork of the North Branch of the Old Spanish Trail. On the basis of preliminary visual analysis, the Cumbres & Toltec Scenic Railroad Corridor located south of the SEZ would not be adversely affected by solar energy development, with the possible exception of visual impacts from the installation of a power tower or other similarly tall structures. Indirect impacts on cultural resources, such as vandalism or theft, are unlikely as a result of new road access to the east. Any new corridors to the south or west would need to be evaluated.	A PA may need to be developed among the BLM, DOE, Colorado SHPO, ACHP, and the Trail Administration for the Old Spanish Trail to consistently address impacts on significant cultural resources from solar energy development within the San Luis Valley. Additional coordination with the CTSR Commission is recommended to address possible mitigation measures for reducing visual impacts on the Cumbres and Toltec Scenic Railroad

1 **TABLE 10.4.1.3-1 (Cont.)**

Resource Area	Environmental Impacts—Proposed Los Mogotes East 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 proposed 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 1 job and less than $0.1 million in income; loss of $74 annually in grazing fees. *Construction:* 218 to 2,885 total jobs; $11.6 million to $153.7 million income in ROI. *Operations:* 15 to 323 annual jobs; $0.5 to $10.2 million annual income in ROI.	None.
Environmental Justice	Minority populations identified within the New Mexico portion of the 50-mi (80-km) radius around the proposed SEZ could be disproportionately affected by the construction and operation of solar facilities. Potential adverse impacts could result from noise and dust during construction; increased traffic related to construction; operations noise; visual impacts of generation and auxiliary facilities to areas of traditional or cultural significance; restricted access to animals and vegetation on developed lands; curtailed mineral, energy, and forestry development in the region; and property value impacts.	None.
Transportation	U.S. 285 provides a regional traffic corridor that could experience moderate impacts from projects that may have up to 1,000 daily workers, with an additional 2,000 vehicle trips per day (maximum). Local road improvements might be necessary on the county roads between U.S. 285 and the SEZ so as not to overwhelm the local roads near any site access point(s).	None.

Footnotes are on next page.

TABLE 10.4.1.3-1 (Cont.)

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; 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; 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; 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 Los Mogotes East SEZ.

[b] The scientific names of all plants, wildlife, and aquatic biota are provided in Sections 10.4.1.10 through 10.4.1.12.

10.4.2 Lands and Realty

10.4.2.1 Affected Environment

The proposed Los Mogotes East SEZ is surrounded on the east by private lands that have been primarily developed for irrigated agriculture. Homesites are also scattered throughout this adjacent area. Although the SEZ itself contains only BLM-administered lands, two parcels of state-owned land that total about 1,100 acres (4.4 km^2) abut the SEZ on the north and south. Access to the SEZ and areas west of the SEZ is readily available via three county roads from U.S. 285. A 69-kV transmission line terminates a short distance from the SEZ. There are no existing ROW authorizations within the SEZ. The overall character of the SEZ is rural and undeveloped.

There are currently no solar development applications within the Los Mogotes East SEZ; however, there is one solar facility operating in the San Luis Valley on private land near Mosca, about 40 mi (64 km) north of the SEZ. There is ongoing interest in developing additional solar energy facilities on private lands in the valley.

10.4.2.2 Impacts

10.4.2.2.1 Construction and Operations

This analysis assumes that 4,734 acres (19 km^2), or 80%, of the proposed Los Mogotes East SEZ could be developed for utility-scale solar energy production over a 20-year period. This development would establish an industrial area that would exclude most other existing and potential uses from the site. Because the character of the area is currently rural and undeveloped, utility-scale solar energy development would introduce a new and discordant land use to the area. If solar development was to occur, many existing and potential uses of the public lands in the SEZ would be foregone, perhaps in perpetuity. It is also possible that with landowner agreement state and private lands located near the SEZ also could be developed in the same or a complementary manner as the public lands in the SEZ.

Should the proposed Los Mogotes East SEZ be identified as an SEZ, the BLM would still have discretion to authorize ROWs in the area until solar energy development was authorized, and then any future ROWs would have to be compatible with the rights granted for solar energy facilities. It is not anticipated that approval of solar energy development would have a significant impact on ROW availability in the area.

Access to BLM, state, and private lands to the west of the SEZ could be affected by solar energy development if provision is not made to retain legal access through the SEZ.

10.4.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

Availability of transmission from the Los Mogotes SEZ to load centers will be an important consideration for future development in SEZs. The nearest existing transmission line is a 69-kV line adjacent to the SEZ. It is possible that a new transmission line could be constructed from the SEZ to this existing line, but the 69-kV capacity of that line would be inadequate for 865 to 1,557 MW of new capacity. At full build-out capacity of the proposed SEZ, it is clear that substantial new transmission and or upgrades of existing transmission lines would be required to bring electricity to load centers; however, at this time the location and size of such new transmission facilities are unknown. Generic impacts of transmission and associated infrastructure construction and of line upgrades for various resources are discussed in Chapter 5. Project-specific analyses would need to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

Because the SEZ is 3 mi (5 km) from the nearest state or interstate highway, it is assumed that a new road would need to be constructed to U.S. 285 east of the SEZ, disturbing approximately 22 acres (0.09 km^2) of private land.

10.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for impacts on authorizations within the SEZ under the BLM Lands and Realty Program.

10.4.3 Specially Designated Areas and Lands with Wilderness Characteristics

10.4.3.1 Affected Environment

There are no specially designated areas within the proposed Los Mogotes East 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 (see Figure 10.4.3.2-1), many of which are elevated above the SEZ, and some of which are in close proximity to the SEZ. These areas are discussed below. No lands with wilderness characteristics have been identified within 25 mi (40 km) of the SEZ.

Three ACECs—San Luis Hills, Los Mogotes, and Cumbres & Toltec—are located in Colorado, and the San Antonio Gorge ACEC is located in New Mexico. The San Luis Hills, Cumbres & Toltec, and San Antonio Gorge ACECs are within the viewshed of the SEZ (see Section 10.4.14), and scenic values were identified at least as one of the resource values supporting designation as an ACEC. The Los Mogotes ACEC, which is about 1 mi (1.6 km) west of the SEZ, was designated for its wildlife values.

Two BLM-administered WSAs—San Antonio in New Mexico and San Luis Hills in Colorado—are within 10 to 12 mi (16 to 19 km) of the SEZ, and visitors to those areas would be able to see development within the SEZ.

Portions of two designated USFS-administered wilderness areas—South San Juan in Colorado and Cruces Basin in New Mexico—are in the viewshed of the SEZ. The SEZ is also visible from several roadless areas within the Rio Grande and Carson National Forests located to the west and south of the SEZ.

Portions of U.S. 285 and CO 17 and CO 159 have been designated as the Los Caminos Antiguos Scenic Byway by both the state and BLM. This scenic byway passes within 3 mi (5 km) of the SEZ and is in full view of the SEZ for more than 20 mi (32 km) of its length in the San Luis Valley.

The SEZ is located within the boundaries of the recently (2009) designated Sangre de Cristo NHA. The NHA includes three Colorado counties—Alamosa, Conejos, and Costilla.

The route of the West Fork of the North Branch of the Old Spanish Trail parallels within 1 mi (1.6 km) the eastern boundary of the SEZ. Studies are currently ongoing regarding the significance of this portion of the trail and if found warranted, it could be included in the National Trail System. See Section 10.4.17 for additional information on this trail.

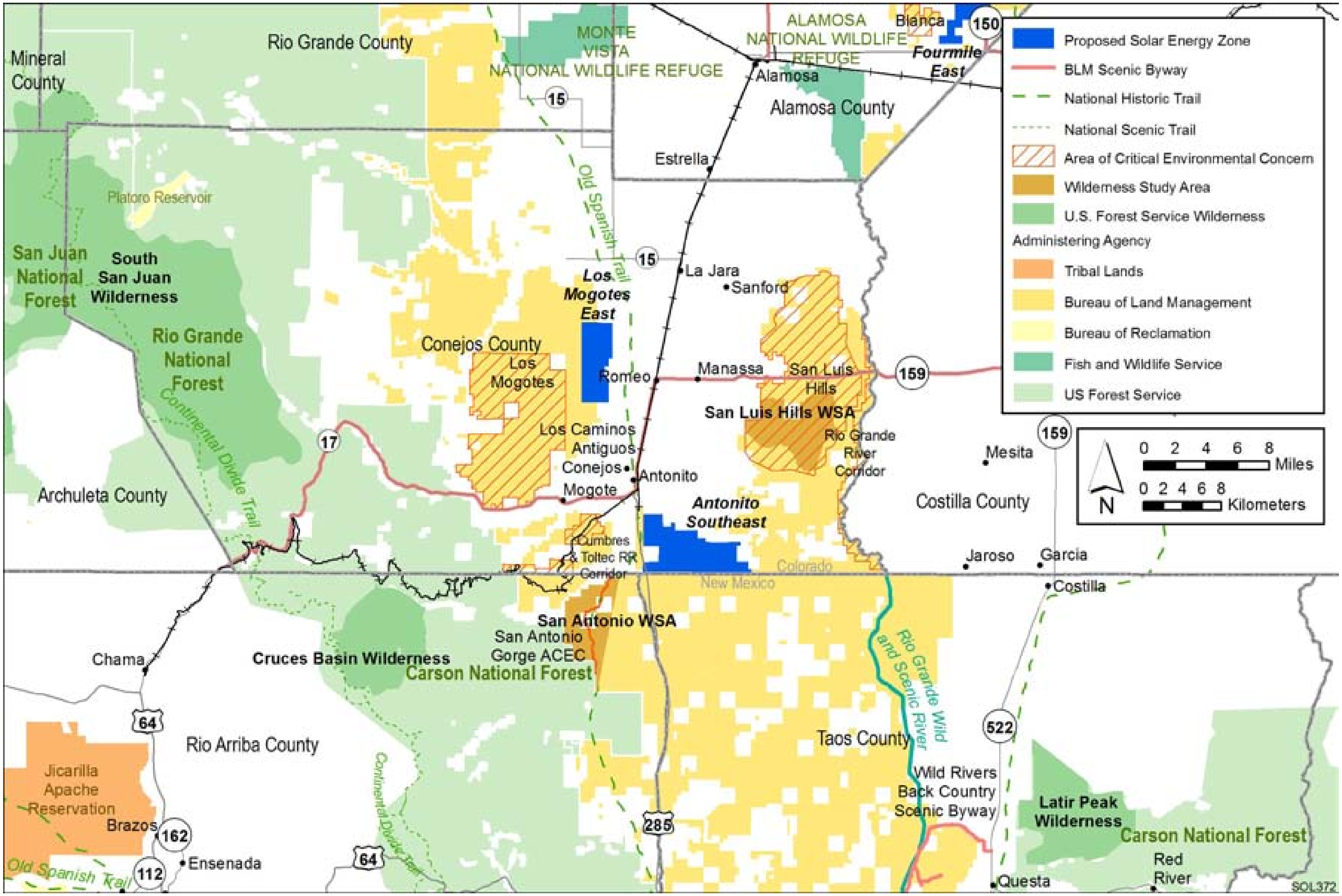

FIGURE 10.4.3.2-1 Specially Designated Areas in the Vicinity of the Proposed Los Mogotes East SEZ

10.4.3.2 Impacts

10.4.3.2.1 Construction and Operations

The primary potential impacts on the specially designated areas near the SEZ would be visual impacts of solar energy development that could affect scenic and/or recreation resources or wilderness characteristics of the areas. The visual impacts could be associated with direct views of the solar facilities, including transmission facilities; glint and glare from reflective surfaces; steam plumes; hazard lighting of tall structures; and night lighting of the facilities. For WSAs, visual impacts from solar development would be most likely to cause the loss of outstanding opportunities for solitude and primitive and unconfined recreation. While the visibility of solar facilities from specially designated areas is relatively easy to determine, the effect of this visibility is difficult to quantify and would vary by solar technology employed, the specific area being affected, and the perception of individuals viewing solar facilities while engaging in recreation activities g in areas within sight of the SEZ. Solar energy facilities, especially if the SEZ is fully developed, would be an important visual component in the viewshed from portions of some of these specially designated areas. Viewshed analysis for this SEZ has shown that the visibility of shorter solar energy facilities would be less in some areas than power tower facilities. Section 10.4.14 provides detail on all viewshed analyses for this SEZ. Potential impacts discussed below are general, and assessment of the visual impact of solar energy projects must be conducted on a site-specific and technology-specific basis to accurately identify impacts.

In general, the closer a viewer is to solar development, the greater the effect on an individual's perception of impact. From a visual analysis perspective, the most sensitive viewing distances generally are from 0 to 5 mi (0 to 8 km), but could be farther depending on other factors including the viewing height above or below a solar energy development area; the size of the solar development area; and the purpose for which people visit an area. Individuals seeking a wilderness or scenic experience within these specially designated areas could be expected to be more adversely affected than those simply traveling along the highway with another destination in mind. In the case of the Los Mogotes East SEZ, the flat terrain and the low-lying location of the SEZ in relation to portions of some of the surrounding specially designated areas would highlight the industrial-like development in the SEZ.

The occurrence of glint and glare at solar facilities could potentially cause large though temporary increases in brightness and visibility of the facilities. The visual contrast levels projected for sensitive visual resource areas that were used to assess potential impacts on specially designated areas 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. Figure 10.4.3.2-1 shows the location of the areas discussed below.

ACECs

- The Cumbres & Toltec ACEC was established to protect the viewshed of the scenic train route that passes through the ACEC. The principle "users" for this ACEC are people who ride the train and view these lands during their train ride. The nearest boundary of the SEZ is 7 mi (11 km) from the ACEC. Because of the distance, and vegetative and topographic screening, visitors on the train within the ACEC would not have continuous views of development within the SEZ. Based on visual analysis it is anticipated that scenic resources in the ACEC would be minimally affected by development within the SEZ, but there is potential that the scenic train ride experience for some visitors could be diminished.

- Much of the San Luis Hills ACEC, which is east of the SEZ, is elevated above the SEZ and visitors within portions of the ACEC would have a full view of solar development although the minimum distance from the SEZ to the ACEC is about 9 mi (15 km). Because of the distance and the presence of agricultural development between the ACEC and the SEZ, the potential for visual impact on users of the ACEC would be lessened and is expected to be minimal.

- The San Antonio Gorge ACEC is 11 mi (18 km) south of the SEZ. Because of the distance from the SEZ and since much of the canyon is incised and likely does not have a view of the SEZ, it is unlikely that development in the SEZ would have any impact on users of the ACEC.

- The Los Mogotes ACEC is located 1 mi (1.6 km) west of the SEZ and likely would be adversely affected by development of the SEZ, which would add additional disturbance into an area that at present is relatively undisturbed. Improved access to the SEZ could lead to additional vehicular traffic and human disturbance within the ACEC that could impair its overall value to wildlife.

WSAs

- The San Luis Hills WSA is included within the exterior boundaries of the ACEC of the same name described above, and that description also applies to the WSA. The closest boundary of the WSA to the SEZ is also 9 mi (15 km) from the SEZ. Largely because of the distance between the WSA and the SEZ and the existing agricultural and other human development visible from the WSA, it is not anticipated that solar development of the SEZ would have a significant impact on the wilderness characteristics of the WSA or on the experience of wilderness visitors.

- The San Antonio WSA includes the San Antonio Gorge ACEC but, unlike the ACEC, visitors within most of the WSA would have a full view of the SEZ, although the distance ranges from 11 to 16 mi (18 to 26 km). Because of the distance between the WSA and SEZ, impacts on wilderness characteristics and the experience of wilderness visitors would be minimal.

Wilderness and Roadless Areas

- Portions of the South San Juan and Cruces Basin WAs and numerous roadless areas would have long-distance views of development within the SEZ of about 20 mi (32 km). Although solar facilities in the SEZ would be visible, because of the distance, there would be little to no effect on wilderness characteristics or on the experience of wilderness visitors.

Los Caminos Antiguos Scenic Byway

- Vehicle passengers on about 29 mi (47 km) of the scenic byway would have a clear view of solar development within the SEZ. A portion of the byway passes within 3 mi (5 km) of the SEZ, and about 8 mi (13 km) of the highway is within the most visually sensitive zone from 0 to 5 mi (0 to 8 km). The potential impact of development of the SEZ on the byway and byway users is not known, but the SEZ would be highly visible.

Sangre de Cristo National Heritage Area (NHA)

- The NHA was recently designated, and planning for it is not yet complete; thus it is difficult to assess the impact that solar development in the SEZ might have. However, an NHA is described as a place where natural, cultural, historic, and scenic resources combine to form a cohesive, nationally important landscape arising from patterns of human activity shaped by geography (NPS 2008). This definition implies that visual impacts from solar energy development could be of concern.

West Fork of the North Branch of the Old Spanish Trail

- Solar development within the SEZ could be within 1 mi (1.6 km) of the route of the trail and would have a major impact on the historic and visual integrity of the trail. Until the ongoing trail study is complete, it is not possible to know whether this segment of the trail will be found to have significant values that should be preserved or what potential management actions may be required. See Section 10.4.17 for additional information on the trail.

10.4.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

Section 10.4.2.2.2 presents a discussion of transmission facilities. In addition, should a new transmission line be required, there is potential for additional impact on the West Fork of the North Branch of the Old Spanish Trail.

Three miles (5 km) of new road constructed east of the site would add minimally to the visual impact on specially designated areas associated with the SEZ facilities.

10.4.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts. The exceptions may be potential visual impacts on travelers on the scenic byway and impacts on the NHA. Impacts on these two areas would be better determined or mitigated once ongoing studies and planning are complete and could be considered as part of a project specific proposal. Additionally, impacts on the wildlife values of the Los Mogotes ACEC would likely not be mitigable.

Proposed design features specific to the proposed Los Mogotes East SEZ include the following:

- Early consultation should be initiated with the entity responsible for developing the management plan for the Sangre de Cristo NHA to understand how development of the SEZ could be consistent with NHA plans/goals.

- Pending completion of a study on the significance and definition of management needs (if any) of the West Fork of the North Branch of the Old Spanish Trail, solar development should be restricted to areas that do not have the potential to adversely affect the setting of the trail. After the study is completed, if management actions are warranted for this portion of the trail, solar energy development should be consistent with protection of identified values of the trail.

10.4.4 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 Los Mogotes East SEZ are discussed in Sections 10.4.4.1 and 10.4.4.2.

10.4.4.1 Livestock Grazing

10.4.4.1.1 Affected Environment

The SEZ includes portions of three seasonal grazing allotments: Ciscom Flat (#14212), Capulin (#14207), and Little Mogotes (#24222). The allotments are used by four permittees and support a total forage production of 2,337 AUMs per year. There are livestock management facilities, including fences and watering places, in the area. Table 10.4.4.1-1 summarizes key acreage and production data for these allotments.

10.4.4.1.2 Impacts

Construction and Operations

Should utility-scale solar development occur in the SEZ, grazing would be excluded from the areas developed as provided for inBLM grazing regulations (43 CFR Part 4100). This would include reimbursement of permittees for their portion of the value for any range improvements in the area removed from the grazing allotment. The 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 Ciscom Flat allotment is largely contained within the proposed area of the SEZ, and 84% of public lands in the allotment would be affected by solar development. If full solar development occurred in the SEZ, the BLM grazing permit for the Ciscom Flat allotment would probably be cancelled and the permittee would be displaced.

At full SEZ development, about 8% of the public lands in the Capulin allotment and about 16% of the public lands in the Little Mogotes allotment would be affected by solar energy development. The grazing permits for these two allotments would be modified to exclude portions of the allotments, and there likely would be a small to moderate impact on those operations. Because of the relatively small amount of land that would be removed from these two allotments and depending on the significance of those lands to the operation of the allotments, it might be possible to redistribute livestock use throughout the remaining portions of the allotments and to avoid a flat percentage reduction in use comparable to the percentage

TABLE 10.4.4.1-1 Grazing Allotments within the Proposed Los Mogotes East SEZ

Allotment	Total Acres[a]	% Total in SEZ[b]	State Acres/ Authorized AUMs	Active BLM AUMs	No. of Permittees
Ciscom Flat	4,320	84	640/70	191	1
Capulin	8,790	8	640/14	742	1
Little Mogotes	13,803	16	640/81	1,404	2

[a] Total acres, including public and state land, and AUMs, is from the BLM Rangeland Administration System report (BLM 2008b). To convert acres to km^2, multiply by 0.004047.

[b] Represents the percentage of public land in the allotment, within the SEZ.

loss in land area of the permit. On the basis of the probable cancellation of the Ciscom Flat allotment and the possible reduction in AUMs comparable to the acreage loss from the other two allotments, about 475 AUMs would be lost from the public lands. Section 10.4.19.2.1 provides more information on the economic impact of this loss of grazing capacity.

Each of the BLM allotments contains one state-owned section of land. However, cancellation/modification of the BLM grazing permits would not prevent these areas from continuing to be leased for grazing.

Although the impacts on the Ciscom Flat permittee would depend on the specific situation, there likely would be an adverse economic impact, and possibly an adverse social impact since for many permittees since operating grazing allotments on public lands has been a long-standing tradition. It is possible that solar development proponents could purchase all or portions of the existing grazing allotment both to facilitate solar operations and to minimize the impact on the existing public land permittees.

Transmission Facilities and Other Off-Site Infrastructure

It is anticipated that road and transmission facility construction east of the SEZ would not cause additional impact on livestock grazing on the three allotments.

10.4.4.1.3 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 disruption of grazing operations; however, it may not be possible to fully mitigate the economic loss to the holders of grazing permits and the social impacts from loss of grazing rights.

A proposed design feature specific to the proposed Los Mogotes East SEZ is as follows:

- Since the Capulin and Little Mogotes allotments are relatively large, it may be possible to mitigate the loss of livestock grazing from these allotments by changing management of the allotments and/or providing new range improvements (e.g., fences, watering places) elsewhere in the allotments. It also may be possible to mitigate some or all of the loss by altering allotment boundaries or possibly offering an exchange of allotments with other unoccupied allotments.

10.4.4.2 Wild Horses and Burros

10.4.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. Four wild horses HMAs are located in Colorado; two are in New Mexico, but none are near the proposed Los Mogotes East SEZ. The closest wild horse HMA to the SEZ is the Carracas Mesa HMA in New Mexico, which is about 70 mi (274 km) west of the SEZ. Located about 12 mi (19 km) south of the SEZ in New Mexico is the Punche Valley HA, which is a 70,809-acre (287-km^2) area (including 16,606 acres [67 km^2] of private lands) that historically was wild horse habitat but has not been designated for long-term management of wild horses. In FY 2009, the BLM estimated there were no horses or burros within the HA. There have been occasional reports of horses sited in the Antonito Southeast SEZ which is adjacent to the HA and is about 8 mi (13 km) southeast of the Los Mogotes East SEZ, but there have been no reports of horses in the Los Mogotes East SEZ.

10.4.4.2.2 Impacts

Because the closest wild horse HMA is more than 70 mi (225 km) from the Los Mogotes East SEZ, solar energy development would not affect wild horses and burros that are managed by the BLM.

10.4.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary to protect or minimize impacts on wild horses and burros.

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10.4.5 Recreation

10.4.5.1 Affected Environment

The proposed Los Mogotes East SEZ is flat, and the quality of its natural features would not generally attract recreational users from distant locations. Although there are no recreation data specific to the area, the area is used by local residents for general outdoor recreation, including horseback riding, OHV and backcountry driving, and hunting. Principle species of interest to hunters would likely include deer and pronghorn antelope. Rabbits, doves, and quail are also hunted in the area. The area has been designated in the San Luis Valley Travel Management Plan as Limited, Designated Roads and Trails. The area can be accessed via county roads that connect to U.S. 285. Three road/trail segments within the SEZ have been identified as Open Motorized Road and are available for OHV or vehicular travel and also provide access to areas west of the SEZ. There are also several low-quality dirt roads that wind through portions of the area but that are not designated for motorized use. Recreational use of the SEZ area is minimal.

The CTSR operates between May and October on an established rail line that runs from Antonito, Colorado, to Chama, New Mexico (CTSR 2010). The railroad passes within 6 mi (10 km) of the southern border of the SEZ, and solar development on the site would be visible to railroad passengers.

10.4.5.2 Impacts

10.4.5.2.1 Construction and Operations

Recreational visitors would lose the use of any portions of the SEZ developed for solar energy production. Access through areas developed for solar power production could be closed or rerouted. There would not be a significant loss of recreation use if the SEZ was developed, but some users would be displaced. Numerous areas of public land in reasonably close proximity to the area could provide alternative sites for displaced users.

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. Such open routes crossing areas granted ROWs for solar facilities would be redesignated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

Development of the SEZ would be visible from short portions of the CTSR, but, depending on the solar technologies employed and because the SEZ is at the edge of the most sensitive visual area, the potential impact on recreation visitors riding the train would be minor.

10.4.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

It is anticipated that road and transmission facility construction would occur east of the SEZ and would not cause additional impact to recreation resources.

10.4.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be required to protect recreational resources. Some recreational use would be lost from the area and would not be mitigated. Access to areas of the SEZ that are undeveloped, and to areas west of the SEZ, could be effectively maintained through application of the programmatic design features described in Appendix A, Section A.2.2.

10.4.6 Military and Civilian Aviation

10.4.6.1 Affected Environment

The proposed Los Mogotes East SEZ is not affected by any MTRs. The nearest civilian airport is at Alamosa about 20 mi (32 km) from the SEZ.

10.4.6.2 Impacts

Recent information from the military indicates that there are no concerns about solar development in the proposed Los Mogotes East SEZ. Because of the distance to the nearest civilian airport there would be no impacts on civil aviation.

10.4.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features would be necessary to protect military or civilian aviation uses. The programmatic design features described in Appendix A, Section A.2.2, would require early coordination with the DoD to identify and mitigate, if possible, potential impacts on the use of MTRs.

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10.4.7 Geologic Setting and Soil Resources

10.4.7.1 Affected Environment

10.4.7.1.1 Geologic Setting

Regional Geology

The proposed Los Mogotes East SEZ is located in the southern part of the San Luis Valley, an alluvium-filled basin within the Southern Rocky Mountain physiographic province in south-central Colorado (Figure 10.4.7.1-1). 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 10.4.7.1-2). The proposed Los Mogotes East SEZ sits above the Tertiary basalts of the Hinsdale Formation (along the eastern front of the San Juan Mountains) near the southwestern margin of the Alamosa Basin (Figure 10.4.7.1-3). The basalts of the Hinsdale Formation (Miocene) are associated with early rifting in the valley (about 27 million years ago) and covered ash-flow tuffs of the San Juan volcanic field along the western margin of the valley before the volcanic field was uplifted and eroded (Brister and Gries 1994). Basin fill sediments occur below the basalt and just beyond the eastern border of the SEZ, thickening to the east. These sediments are the major source of groundwater in the region.

Exposed sediments in the San Luis Valley consist mainly of modern alluvial deposits and the fluviolacustrine clays and sands of the Alamosa Formation (Figure 10.4.7.1-4). 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.

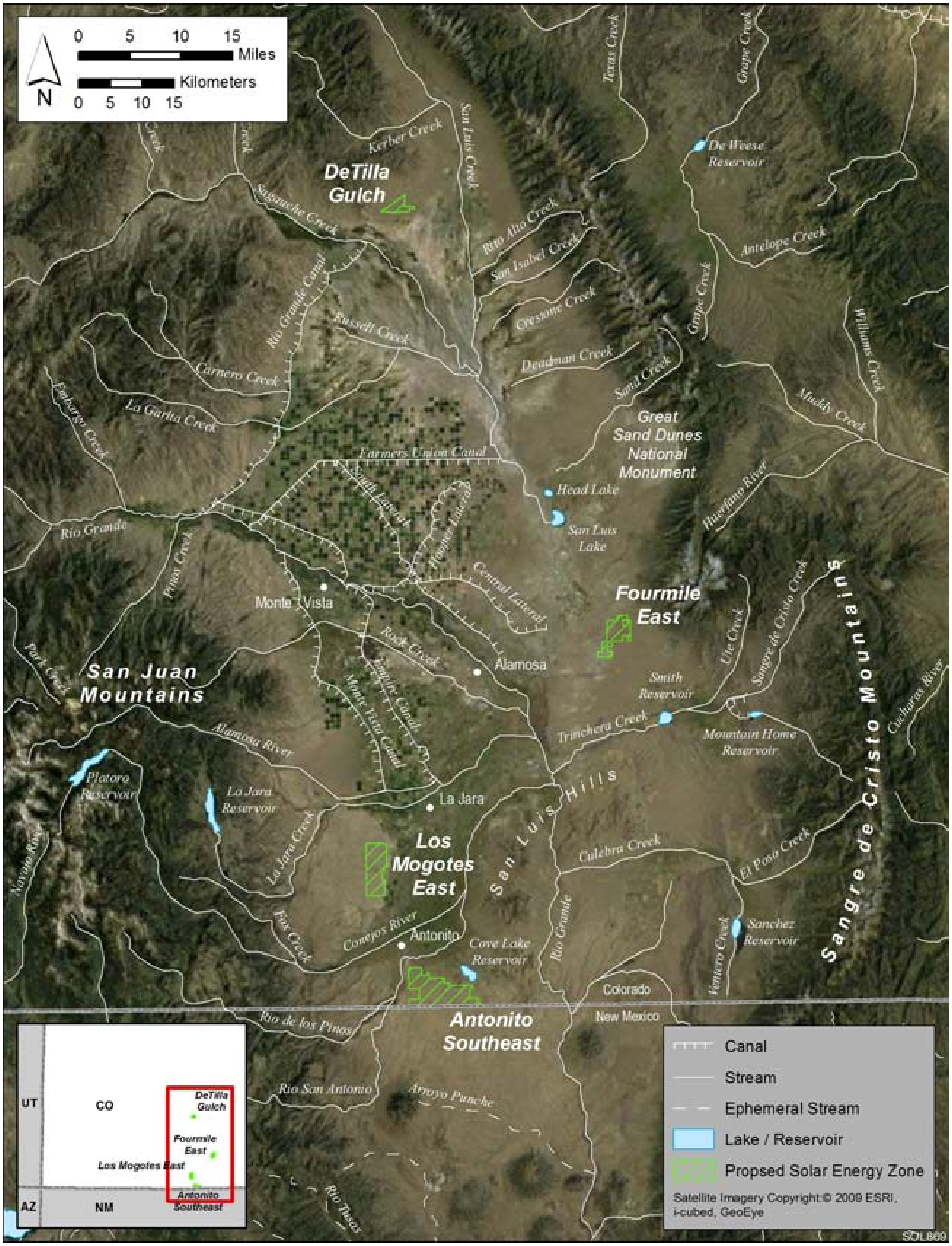

FIGURE 10.4.7.1-1 Physiographic Features of the San Luis Valley

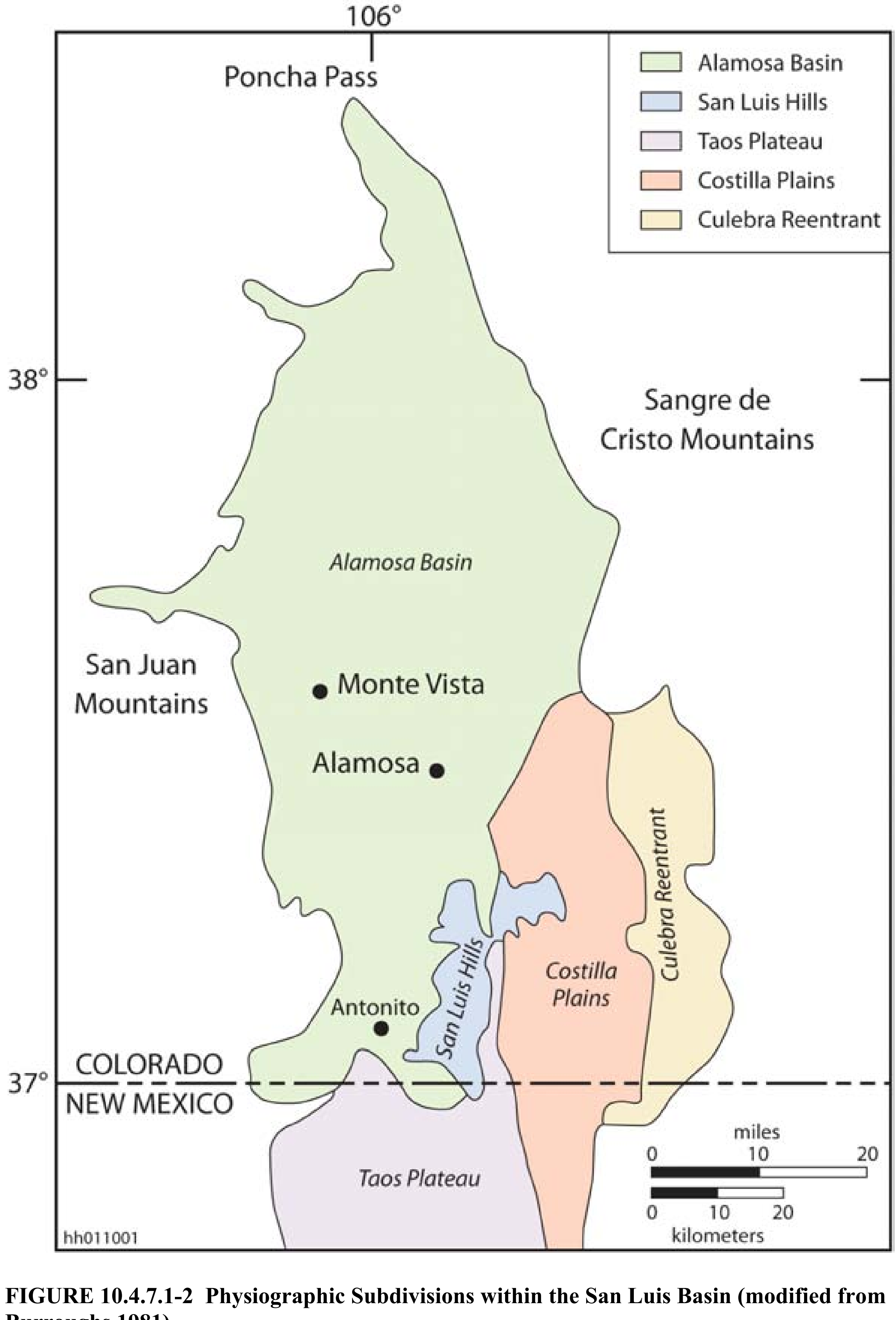

FIGURE 10.4.7.1-2 Physiographic Subdivisions within the San Luis Basin (modified from Burroughs 1981)

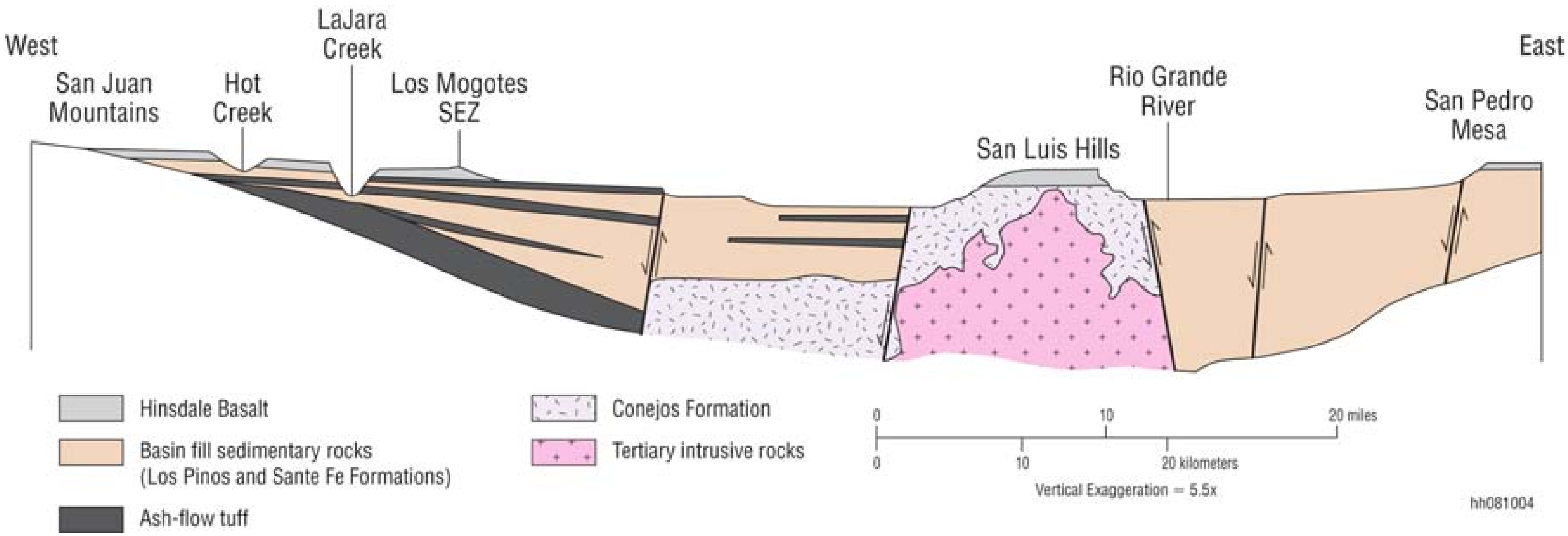

FIGURE 10.4.7.1-3 Generalized Geologic Cross Section (West to East) across the Southern Part of the Alamosa Basin (modified from Thompson et al. 1991)

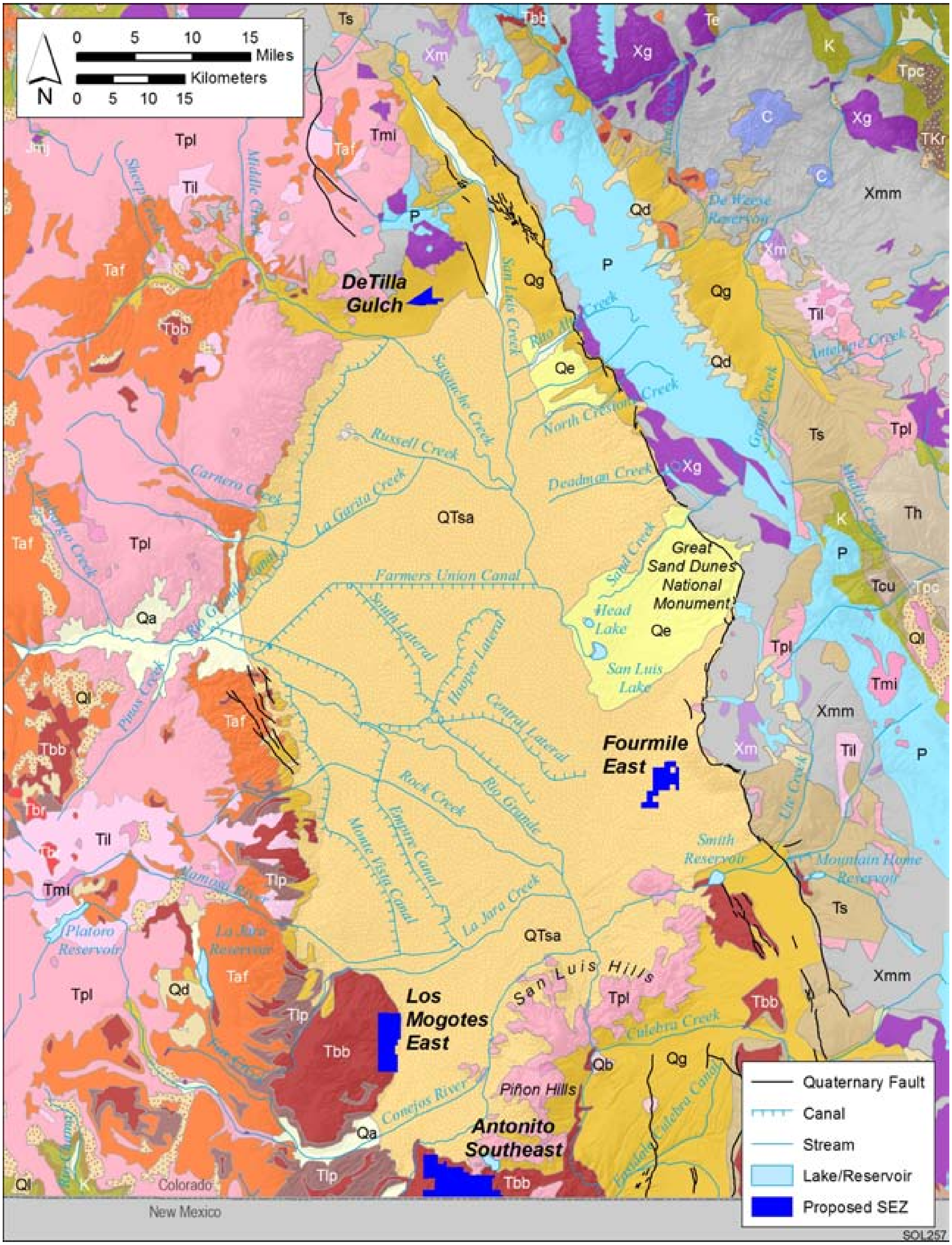

FIGURE 10.4.7.1-4 Geologic Map of the San Luis Valley and Vicinity (adapted from Stoeser et al. 2007 and Tweto 1979)

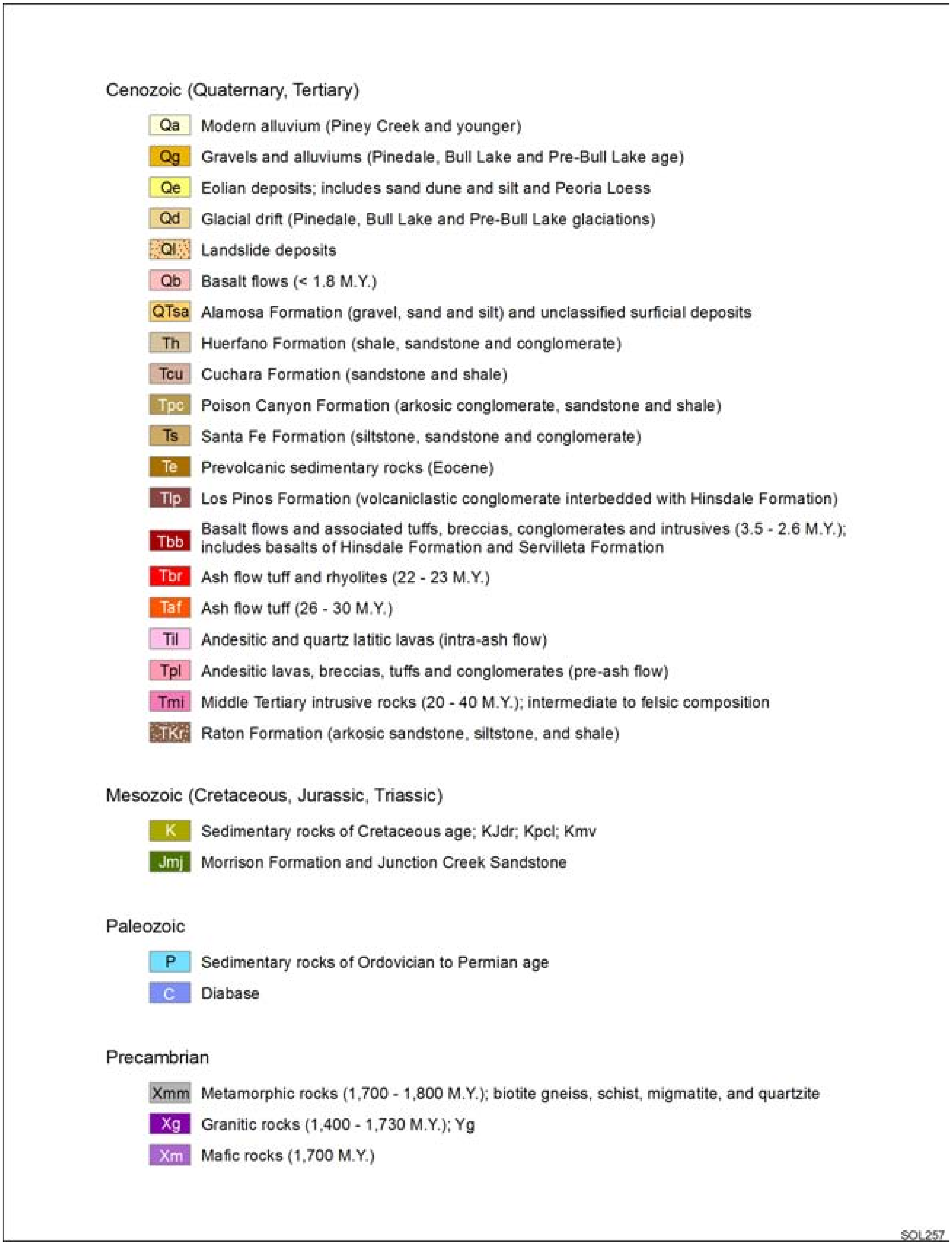

FIGURE 10.4.7.1-4 (Cont.)

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 basalt hills and mesas of the San Luis Hills and the dune fields of the Great Sand Dunes. Playa lakes are present in the north part of the valley (Leonard and Watts 1989; Emery 1979).

The proposed Los Mogotes East SEZ is about 17 mi (27 km) west of the Rio Grande in Conejos County (Figure 10.4.7.1-1). Its terrain is relatively flat with a gentle dip to the east (Figure 10.4.7.1-5). An unnamed drainage feature and its tributaries run from west to east across the southern portion of the SEZ (sections 13, 14, 23, 24, 25, and 26); the drainage discharges to an irrigation ditch (Romero Ditch) that serves croplands to the east. Elevations range from about 7,710 ft (2,350 m) along the site's eastern boundary to 7,956 ft (2,425 m) just outside of its western boundary. The highest point in the area is 8,038 ft (2,450 m) in the southwestern corner of the SEZ.

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 Los Mogotes East SEZ. Solar project developers may need to conduct a geotechnical investigation to assess geologic hazards locally to better identify facility design criteria and site-specific design features to minimize their risk.

Seismicity. Seismic activity associated with earthquakes in Colorado is low to moderate, with a slightly higher risk in and around the Rio Grande rift zone (Kirkham and Rogers 1981). The rift zone is an extensional stress regime and consists of a series of grabens (fault-bounded basins) that extend along the northeast-oriented rift axis. It is currently dormant; however, earthquakes could potentially occur as a result of movement along existing normal faults within and along the boundaries of the San Luis Basin (Blume and Sheehan 2002).

No known Quaternary faults occur within the proposed Los Mogotes East SEZ. The closest Quaternary faults are the group of minor faults located in the foothills near Monte Vista, about 24 mi (41 km) to the north-northwest of the SEZ in Rio Grande County at the western edge of the Rio Grande rift (Figure 10.4.7.1-6). Offsets of Pleistocene alluvial fan deposits place the most recent movement along the fault at less than 1.6 million years ago. Downward displacement is to the southwest and southeast of the fault line (Kirkham 1998).

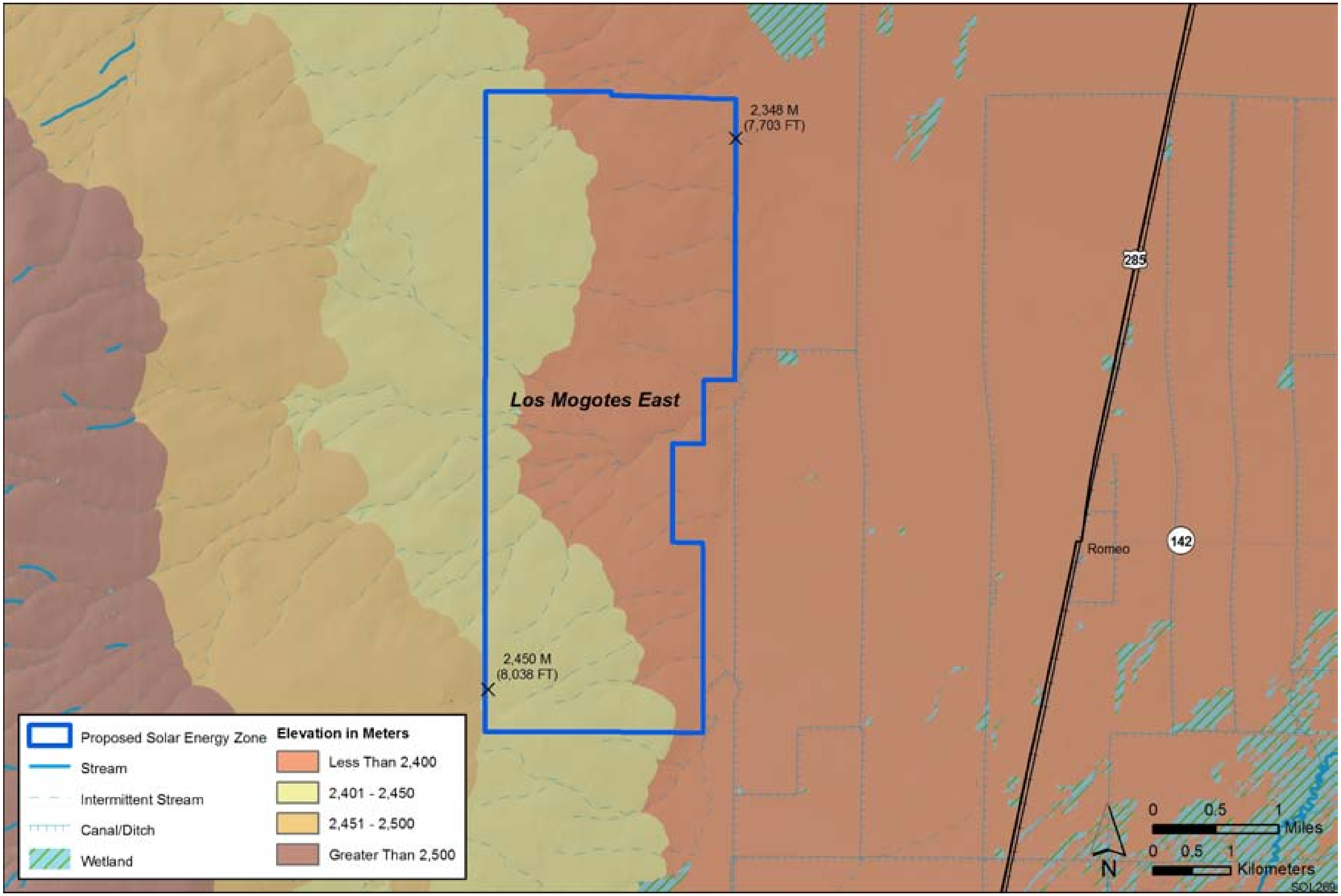

FIGURE 10.4.7.1-5 General Terrain of the Proposed Los Mogotes East SEZ

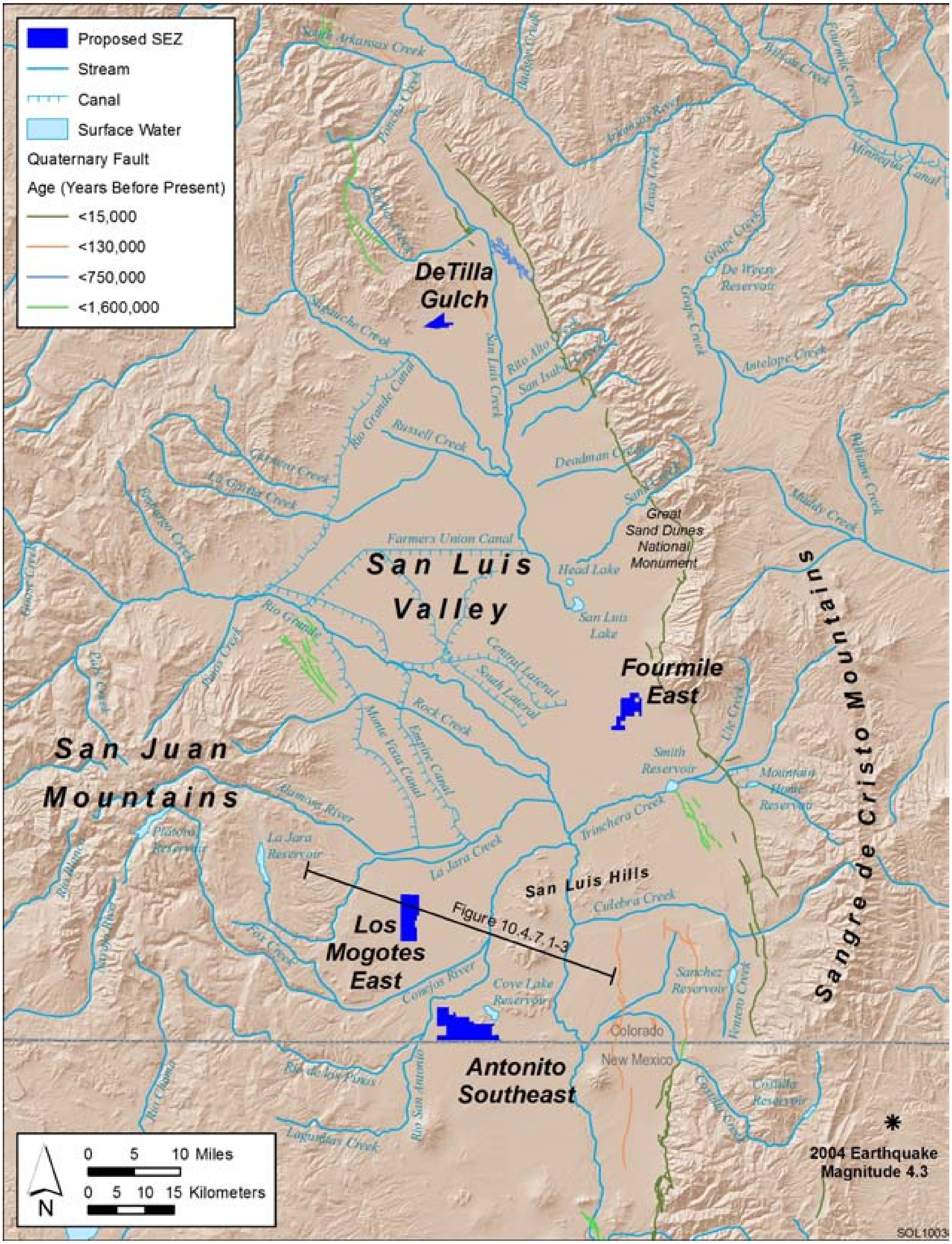

FIGURE 10.4.7.1-6 Quaternary Faults in the San Luis Valley (USGS and CGS 2009; USGS 2010a,b)

From June 1, 2000 to May 31, 2010, 25 earthquakes were recorded within a 61-mi (100-km) radius of the proposed Los Mogotes East SEZ. The largest earthquake during that period occurred on August 1, 2004 (it is also the largest recorded earthquake since 1988). It was located about 60 mi (95 km) southeast of the SEZ in the Sangre de Cristo Mountains (New Mexico) and registered a moment magnitude (Mw)[1] of 4.3 (Figure 11.2.7.1-6). During this period, 13 (52%) of the recorded earthquakes within a 61-mi (100-km) radius of the SEZ had magnitudes greater than 3.0 (USGS 2010a).

Liquefaction. The proposed Los Mogotes East SEZ is located within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.05 and 0.06 g. Shaking associated with this level of acceleration is generally perceived as moderate; however, the potential for damage to structures is very light (USGS 2008). Given the low intensity of ground shaking and the low incidence of historic seismicity in the San Luis Valley, the potential for liquefaction in valley sediments is also likely to be low.

Volcanic Hazards. The San Juan Mountains west of the San Luis Valley are the largest erosional remnant of a nearly continuous volcanic field that stretched across the Southern Rockies during the Tertiary period (Lipman et al. 1970). Extensive volcanic activity occurred in this volcanic field about 35 to 30 million years ago, during which time lavas and breccias of intermediate composition were erupted from numerous scattered central volcanoes. About 30 million years ago, volcanic activity associated with large calderas throughout the central and western part of the San Juan Mountains changed to explosive ash-flow eruptions that deposited several miles (kilometers) of lava and ash throughout the area. Once extension began in the Rio Grande rift, about 27 million years ago, volcanic activity was predominantly basaltic. Flood basalts erupted intermittently from fissures in the rift valley from 26 to 14 million years ago. Examples include the Miocene basalts of the Hinsdale Formation, which occur along the western edge of the San Luis Valley and in the San Luis Hills, and the younger basalt flows (e.g., the Servilleta Basalt) of the Taos Plateau in the southern part of the valley (Lipman et al. 1970; Lipman and Mehnert 1979, Thompson et al. 1991; Brister and Gries 1994; Lipman 2006).

Although there are numerous volcanic vents and historic flows in the San Luis Valley region and volcanic activity has occurred as recently as 2 million years ago on the Taos Plateau, there is currently no evidence of volcanic eruptions or unrest in south-central Colorado.

Slope Stability and Land Subsidence. The incidence of rock falls and slope failures can be moderate to high along mountain fronts and can present a hazard to facilities on the relatively flat terrain of valley floors, such as the San Luis Valley, if they are located at the base of steep slopes. The risk of rock falls and slope failures decreases toward the flat valley center.

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[1] Moment magnitude (Mw) is used for earthquakes with magnitudes greater than 3.5 and is based on the moment of the earthquake, equal to the rigidity of the earth times the average amount of slip on the fault times the amount of fault area that slipped (USGS 2010b).

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 Los Mogotes East SEZ include those associated with soil compaction (restricted infiltration and increased runoff), expanding clay soils (destabilization of structures), and hydro-compactible or collapsible soil (settlement). Disturbance of soil crusts and desert pavement on soil surfaces (if present) may increase the likelihood of soil erosion by wind.

Alluvial fan surfaces, such as those that occur along the valley margins, can be the sites of damaging high-velocity "flash" floods and debris flows during periods of intense and prolonged rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris flow fans) depends on the specific morphology of the fan (National Research Council 1996). Section 10.4.9.1.1 provides further discussion of flood risks within the Los Mogotes East SEZ.

10.4.7.1.2 Soil Resources

Soils within the proposed Los Mogotes East SEZ are predominantly very stony and cobbly loams of the Travelers and Garita Series, which together make up about 98% of the soil coverage at the site (Figure 10.4.7.1-7). Soil map units within the Los Mogotes East SEZ are described in Table 10.4.7.1-1. Parent material consists of sediments weathered from basalt (beyond the western site border, soils are derived from alluvial sources). Soils within the SEZ are characterized as shallow and deep and well to excessively well-drained. Most of the soils on the site have moderate to high surface-runoff potential and moderate to moderately rapid 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 but the playa soils, which were not rated. The susceptibility to wind erosion is low to moderate, with as much as 86 tons of soil per acre eroded by wind per year. All soils within the SEZ have features that are favorable for fugitive dust formation (NRCS 2009).

The Garita cobbly loam occurs on the steeper slopes (3 to 25%) of intermittent drainages throughout the site. Very stony loams of the Travelers Series also occur on steeper slopes along the southern portion of the site's western boundary. None of the soils within the SEZ are rated as hydric.[2] Flooding of soils at the site is not likely and occurs with a frequency of less than once in 500 years. All soils at the site are vulnerable to compaction. Less than 3% of the soils (Luhon and Monte loams) are classified as prime farmland, if irrigated (NRCS 2009).

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[2] A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding (NRCS 2009).

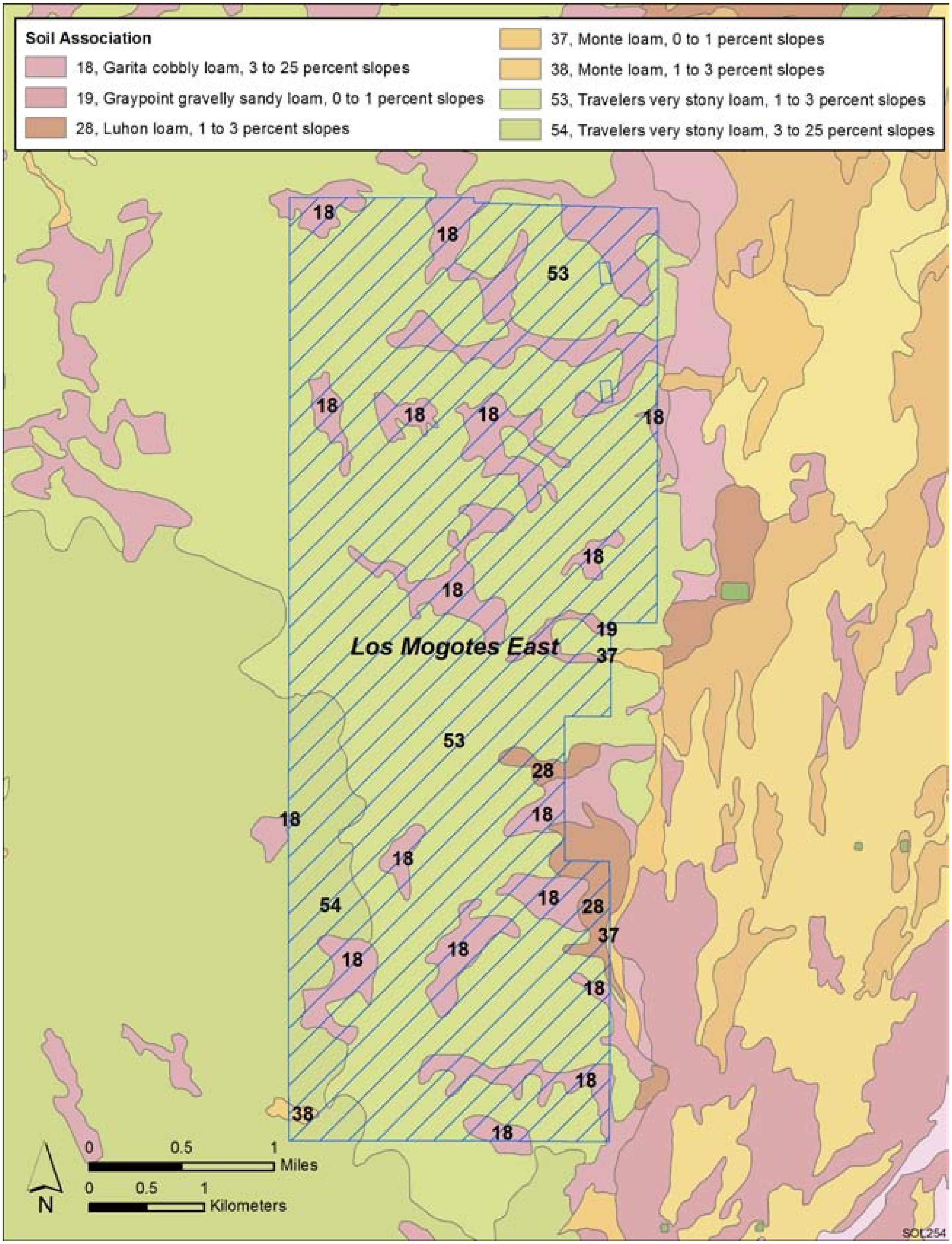

FIGURE 10.4.7.1-7 Soil Map for the Proposed Los Mogotes East SEZ (NRCS 2008)

TABLE 10.4.7.1-1 Summary of Soil Map Units within the Proposed Los Mogotes East SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in acres[b] (percent of SEZ)
53	Travelers very stony loam (1 to 3%)	Slight	Low (WEG 8)[c]	Nearly level soils on mesas and hillslopes capped by basalts, andesite, and/or rhyolite. Parent material consists of thin calcareous sediments weathered from basalt. Shallow and well to somewhat excessively drained, with high surface runoff potential (low infiltration rate) and moderate to moderately rapid permeability. Available water capacity is very low. Used mainly as rangeland. Susceptible to compaction.	4,249 (72)
18	Garita cobbly loam (3 to 25%)	Slight	Moderate (WEG 4)	Nearly level to gently sloping soils on alluvial fans and fan terraces. Parent material consists of thick calcareous and gravelly alluvium derived from basalt. Deep and well drained, with moderate surface runoff potential and moderate permeability. Available water capacity is low. Used mainly as native pastureland. Susceptible to compaction.	1,075 (18)
53	Travelers very stony loam (3 to 25%)	Slight	Low (WEG 8)	Nearly level to gently sloping soils on mesas and hill slopes capped by basalts, andesite, and/or rhyolite. Parent material consists of thin calcareous material weathered from basalt. Shallow and well to somewhat excessively drained, with high surface runoff potential (low infiltration rate) and moderate to moderately rapid permeability. Available water capacity is very low. Used mainly as rangeland. Susceptible to compaction.	454 (8)
28	Luhon loam (1 to 3%)	Slight	Moderate (WEG 4)	Nearly level soils on alluvial fans and valley side slopes. Parent material consists of mixed calcareous alluvium. Deep and well drained with moderate surface runoff potential and moderate permeability. Available water capacity is high. Used mainly as native pastureland; prime farmland if irrigated.[d] Susceptible to compaction; severe rutting hazard.	90 (2)

TABLE 10.4.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area (percent of SEZ)
19	Graypoint gravelly sandy loam (0 to 1%)	Slight	Moderate (WEG 4)	Nearly level soils on broad fans and fan terraces. Formed in alluvium derived from basalt. Deep and somewhat poorly drained, with moderate surface runoff potential and moderate permeability. Shrink-swell potential is low to moderate. Available water capacity is low. Used mainly as rangeland and irrigated cropland, pasture, and hay land. Susceptible to compaction.	32 (<1)
37, 38	Monte loam (0 to 3%)	Slight	Moderate (WEG 4)	Nearly level soils on alluvial fans and floodplains. Parent material consists of alluvium derived from rhyolite and latite. Soils are deep and well drained, with moderate surface runoff potential and moderate permeability. Available water capacity is high. Used mainly for native rangeland and irrigated cropland; prime farmland if irrigated. Susceptible to compaction; severe rutting hazard.	7 (<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 slop and soil erosion factor K and represent soil loss caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed by ground disturbance. A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions.

[b] To convert acres to km^2, multiply by 0.004047.

[c] WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEG 4, 86 tons per acre per year; WEG 8, 0 tons per acre per year.

[d] Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Source: NRCS (2009)

10.4.7.2 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 facilities in varying degrees and are described in more detail for the four phases of development in Section 5.7 .1.

Because impacts on soil resources result from ground-disturbing activities in the project area, soil impacts would be roughly proportional to the size of a given solar facility, with larger areas of disturbed soil having a greater potential for impacts than smaller areas (Section 5.7.2). The magnitude of impacts would also depend on the types of components built for a given facility since some components would involve greater disturbance and would take place over a longer time frame.

10.4.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified for soil resources at the proposed Los Mogotes East 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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10.4.8 Minerals (Fluids, Solids, and Geothermal Resources)

10.4.8.1 Affected Environment

The San Luis Basin in which the SEZ is located is identified as an oil and gas producing region (Burnell 2008). Currently there are no oil and gas leases in the SEZ although all of the area was leased for oil and gas at one time (BLM and USFS 2010b). There is currently no oil or gas produced in Conejos County (Burnell 2008). The San Luis Basin area has been identified in the BLM's San Luis Valley RMP (BLM 1991) as an area of low potential for oil and gas development. The area is open for discretionary mineral leasing, including leasing for oil and gas.

There are no mining claims in the SEZ (BLM and USFS 2010a), and these lands were closed to locatable mineral entry in June,2009, pending the outcome of this PEIS.

The San Luis Basin is also a region of known and potential geothermal resources, and interest in the area for possible electrical generation based on geothermal resources has increased (Burnell 2008). Several geothermal springs and wells have been developed in portions of the basin, the nearest at La Jara, about 6 mi (10 km) northeast of the proposed Los Mogotes East SEZ (Laney and Brizzee 2005). No geothermal leasing or development has occurred within the SEZ (BLM and USFS 2010b).

10.4.8.2 Impacts

If the area is identified as an SEZ, it would continue to be closed to all incompatible forms of mineral development.Since the area does not contain existing mining claims, it is assumed that valuable locatable minerals are not present on the site and there would be no loss of locatable mineral production in the future

Although the San Luis Basin in which the SEZ is located is identified as an oil and gas production area, since there are no oil and gas leases in the area and the BLM has determined that the area has low potential for oil and gas production, it is assumed there would be minimal or no effect on oil and gas resources if the area was developed for solar energy production. Additionally, oil and gas development that uses directional drilling to access resources under the area (should any be found) could be allowed.

Solar energy development of the SEZ would preclude future surface use of the site to produce geothermal energy but would not preclude the possibility of accessing geothermal resources, should any be found, through directional drilling. Because of the lack of current geothermal development within the SEZ and the potential to still access geothermal resources, solar development of the SEZ would have no impact on development of geothermal resources.

If the area is identified as an SEZ, some mineral uses might be allowed. For example, the production of common minerals, such as sand and gravel and mineral materials used for road construction, might take place in areas not directly developed for solar energy production and would not interfere with solar energy operations.

10.4.8.3 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.

10.4.9 Water Resources

10.4.9.1 Affected Environment

The proposed Los Mogotes East 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 and 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 10.4.9.1-1) while the southern portion of the valley drains to the Rio Grande (Topper et al. 2003, Mayo et al. 2007). The proposed Los Mogotes East SEZ is located in the southern portion of the San Luis Valley and has surface elevations ranging from 7,710 to 8,030 ft (2,350 to 2,448 m) with a general west to east drainage pattern. The climate of the San Luis Valley is arid, with evaporation rates often exceeding precipitation amounts (Robson and Banta 1995). The average annual precipitation and snowfall amounts in the southern San Luis Valley are on the order of 7 and 25 in. (18 and 64 cm), respectively (WRCC 2010a). Precipitation and snowfall amounts are much greater in the surrounding mountains and on the order of 27 and 237 in. (69 and 602 cm), respectively, at elevations 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).

10.4.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)

No permanent surface water bodies occur on the proposed Los Mogotes East SEZ. Several ephemeral washes drain across the site in a west to east direction as they come off the San Juan Mountains. The La Jara Reservoir is located 15 mi (24 km) to the northwest, with La Jara Creek running west to east parallel to the northern boundary of the SEZ. The Alamosa River also flows from west to east approximately 5 mi (8 km) north of the proposed SEZ. Mining activities in the headwaters of the Alamosa River has resulted in sediments and floodplain soils, as well as nearby irrigated farm fields, having elevated heavy metals concentrations (Csiki and Martin 2008). The Conejos River is located 5 mi (8 km) to the south of the SEZ (Figure 10.4.9.1-1).

Flood hazards have not been identified (Zone D) for Conejos County (FEMA 2009). Intermittent flooding may occur along the ephemeral washes with temporary ponding and erosion. Peak flows in the Conejos River are on the order of 1,000 to 2,000 ft^3/s (28 to 56 m^3/s) coming out of the San Juan Mountains (USGS 2010b, stream gauge 08246500). Given the distance to the SEZ, it is unlikely that flooding in the Conejos River would affect the proposed Los Mogotes East SEZ.

The NWI identifies several small palustrine wetlands with emergent vegetation surrounding the proposed Los Mogotes East SEZ. These wetlands are intermittently flooded, thus they are dry for most of the year. In addition, there is a large concentration of palustrine

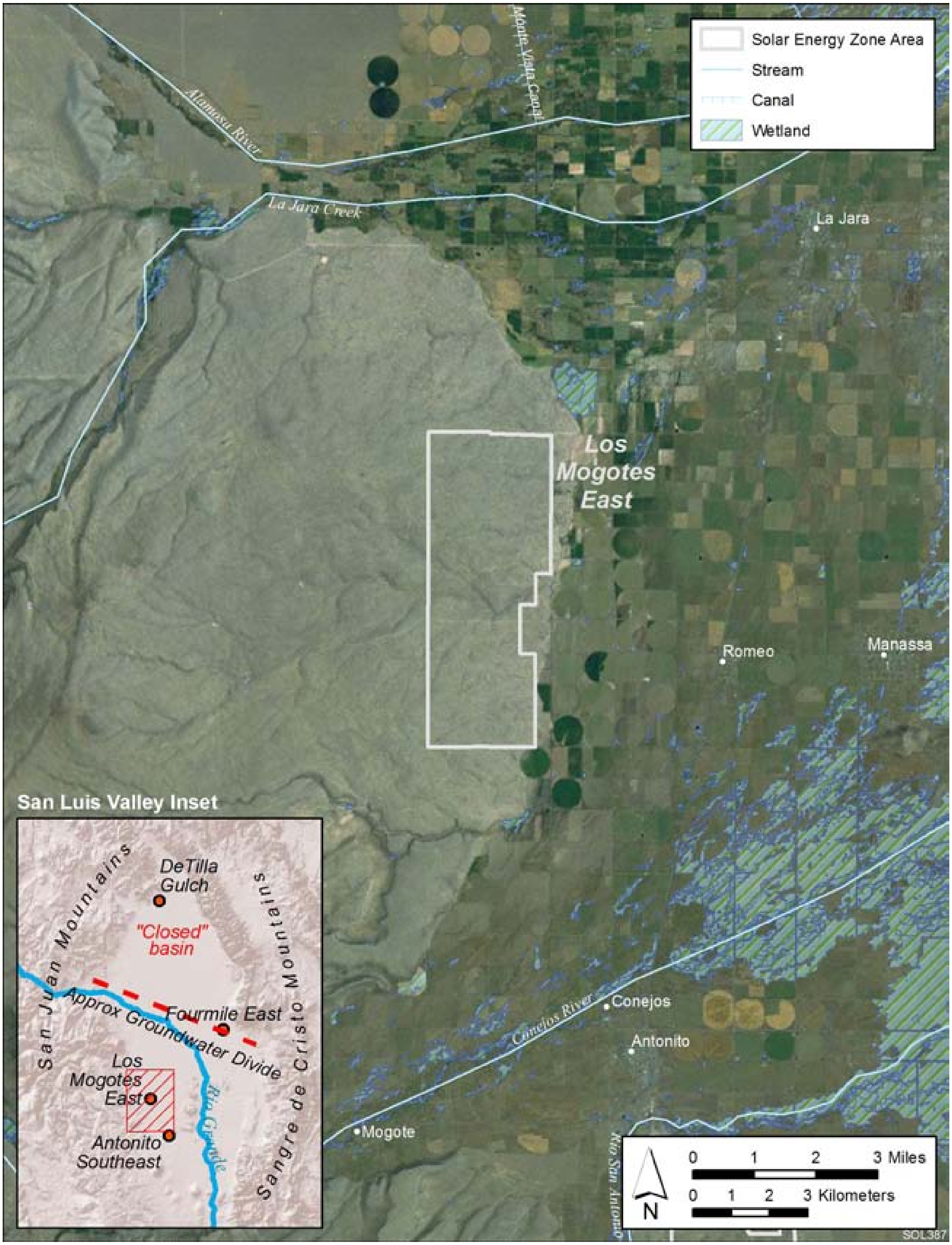

FIGURE 10.4.9.1-1 Surface Water Features in the San Luis Valley

wetlands along the riparian areas of the Conejos River. These wetlands range from being temporally to seasonally flooded (USFWS 2009b). Further information on these wetlands is described in Section 10.4.

10.4.9.1.2 Groundwater

Groundwater in the San Luis Valley is primarily in basin fill deposits ranging from 8,000 to 30,000 ft (2,438 to 9,144 m) in thickness and consisting of unconsolidated to moderately consolidated deposits of gravel, sands, and clays of Tertiary and Quaternary age (Robson and Banta 1995, Mayo et al. 2007). These basin fill deposits consist of two hydrogeologic units, the upper unconfined aquifer and the lower confined aquifer, which are separated by a series of confining clay layers and unfractured volcanic rocks (Brendle 2002). The unconfined aquifer covers most of the valley floor and occurs in unconsolidated valley sediments up to depths of 200 ft (61 m) (Mayo et al. 2007). The deeper confined aquifer covers about half of the valley floor and occurs in the unconsolidated sediments interlayered with basalt flows ranging in depth from 50 to 30,000 ft (15 to 9,100 m) (Emery 1994; Mayo et al. 2007). Groundwater flow in the upper unconfined aquifer follows the surface drainage divide in the San Luis Valley, with flows towards San Luis Lake in the northern portion of the valley (referred to as the closed basin) and flows towards the Rio Grande in the southern portion of the valley; however, flow is not separated in the lower confined aquifer, which in general flows towards the closed basin portion of the valley (Mayo et al. 2007).

Aquifers in the San Luis Valley are predominantly recharged by snowmelt runoff from higher elevations of the surrounding mountain ranges along the valley rim (Robson and Banta 1995), as well as by irrigation return flows, subsurface inflow, and seepage from streams (Emery 1994). The upper unconfined aquifer receives upward groundwater flows from the lower confined aquifer in some regions of the valley, but the conceptual model of leakage between the aquifers is not fully realized (Mayo et al. 2007). Because of the low precipitation rates and high evaporation rates in the valley, precipitation within the valley is not a significant recharge source (with only about 1% of the annual precipitation reaching the aquifers) (Robson and Banta 1995). Groundwater discharge is primarily through groundwater extractions, evapotranspiration, and surface water discharge to the Rio Grande (Emery 1994; Mayo et al. 2007). Estimates of groundwater recharge and discharge processes are variable depending upon assumptions made in performing a water balance, but total groundwater recharge and discharge for the entire San Luis Valley are on the order of 2.8 million ac-ft/yr (3.5 billion m^3/yr) (SLV Development Resources Group 2007).

The proposed Los Mogotes East SEZ is located to the west of the San Luis Hills on a thin, discontinuous veneer of alluvial sediments underlain by basalt (see Section 10.4.7.1 for further details) (Miggins et al. 2002; Machette and Thompson 2007). The confining clay layer found in the majority of the central region of the San Luis Valley ends approximately 1 mi (1.6 km) east of the proposed SEZ in the agricultural fields area as shown in Figure 10.4.9.1-1 (Colorado DWR 2010a). The basalt is not fractured enough near the surface to yield sufficient groundwater at it acts as a confining unit under the proposed SEZ. The thickness of the basalt under the site has not been characterized but is expected to vary with the old terrain of the valley at the time the basalt filled the valley, about 3.7 million years ago (Machette and Thompson 2007). Available monitoring well information is primarily available in areas east of the proposed SEZ, so further characterization of the unconfined and confined aquifers within the proposed Los Mogotes East SEZ would need to be assessed during the site characterization phase. Monitoring wells in the unconfined aquifer within 1 mi (1.6 km) to the east of the SEZ boundary drilled to depths from 30 to 50 ft (9 to 15 m) show some seasonal variations in groundwater surface elevations (rising during winter-spring and falling during summer-fall) with depths to groundwater ranging from 15 to 35 ft (5 to 11 m) below the surface (USGS 2010d; well numbers 371329106015401 and 370936106040505). The general groundwater flow pattern in the unconfined aquifer is towards the east following the Conejos River and La Jara Creek (RGWCD 2010; well numbers RGWCD59a, RGWCD73, RGWCD84, RGWCD88). Monitoring wells in the confined aquifer are located more than 4 mi (6 km) north and east of the proposed SEZ under the clay layer confining unit that indicate artesian conditions and a general flow direction from west to east (RGWCD 2010; well numbers CON01, CON02, CON03).

Water quality in the aquifers of the San Luis Valley varies according to location, with good water quality along the valley edges to poor water quality in the vicinity of the natural depression around San Luis Lake (Topper et al. 2003). Total dissolved solids (TDS) concentrations are generally less than 300 mg/L in the southern portion of the San Luis Valley in the unconfined aquifer and less than 200 mg/L in the lower confined aquifer (Mayo et al. 2007).

10.4.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals in Conejos County were estimated to be 402,680 ac-ft/yr (497 million m^3/yr), of which about 94% was from surface water sources (streams, springs, and irrigation canals and laterals). The largest water use category was irrigation, at 386,965 ac-ft/yr (477 million m^3/yr) composing 96% of the water use, which was principally supplied by surface waters. Groundwater withdrawals were primarily used for supporting aquaculture at 13,740 ac-ft/yr (16.9 million m^3/yr), irrigation at 7,712 ac-ft/yr (9.5 million m^3/yr), and public water supply at 1,614 ac-ft/yr (2.0 million m^3/yr) (Kenny et al. 2009).

Colorado administers its water rights using the Doctrine of Prior Appropriation as its cornerstone 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 Los Mogotes East 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 to 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 depletions in terms of timing, location, amount, and quality (Colorado DWR 2008).

A major element of water management in the San Luis Valley is the Rio Grande Compact of 1938, which obligates Colorado to deliver a specified quantity of water (dependent on natural supply) in the Rio Grande as it crosses the Colorado–New Mexico state line (Colorado District Court 2004). Since its inception, several U.S. Supreme Court and Colorado Supreme Court decisions (e.g., *Texas v. Colorado* 1968; *Alamosa-La Jara Water Users Protection Association v. Gould* 1983) have imposed that the Colorado Division of Water Resources develop rules and regulations regarding surface water and groundwater appropriations within the Rio Grande Basin. The process of modifying and adopting new rules and regulations regarding surface water and groundwater rights is still ongoing. Recently in 2008, the San Luis Valley Rules Advisory Committee was established to develop new rules and regulations regarding groundwater use and water rights administration in the Rio Grande Basin (Wolfe 2008). Many issues concerning the Colorado Division of Water Resources' attempts to develop a management plan for surface waters and groundwater in the Rio Grande Basin are summarized in Case Numbers 06CV64 & 07CW52 brought before the Division 3 Water Court (Colorado District Court 2010).

The new rules and regulations governing surface water and groundwater in the Rio Grande Basin are not final; however, they will impose limits on groundwater withdrawals in order to reduce groundwater extractions to a sustainable level and help sustain treaty obligations (Colorado District Court 2010, Colorado DWR 2010c). The viability of any solar energy project will depend upon its ability to secure water rights, which would need to be done by 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 (0.5 km^2) acre farm (SLV Development Resources Group 2007). The transfer of agricultural water rights for solar energy development will result in agricultural fields being put out of production and will significantly alter land use in the San Luis Valley.

Additional factors that solar projects will need to consider with respect to obtaining and transferring water rights include the location of the water right, whether it is a surface water or groundwater source, and the seniority of the water right. However, the biggest challenge in

[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).

transferring water rights for solar energy projects will be coming up with a suitable augmentation plan, which will either be accomplished through the water courts, a groundwater management plan, or a substitute water supply plan (for temporary water uses) depending upon court decisions regarding groundwater management in the San Luis Valley that are expected in the near future (Colorado District Court 2010, Colorado DWR 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).

10.4.9.2 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 excessive withdrawal from aquifers).

10.4.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy facilities, which are described in more detail for the four phases of development in Section 5.9.1; these impacts would be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2. The proposed Los Mogotes East SEZ has several ephemeral washes throughout, and several small palustrine wetlands surround the site. Siting of facilities and stormwater management plans need to address the potential impacts of increased runoff and sedimentation in the region of these washes and wetlands. Additionally, the surface sediments of the proposed Los Mogotes East SEZ would need to be assessed for potential heavy metal contamination given its proxmity to agricultural fields that have used irrigation water from the Alamosa River.

10.4.9.2.2 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 Los Mogotes East 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 51% of the SEZ total area during the peak construction year; and

- Water use requirements for hybrid cooling systems are assumed to be on the same order of magnitude as those using dry cooling (see Section 5.9.2.1).

Site Characterization. During site characterization, water would be used mainly for dust suppression and the workforce potable water supply. Impacts on water resources during this phase of development are expected to be negligible 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 Los Mogotes East 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 10.4.9.2-1 and could be as high as 964 ac-ft (1.2 million m^3). In addition, the generation of up to 74 ac-ft (91,300 m^3) of sanitary wastewater would need to be treated either on-site or sent to an off-site facility.

Groundwater wells would have to yield an estimated 425 to 597 gpm (1,609 to 2,260 L/min) to meet the estimated construction water requirements. In the San Luis Valley, current well yields for large production wells are as high as 2,000 gpm (7,571 L/min); however, the majority of well yields are less than 200 gpm (757 L/min) (RGWCD 2010). The effects of

TABLE 10.4.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Los Mogotes East SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	612	919	919	919
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	686	964	938	928
Wastewater generated				
Sanitary wastewater (ac-ft)	74	45	19	9

[a] Assumptions of water use for fugitive dust control, potable supply for workforce, and wastewater generation are presented in Appendix M.

[b] Fugitive dust control estimation assumes a local pan evaporation rate of 54 in./yr (137 cm/yr) (Cowherd et al. 1988; WRCC 2010c).

[c] To convert ac-ft to m^3, multiply by 1,234.

groundwater withdrawal and the availability of existing 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 10.4.9.2-2). At full build-out capacity, water needs for mirror/panel washing are estimated to range from 26 to 473 ac-ft/yr (32,000 to 583,400 m^3/yr). As much as 13 ac-ft/yr (16,000 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 10.4.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per MW. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

The maximum total water usage during one year of normal operations would be greatest for those technologies using the wet-cooling option and is estimated to be as high as 14,216 ac-ft/yr (17.5 million m^3/yr) (Table 10.4.9.2-2). Water usage for dry-cooling systems would be as high as 1,433 ac-ft/yr (1.8 million m^3/yr), about 10 times less than for wet cooling. Water needs for normal operations could be met by trucking in water from an off-site source

TABLE 10.4.9.2-2 Estimated Water Requirements during Normal Operations at the Proposed Los Mogotes East SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	947	526	526	526
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	473	263	263	26
Potable supply for workforce (ac-ft/yr)	13	6	6	1
Dry-cooling (ac-ft/yr)[e]	189–947	105–526	NA[f]	NA
Wet-cooling (ac-ft/yr)[e]	4,261–13,730	2,367–7,628	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	269	27
Dry-cooled technologies (ac-ft/yr)	675–1,433	374–795	NA	NA
Wet-cooled technologies (ac-ft/yr)	4,747–14,216	2,636–7,897	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[f]	269	149	NA	NA
Sanitary wastewater (ac-ft/yr)	13	6	6	1

[a] Land area for parabolic trough was estimated at 5 acres/MW (0.02 km^2/MW); land area for the power tower, dish engine, and PV technologies was estimated at 9 acres/MW (0.04 km^2/MW).

[b] Water needs are linearly related to power. Water usage for any other size project can be estimated by using multipliers provided in Table M.9-2 (Appendix M).

[c] Value assumes a usage rate of 0.5 ac-ft/yr/MW for mirror washing for parabolic trough, power tower, and dish engine technologies and a rate of 0.05 ac-ft/yr/MW for panel washing for PV systems.

[d] To convert ac-ft to m^3, multiply by 1,234.

[e] Dry-cooling value assumes 0.2 to 1.0 ac-ft/yr/MW; wet-cooling value assumes 4.5 to 14.5 ac-ft/yr/MW (range in these values represents 30 and 60% operating times) (DOE 2009a).

[f] NA = not applicable.

[g] Value scaled from 250-MW Beacon Solar project with an annual discharge of 44 gpm (167 L/min) (AECOM 2009). Blowdown estimates are relevant to wet cooling only.

for low water use technologies (e.g., dish engine or PV) or from groundwater at the site, if it is available (see Sections 10.4.9.1.2 and 10.4.9.1.3). For example, a dish engine facility would require about 269 ac-ft/yr (331,800 m^3/yr), including water needed for mirror washing and the workforce potable water supply. For a constant rate of withdrawal, this quantity of water could be obtained from a groundwater well with a pump rate of about 167 gpm (632 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 8,800 gpm (33,300 L/min) would be needed, which is approximately four times larger than the largest production wells in the San Luis Valley (RGWCD 2010). Based on water use requirements, wet-cooling technologies would not be feasible given their high water needs. In addition, any large groundwater withdrawals could adversely affect water flow in the Conejos River, which receives groundwater from the unconfined and confined aquifers.

The availability of water rights and the impacts associatedwith 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 by using water use factors described in Appendix M.9.

Normal operations at the proposed Los Mogotes East SEZ would produce up to 13 ac-ft/yr (16,000 m^3/yr) of sanitary wastewater (Table 10.4.9.2-2) that would need to be either treated 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 149 to 269 ac-ft/yr (184,000 to 332,000 m^3/yr) (Table 10.4.9.2-2). 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 would be 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.

10.4.9.2.3 Off-Site Impacts: Roads and Transmission Lines

The proposed Los Mogotes East SEZ is located adjacent to a 69-kV transmission line and about 3 mi (5 km) from U.S. 285, as described in Section 10.4.1.1.2. Impacts associated with the construction of roads and transmission lines primarily deal with water use demands for construction, water quality concerns relating to potential chemical spills, and land disturbance effects on the natural hydrology. Water needed for road modification and transmission line construction activities (e.g., for soil compaction, dust suppression, and potable supply for workers) could be trucked to the construction area from an off-site source. As a result, water impacts due to water use 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.

10.4.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources from solar energy development at the proposed Los Mogotes East 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 alter groundwater recharge and discharge processes. The proposed SEZ contains several ephemeral washes throughout, and several small palustrine wetlands surround the site. 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 and clogging of groundwater recharge areas.

Water in the Rio Grande Basin is managed strictly because of its scarcity, treaty obligations, and its necessity for supporting agriculture in the San Luis Valley. Both surface water and groundwater rights are over-appropriated, so water requirements for solar energy development would have to be met through the purchase of senior water rights. Water withdrawals in the basin are managed to control discharge to the Rio Grande system, in accordance with the Rio Grande Compact, so water withdrawals under purchased water rights would need to result in no net impact on the basin. In addition, applications for new points of groundwater diversion would have to demonstrate no impact on adjacent surface and groundwater rights holders. Since current water rights are used primarily for irrigation, the purchase and diversion of groundwater rights for solar energy facilities 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 10.4.9.1.3), the water requirements for full build-out with dry-cooled parabolic trough technology would need to fallow 896 acres (3.6 km^2) of agricultural fields, whereas PV technology would need to fallow only 17 acres (0.07 km^2). This is a hypothetical example only and does not take into account securing water rights needed for an augmentation plan either. 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 to be unfeasible (Gibson 2010, McDermott 2010).

The scarcity and strict management of water resources in the San Luis Valley suggest that utility-scale solar energy facilities that require more than 1,000 ac-ft/yr (1.2 million m^3/yr) would have a difficult time securing water rights (McDermott 2010). Considering the estimated water use requirements for the four solar energy technologies presented in Table 10.4.9.2-2, technologies using wet cooling are not feasible and dry-cooling technologies would need to use water conservation measures to try and reduce water needs. Impacts associated with groundwater withdrawals are primarily addressed by the thorough process involved in obtaining water rights in the Rio Grande Basin, which is primarily overseen by the Colorado Division of Water Resources and the Division 3 Water Court (see Section 10.4.9.1.3). Securing water rights in the Rio Grande Basin is a complex and expensive process, so dish engine and PV technologies are the preferable solar energy technologies for the proposed Los Mogotes East SEZ because of their low water use requirements.

10.4.9.3 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 Los Mogotes East SEZ include the following:

- Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures;

- Land disturbance activities should avoid impacts to the extent possible near ephemeral washes on site and surrounding wetlands;

- During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as being within a 100-year floodplain;

- 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.

10.4.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Los Mogotes East SEZ. The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and included the SEZ and a 60-ft (18-m) wide portion of an assumed access road corridor. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1-mi (1.6-km) wide assumed access road corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. No area of direct or indirect effects was assumed for new transmission lines because they are not expected to be needed for facilities on the Los Mogotes East SEZ with the proximity of an existing line.

Indirect effects considered in the assessment included effects from surface runoff, dust, and accidental spills from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. Because there is some overlap between the area of indirect effect of the SEZ and the area affected by the access road corridor, the size of the affected area is somewhat less than the sum of the areas of direct and indirect effects. These areas are defined and the impact assessment approach is described in Appendix M.

10.4.10.1 Affected Environment

The proposed Los Mogotes East SEZ is located primarily within the San Luis Alluvial Flats and Wetlands Level IV ecoregion. Although most areas within this ecoregion have been converted to irrigated cropland, remaining shrubland communities include shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), and greasewood (*Sarcobatus vermiculatus*) (Chapman et al. 2006). The northwestern portion of this 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. 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*). These ecoregions are located within the Arizona/New Mexico Plateau Level III ecoregion, which is described in Appendix I. Land areas surrounding the SEZ lie within the San Luis Alluvial Flats and Wetlands and the San Luis Shrublands and Hills Level IV ecoregions. Annual precipitation in the vicinity of the SEZ is low, averaging 7.3 in. (18.5 cm) at Manassa, Colorado (see Section 10.4.13).

Land cover types, described and mapped under the 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 Los Mogotes East SEZ are shown in Figure 10.4.10.1-1. Table 10.4.10.1-1 provides the surface area of each land cover type within the potentially affected area.

Lands within the proposed Los Mogotes East SEZ are classified primarily as Inter-Mountain Basins Semi-Desert Shrub Steppe. Additional cover types within the SEZ include Inter-Mountain Basins Semi-Desert Grassland, Inter-Mountain Basins Mixed Salt Desert Scrub, and Inter-Mountain Basins Greasewood Flat. Less than 1 acre (<0.01 km^2) of Agriculture occurs within the SEZ.

Winterfat and Greene's rabbitbrush (*Chrysothamnus greenei*) were observed to be the dominant species in some areas of the SEZ in July 2009. Large areas of the SEZ support a shrub steppe community, while other areas of the SEZ support a shrub-dominated community with few associated grasses. 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.

Lands within the access road corridor include 12 cover types. Agriculture is the predominant cover type in the corridor; Invasive Annual and Biennial Forbland and Inter-Mountain Basins Semi-Desert Shrub Steppe are also common cover types. Additional cover types include a wide variety of woodland, shrubland and grassland types (Table 10.4.10.1-1).

The area surrounding the SEZ, within 5 mi (8 km), includes 26 cover types, which are listed in Table 10.4.10.1-1. The predominant cover types are Agriculture and Inter-Mountain Basins Semi-Desert Shrub Steppe.

Numerous ephemeral dry washes occur within the SEZ and access road corridor. These dry washes typically contain water for short periods during or following precipitation events, and include temporarily flooded areas, but typically do not support wetland or riparian habitats. However, a number of the intermittent streams that cross the SEZ support riparian habitats of grasses and scattered shrubs. Squawbush (*Rhus trilobata*) was observed on the SEZ in July 2009 in the upper margins of riparian areas. The NWI does not identify any wetlands within the SEZ; however, all or portions of 12 wetlands occur within the assumed access road corridor, and total 43 acres (0.17 km^2) (Figure 10.4.10.1-2) (USFWS 2009b). NWI maps are produced from high-altitude imagery and are subject to uncertainties inherent in image interpretation (USFWS 2009b). Seven of these wetlands are classified as excavated aquatic bed wetlands while five support emergent plant communities. Emergent plant communities are composed primarily of herbaceous species rooted in shallow water or saturated soil. These range from temporarily flooded to seasonally flooded and occur primarily within the Agriculture cover type with a small portion in Invasive Annual and Biennial Forbland.

A number of small wetlands occur near the SEZ, outside of the access road corridor. Most of these wetlands are classified as palustrine wetlands with emergent plant communities and hydrologic regimes that range from intermittently flooded (surface water is usually absent

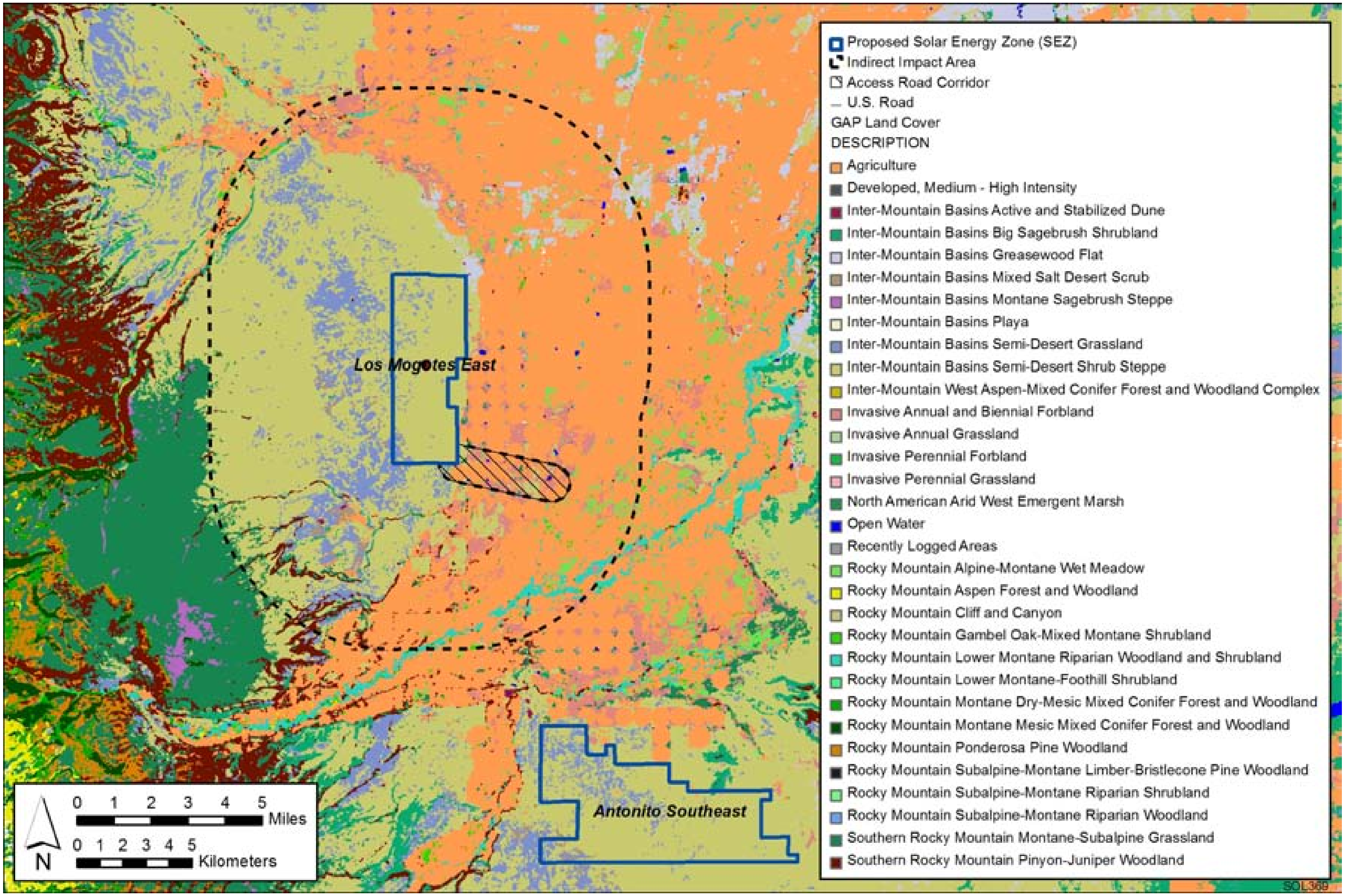

FIGURE 10.4.10.1-1 Land Cover Types within the Proposed Los Mogotes East SEZ (Source: USGS 2004)

TABLE 10.4.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Los Mogotes East SEZ and Potential Impacts

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Access Road (Direct Effects)[e]	Overall Impact Magnitude[f]
S079 Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	5,439 acres[g] (0.8%, 2.2%)	34,970 acres (5.0%)	3 acres (<0.1%)	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.	428 acres (0.6%, 1.6%)	6,906 acres (10.2%)	<1 acre (<0.1%)	Small
S065 Inter-Mountain Basins Mixed Salt Desert Scrub: Generally consists of open shrublands which include at least one species of Atriplex along with other shrubs. Perennial grasses dominate a sparse to moderately dense herbaceous layer.	19 acres (1.4%, 1.8%)	557 acres (40.9%)	0 acres	Moderate
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.	8 acres (<0.1%,<0.1%)	1,145 acres (0.5%)	<1 acre (<0.1%)	Small
N80 Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	<1 acre (<0.1%, <0.1%)	42,014 acres (6.8%)	12 acres (<0.1%)	Small

TABLE 10.4.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b]			Overall Impact Magnitude[f]
	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Access Road (Direct Effects)[e]	
D09 Invasive Annual and Biennial Forbland: Areas dominated by annual and biennial non-native forb species.	0 acres	5,434 acres (10.1%)	5 acres (<0.1%)	Small
S102 Rocky Mountain Alpine-Montane Wet Meadow: Occurs on wet soils in very low-velocity areas along ponds, lakes, streams, and toeslope seeps. This cover type is dominated by herbaceous species and often occurs as a mosaic of several plant associations. The dominant species are often grass or grass-like plants.	0 acres	1,409 acres (1.3%)	<1 acre (<0.1%)	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	851 acres (0.3%)	<1 acre (<0.1%)	Small
S054 Inter-Mountain Basins Big Sagebrush Shrubland: Dominated by basin big sagebrush (*Artemisia tridentata tridentata*), Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), or both. Other shrubs may be present. Perennial herbaceous plants are present but not abundant.	0 acres	690 acres (0.1%)	<1 acre (<0.1%)	Small
N11 Open Water: Plant or soil cover is generally less than 25%.	0 acres	80 acres (0.4%)	<1 acre (<0.1%)	Small

TABLE 10.4.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Access Road (Direct Effects)[e]	Overall Impact Magnitude[f]
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	1,346 acres (0.4%)	<1 acre (<0.1%)	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	184 acres (0.1%)	<1 acre (<0.1%)	Small
D06 Invasive Perennial Grassland: Dominated by non-native perennial grasses.	0 acres	41 acres (1.8%)	<1 acre (<0.1%)	Small
S093 Rocky Mountain Lower Montane Riparian Woodland and Shrubland: Occurs on streambanks, islands, and bars, in areas of annual or episodic flooding, and often occurs as a mosaic of tree-dominated communities with diverse shrubs.	0 acres	863 acres (3.0%)	0 acres	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	67 acres (<0.1%)	0 acres	Small

TABLE 10.4.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Access Road (Direct Effects)[e]	Overall Impact Magnitude[f]
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	62 acres (0.3%)	0 acres	Small
D07 Invasive Perennial Forbland: Dominated by non-native perennial forb species.	0 acres	34 acres (20.5%)	0 acres	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	16 acres (0.1%)	0 acres	Small
N22 Developed, Medium–High Intensity: Includes housing and commercial/industrial development. Impervious surfaces compose 50 to 100% of the total land cover.	0 acres	12 acres (0.9%)	0 acres	Small
S032 Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland: Occurs on mountain slopes, canyon sideslopes, and ridgetops. Shrub and graminoid species are generally present.	0 acres	12 acres (<0.1%)	0 acres	Small

TABLE 10.4.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Access Road (Direct Effects)[e]	Overall Impact Magnitude[f]
N21 Developed, Open Space – Low Intensity: Includes housing, parks, golf courses, and other areas planted in developed settings. Impervious surfaces compose up to 49% of the total land cover.	0 acres	11 acres (0.8%)	0 acres	Small
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	4 acres (0.1%)	0 acres	Small
S091 Rocky Mountain Subalpine-Montane Riparian Shrubland: Occurs along low-gradient streams, alluvial terraces, and floodplains; around seeps, fens, and isolated springs on hillslopes; and in above-treeline snowmelt-fed basins. This cover type often occurs as a mosaic of shrub and herbaceous communities.	0 acres	3 acres (<0.1%)	0 acres	Small
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	2 acres (<0.1%)	0 acres	Small
D03 Recently Mined or Quarried: Includes open pit mines and quarries.	0 acres	2 acres (0.4%)	0 acres	Small

TABLE 10.4.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Corridor and Outside SEZ (Indirect Effects)[d]	Assumed Access Road (Direct Effects)[e]	Overall Impact Magnitude[f]
D08 Invasive Annual Grassland: Dominated by non-native annual grass species.	0 acres	1 acre (0.4%)	0 acres	Small

[a] Land cover descriptions are from USGS (2005). Full descriptions of land cover types, including plant species, can be found in Appendix J. Some wetlands within the assumed access road corridor are not mapped as wetland cover types by SWReGAP.

[b] Area in acres, determined from USGS (2004).

[c] Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region. Some wetlands within the assumed access road corridor are not mapped as wetland cover types by SWReGAP.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and within a 1-mi (1.6-km) wide assumed access road corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project facilities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. It includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.

[e] For the access road, direct effects were estimated within a 3-mi (5-km) long, 60-ft (18-m) wide ROW for an assumed access road connecting to the nearest highway. Impacts are for the area of the cover type within the assumed ROW, the percentage that area represents of all occurrences of that cover type within the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and are (1) *small*: a relatively small proportion of the cover type (≤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.

[g] To convert acres to km^2, multiply by 0.004047.

1

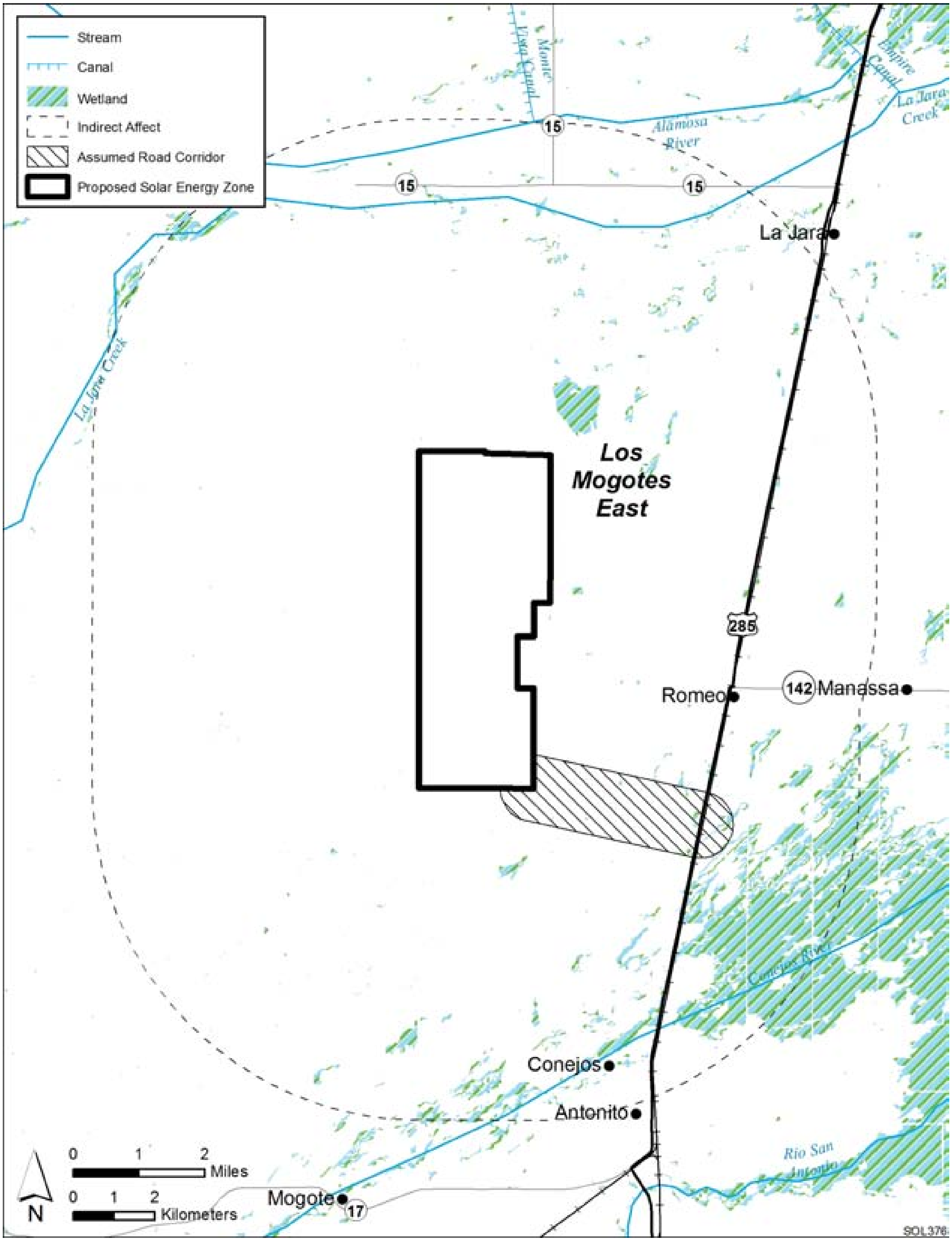

FIGURE 10.4.10.1-2 Wetlands within the Proposed Los Mogotes East SEZ (Source: USFWS 2009a)

but may be present for variable periods) to seasonally flooded (surface water is present for extended periods, particularly early in the growing season, but is usually absent by the end of the growing season). Several support only a sparse plant cover. Wetlands to the west of the SEZ are primarily associated with ephemeral streams, which flow to the east. These wetlands primarily occur within the Inter-Mountain Basins Semi-Desert Shrub Steppe cover type. Many of the small wetlands east of the SEZ are excavated ponds that support floating aquatic plant communities.

A large palustrine wetland with emergent plant communities occurs 0.5 mi (0.8 km) northeast of the SEZ. This 268-acre (1.08-km^2) wetland receives surface water flows from the northern portion of the SEZ (Figure 10.4.10-2). La Jara Creek, with emergent and scrub shrub wetlands, lies downstream of this wetland. Extensive palustrine wetlands are associated with the Conejos River to the south and southeast of the SEZ. These wetlands primarily support emergent plant communities and range from being temporarily flooded (when surface water is present for brief periods during the growing season, but the water table is usually located well below the soil surface) to being seasonally flooded; however, forested and scrub/shrub wetlands also occur, especially near stream channels. These wetlands include Rocky Mountain Alpine-Montane Wet Meadow and Rocky Mountain Lower Montane Riparian Woodland and Shrubland cover types. See Section 10.4.9.1.1 for a description of the hydrological characteristics of wetlands in the vicinity of the SEZ.

The State of Colorado maintains an official state list of weed species that are designated noxious species. Table 10.4.10.1-2 provides a summary of the noxious weed species regulated in Colorado that are known to occur in Conejos County. No species included in Table 10.4.10.1-2 was observed on the SEZ.

TABLE 10.4.10.1-2 Colorado Noxious Weeds Occurring in Conejos County[a]

Common Name	Scientific Name	Status
Black henbane	*Hyoscyamus niger*	List B
Bull thistle	*Cirsium vulgare*	List B
Hoary cress	*Cardaria draba*	List B
Leafy spurge	*Euphorbia esula*	List B
Oxeye daisy	*Chrysantheum leucanthemum*	List B
Perennial pepperweed	*Lepidium latifolium*	List B
Russian knapweed	*Acroptilon repens*	List B
Scotch thistle	*Onopordum acanthium*	List B
Yellow toadflax	*Linaria vulgaris*	List B
Canada thistle	*Cirsium arvense*	List B
Musk thistle	*Carduus nutans*	List B
Field bindweed	*Convolvulus arvensis*	List C

[a] County occurrence was determined from USDA (2010).

Source: CDA (2010).

The Colorado Department of Agriculture classifies noxious weeds into one of three lists (CDA 2010):

- "List A species in Colorado that are designated by the Commissioner for eradication."

- "List B weed species are species for which the Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, develops and implements state noxious weed management plans designed to stop the continued spread of these species."

- "List C weed species are species for which the Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, will develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans will not be to stop the continued spread of these species but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species."

Nineteen noxious weeds and invasive plant species are known or suspected to occur in the San Luis Valley Resource Area, which includes the proposed Los Mogotes East SEZ (Table 10.4.10.1-3).

Species that are known to occur near the SEZ include Russian knapweed, hoary cress, musk thistle, Canada thistle, field bindweed, black henbane, perennial pepperweed, and yellow toadflax (BLM 2010a). The only species from Table 10.4.10.1-3 on List A, Hydrilla, is an aquatic species and not known to occur in the vicinity of the SEZ.

10.4.10.2 Impacts

The construction of solar energy facilities within the proposed Los Mogotes East 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 (4,734 acres [19.2 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

TABLE 10.4.10.1-3 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 (2010).

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 on vegetation from solar energy development that are encountered within the SEZ or along related ROWs are described in more detail in Section 5.10.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A .2.2, and through any additional mitigation applied. SEZ-specific design features are described in Section 10.4.10.3.

10.4.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact could affect a relatively small proportion (≤1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); moderate if it could affect an intermediate proportion (>1 but ≤10%) of cover type; and large if it 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 cover type. Additional cover types within the SEZ that would be affected include Inter-Mountain Basins Semi-Desert Grassland, Inter-Mountain Basins Mixed Salt Desert Scrub, and Inter-Mountain Basins Greasewood Flat. 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 Los Mogotes East SEZ are summarized in Table 10.4.10.1-1. Most of these cover types are relatively common in the SEZ region. Full development of the SEZ would result in moderate impacts on Inter-Mountain Basins Mixed Salt Desert Scrub. This cover type is relatively uncommon, representing 0.03% of the land area within the SEZ region. Full development of the SEZ would result in small impacts on all other cover types in the affected area.

Re-establishment of shrub or grassland communities in temporarily disturbed areas would likely be very difficult because of the arid conditions and may require extended periods of time. In addition, noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation.

Potential impacts on wetlands as a result of solar energy facility development are described in Section 5.6.1. Specific to the affected area of the proposed Los Mogotes East SEZ, approximately 43 acres (0.17 km^2) of wetland habitat occur within the assumed access road corridor and could be affected by construction within the ROW. No wetlands have been identified within the SEZ.

Grading could result in direct impacts on the wetlands within the access road corridor if fill material is placed within wetland areas. Grading near wetlands in the corridor or near the SEZ 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 in the corridor or near the SEZ, such as the large wetland northeast of 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. The wetlands located to the west 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 downgradient 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 or the access road corridor could also be affected by ground-disturbing activities. Grading could also affect dry washes within the SEZ or corridor, 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 10.4.9 for further discussion of washes.

Although the use of groundwater within the Los Mogotes East 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 10.4.9). Plant communities supported by groundwater discharge, such as those along the Conejos River, could become degraded or lost as a result of groundwater flow alterations.

The deposition of fugitive dust from disturbed soils onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition. Communities that would be most likely affected northeast of the SEZ, the predominant downwind direction, are those of the Inter-Mountain Basins Semi-Desert Shrub Steppe cover type, as well as Agriculture. Inter-Mountain Basins Greasewood Flat, Invasive Annual and Biennial Forbland, Inter-Mountain Basins Semi-Desert Grassland, Rocky Mountain Alpine-Montane Wet Meadow, Southern Rocky Mountain Montane-Subalpine Grassland, Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Active and Stabilized Dune, Rocky Mountain Gambel Oak-Mixed Montane Shrubland, Rocky Mountain Ponderosa Pine Woodland, Rocky Mountain Lower Montane Riparian Woodland and Shrubland, and Southern Rocky Mountain Pinyon-Juniper Woodland also occur to the northeast.

10.4.10.2.2 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 61836, Feb. 8, 1999). Potential impacts resulting from noxious weeds and invasive plant species as a result of solar energy facility development are described in Section 5.10.1. Despite required programmatic design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in and adjacent to the affected area of the proposed Los Mogotes East 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 weed species that are known to occur in San Luis Valley near the SEZ include Russian knapweed, hoary cress, musk thistle, Canada thistle, field bindweed, black henbane, perennial pepperweed, and yellow toadflax. Additional species known to occur in Conejos County or the San Luis Valley Resource Area are given in Table 10.4.10.1-2 and Table 10.4.10.1-3, respectively. Approximately 4,956 acres (20.06 km^2) of Invasive Annual and Biennial Forbland, 39 acres (0.16 km^2) of Invasive Perennial Grassland, 34 acres (0.14 km^2) of Invasive Perennial Forbland, and 1 acre (0.004 km^2) of Invasive Annual Grassland occur within 5 mi (8 km) of the SEZ. Land disturbance from project activities and indirect effects of construction and operation could result in the expansion of these invasive species populations.

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 spread of noxious weeds and invasive species. Disturbed areas, including 42,014 acres (170.0 km^2) of Agriculture, 12 acres (0.05 km^2) of Developed, Medium–High Intensity, 11 acres (0.04 km^2) of Developed, Open Space – Low Intensity, and 2 acres (0.008 km^2) of Recently Mined or Quarried occur within the area of indirect effects and may contribute to the establishment of noxious weeds and invasive species.

10.4.10.3 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 whenproject details are considered, 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 semidesert shrub steppe and semidesert grassland habitats and minimize the potential for the spread of invasive species. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

- All dry wash habitats within the SEZ and all wetland and dry wash habitats within the assumed access road corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around wetlands and dry washes to reduce the potential for impacts on these habitats.

- Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, and riparian habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, or accidental spills, and fugitive dust deposition. Maintaining sediment and erosion controls along drainages would reduce the potential for impacts on wetlands near or downgradient from the SEZ. Appropriate buffers and engineering controls would be determined through agency consultation.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on wetlands or springs near the SEZ associated with groundwater discharge, such as the wetlands along the Conejos River.

If these SEZ-specific design features are implemented, it is anticipated that a high potential for impacts from invasive species and impacts on wetlands, springs, dry washes, and riparian habitats would be reduced to a minimal potential for impact. Residual impacts on wetlands or springs could result from remaining groundwater withdrawal; however, it is anticipated that these impacts would be avoided in the majority of instances.

10.4.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could potentially occur within the potentially affected area of the proposed Los Mogotes East 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 SEZ by 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 would occur) and included the SEZ and a 60-ft (18-m) wide portion of an assumed 3-mi (4.8-km) long access road. The maximum developed area within the SEZ would be 4,734 acres (19.2 km^2).

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary, which includes the 1-mi (1.6-km) wide assumed access road where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effects (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or transmission line construction area). Potentially suitable habitat for a species within the SEZ greater than the maximum of 4,734 acres (19.2 km^2) of direct effects 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 effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. These areas of direct and indirect effects are defined and the impact assessment approach is described in Appendix M. No area of direct or indirect effects was assumed for a new access road because of the proximity of an existing state highway to the SEZ.

The primary habitat type within the affected area is semiarid shrub-steppe (Section 10.4.10), although aquatic and riparian habitats occur along the Alamosa River, the Conejos River, and La Jara Creek within the area of indirect effects (Figure 10.4.10.1-1). No permanent water bodies occur within the proposed Los Mogotes East SEZ, but several washes cross the site. Several small, palustrine wetlands that may contain surface water for variable periods of time throughout the year occur surround the SEZ, while a large concentration of temporarily to seasonally flooded palustrine wetlands occurs along the riparian areas of the Conejos River (Section 10.4.9.1.1).

10.4.11.1 Amphibians and Reptiles

10.4.11.1.1 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 Los Mogotes East SEZ. The list of amphibian and reptile 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.

Based on the distribution and habitat preferences of amphibian species in southern Colorado (SWReGAP 2007; CDOW 2009), seven amphibian species could be associated with the aquatic and wetland habitats located near the proposed Los Mogotes East SEZ: the bullfrog (*Rana catesbeiana*), New Mexico spadefoot (*Spea multiplicata*), northern leopard frog (*Rana pipiens*), tiger salamander (*Ambystoma tigrinum*), plains spadefoot (*Spea bombifrons*), western chorus frog (*Pseudacris triseriata*), and Woodhouse's toad (*Bufo woodhousii*). Based on habitat preferences of the amphibian species, Woodhouse's toad would be expected to occur within the SEZ (USGS 2007; Stebbins 2003). Amphibian surveys would need to be conducted to confirm which species occur within the area and whether any amphibian species occur near the wetlands within the SEZ.

Reptile species that could occur within the proposed Los Mogotes East SEZ include the fence lizard (*Sceloporus undulatus*), gopher snake (*Pituophis catenifer*), western rattlesnake (*Crotalus viridis*), short-horned lizard (*Phrynosoma hernandesi*), and western terrestrial garter snake (*Thamnophis elegans*) (CDOW 2009; NMDGF 2009; Stebbins 2003).

Table 10.4.11.1-1 provides habitat information and the types and overall area of suitable land cover for representative amphibian and reptile species that could occur in the SEZ.

10.4.11.1.2 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 inAppendix A, Section A.2.2, and through the applicaton of any additional mitigation. Section 10.4.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed Los Mogotes East 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 10.4.11.1.1, following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific

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TABLE 10.4.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Los Mogotes East SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	
Amphibians					
Woodhouse's toad (*Bufo woodhousii*)	Mesic areas near streams and rivers. Often in agricultural areas and river floodplains. Prefers sandy areas. Can move several hundred meters between breeding and nonbreeding habitats. About 2,601,500 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	86,400 acres of potentially suitable habitat (3.3% of available potentially suitable habitat)	17 acres of potentially suitable habitat lost and 1,495 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
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 1,800,000 acres[h] of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	45,346 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 348 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
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 801,500 acres of potentially suitable habitat occurs in the SEZ region.	428 acres of potentially suitable habitat lost (0.05% of available potentially suitable habitat)	8,312 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	0.4 acre of potentially suitable habitat in area of potential direct effect and 33.6 acres of potentially suitable habitat in area of indirect effect	Small overall impact.. Avoidance of prairie dog colonies would reduce the potential for impact.

TABLE 10.4.11.1-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
Short-horned lizard (*Phrynosoma hernandesi*)	Short-grass prairies, sagebrush, semidesert shrublands, shale barrens, pinyon-juniper and pine-oak woodlands, oak-grass associations, and open conifer forests in mountainous areas. About 3,137,900 acres of potentially suitable habitat occurs in the SEZ region	428 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat)	12,233 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 98 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Snakes					
Gophersnake (*Pituophis catenifer*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 2,050,400 acres of potentially suitable habitat occurs in the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat)	50,081acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	13 acres of potentially suitable habitat in area of potential direct effect and 1,165 acres of potentially suitable habitat in area of indirect effect	Small overall impact.
Western rattlesnake (*Crotalus viridis*)	Most terrestrial habitats. Typically inhabits plains grasslands, sandhills, semidesert and mountain shrublands, riparian areas, and montane woodlands. About 3,555,900 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	87,328 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,498 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 10.4.11.1-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Western terrestrial garter snake (*Thamnophis elegans*)	Most terrestrial and wetland habitats near bodies of water, but can be found many miles from water. About 2,713,600 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	38,382 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 349 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

a Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

b Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area.

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 4,734 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 4,734 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

e For access road development, direct effects were estimated within a 3-mi (4.8-km), 60-ft (18-m) wide access road ROW from the SEZ to the nearest existing highway. As the access road corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the access road.

f Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

Footnotes continued on next page.

TABLE 10.4.11.1-1 (Cont.)

[g] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDOW (2009); NatureServe (2010); NDCNR (2002); USGS (2004, 2005, 2007).

impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 10.4.11.1.3).

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. Table 10.4.11.1-2 summarizes the potential magnitude of impacts on representative amphibian and reptile species resulting from solar energy development on the Los Mogotes East SEZ. Based on the impacts on amphibian and reptiles summarized in Table 10.4.11.1-1, direct impacts on amphibian and reptile species would be small, as 0.3% or less of potentially suitable habitats identified for each species in the SEZ region would be lost. Larger areas of potentially suitable habitats for amphibians and reptile species occur within the area of potential indirect effects (e.g., up to 2.5% of potentially available habitat for the fence lizard). Other impacts on amphibians and reptiles could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, collection, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

Decommissioning 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.

10.4.11.1.3 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., washes). Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While some SEZ-specific design features are best established when project details are considered, design features that can be identified at this time include the following:

- Wash habitats within the SEZ should be avoided to the extent practicable.

- Appropriate engineering controls should be used to minimize impacts on palustrine wetlands surrounding the SEZ resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats.

- The access road should be sited and constructed to minimize impacts on wetlands (if present within the finalized access road location).

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, because 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.

10.4.11.2 Birds

10.4.11.2.1 Affected Environment

This section addresses bird species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Los Mogotes East 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. Within the proposed Los Mogotes East SEZ, waterfowl, wading birds, and shorebirds are uncommon because of the lack of aquatic and wetland habitats. The Alamosa River, the Conejos River, La Jara Creek, and Monte Vista Canal, which occur within the 5-mi (8-km) area of indirect effects adjacent to the SEZ, provide habitat more suitable for waterfowl, wading birds, and shorebirds. The mountain plover (*Charadrius montanus*) may occur on the SEZ. This special status species is discussed in Section 10.4.12.

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. Neotropical migrant species that are common or abundant within Conejos County and that are expected to occur within the proposed Los Mogotes East SEZ include the Brewer's blackbird (*Euphagus cyanocephalus*), Brewer's sparrow (*Spizella breweri*), common nighthawk (*Chordeiles minor*), horned lark (*Eremophila alpestris*), 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*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), short-eared owl (*Asio flammeus*), Swainson's hawk (*Buteo swainsoni*), and turkey vulture (*Cathartes aura*). Special status birds of prey species are discussed in Section 10.4.12

Upland Game Birds

Section 4.10.2.2.5 provides an overview of the upland game birds (primarily pheasants, grouse, quail, and doves) that occur within the six-state study area. The mourning dove (*Zenaida macroura*) is the only upland game bird species expected to occur within the proposed Los Mogotes East SEZ. No activity areas mapped for various upland game bird species, such as the wild turkey (*Meleagris gallopavo*), occur within 5 mi (8 km) of the SEZ (CDOW 2008).

Table 10.4.11.2-1 provides habitat information and the types and overall area of potentially suitable land cover for most of the representative bird species mentioned above.

10.4.11.2.2 Impacts

The types of impacts that birds could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through application of any additional mitigation measures. Section 10.4.11.2.3, below, identifies design features of particular relevance to the proposed Los Mogotes East 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 10.4.11.2.1, 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 10.4.11.2.3).

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 10.4.11.2-1 summarizes the potential impacts on representative bird species resulting from solar energy development in the proposed Los Mogotes East SEZ. Direct impacts on bird species would be small, because only 0.3% or less of potentially suitable habitats identified for each species would be lost (Table 10.4.11.2-1). Larger areas of potentially suitable habitat for bird species occur within the area of potential indirect effects (e.g., up to 5.1% of available potentially suitable habitat for the northern rough-winged swallow). Other impacts on birds could result from collision with the access road and buildings, surface water and sediment runoff from

TABLE 10.4.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Los Mogotes East SEZ

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants					
Brewer's blackbird (*Euphagus cyanocephalus*)	Meadows, grasslands, riparian areas, agricultural and urban areas, and occasionally in sagebrush in association with prairie dog colonies and other shrublands. Requires dense shrubs for nesting. Roosts in marshes or dense vegetation. In winter, most often near open water and farmyards with livestock. About 1,741,300 acres of potentially suitable habitat occurs in the SEZ region.	436 acres of potentially suitable habitat lost (0.03% of available potentially suitable habitat)	52,028 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	13 acres of potentially suitable habitat in area of potential direct effect and 1,189 acres of potentially suitable habitat in area of indirect effect	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 occurs 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 766,300 acres of potentially suitable habitat occurs in the SEZ region.	447 acres of potentially suitable habitat lost (0.06% of available potentially suitable habitat)	9,161 acres of potentially suitable habitat (1.2% of available potentially suitable habitat)	0.4 acre of potentially suitable habitat in area of potential direct effect and 37.6 acres of potentially suitable habitat in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

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TABLE 10.4.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
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 2,637,000 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	86,424 acres of potentially suitable habitat (3.3% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,496 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
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 occurs in agricultural areas. Usually occurs where plant density is low and there are exposed soils. About 2,150,200 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	85,977 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,464 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.4.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 2,484,300 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	90,292 acres of potentially suitable habitat (3.6% of available potentially suitable habitat)	21 acres of potentially suitable habitat in area of potential direct effect and 1,967 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Western meadowlark (*Sturnella neglecta*)	Agricultural areas, especially in winter. Also inhabits native grasslands, croplands, weedy fields, and less commonly in semidesert and sagebrush shrublands. About 1,953,600 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	87,656 acres of potentially suitable habitat (4.5% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,515 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 10.4.11.2-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey					
American kestrel (*Falco sparverius*)	Wide variety of open to semi-open habitats including agricultural areas, grasslands, riparian forest edges, and urban areas. Occurs in most habitats, especially during migration. About 4,300,400 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	89,372 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,515 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
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 4,762,400 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	90,664 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	17 acres of potentially suitable habitat in area of potential direct effect and 1,526 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.

TABLE 10.4.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Red-tailed hawk (*Buteo jamaicensis*)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 3,176,400 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	84,620 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	12 acres of potentially suitable habitat in area of potential direct effect and 1,152 acres of potentially suitable habitat in area of indirect effect)	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
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 1,737,900 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	84,926 acres of potentially suitable habitat (4.9% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,459 acres of potentially suitable habitat in area of indirect effect	Small overall impact.. Avoidance of nest trees would further reduce the potential for impact.
Turkey vulture (*Cathartes aura*)	Occurs in areas of pastured rangeland, non-intensive agriculture, or wild areas with rock outcrops suitable for nesting. Migrates and forages over most open habitats. Will roost communally in trees, exposed boulders, and occasionally access road support towers. About 1,080,300 acres of potentially suitable habitat occurs in the SEZ region.	19 acres of potentially suitable habitat lost (<0.01% of available potentially suitable habitat)	43,671 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	12 acres of potentially suitable habitat in area of potential direct effect and 1,128 acres of potentially suitable habitat in area of indirect effect	Small overall impact.

TABLE 10.4.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Western burrowing owl (*Athene cunicularia*)	Well-drained grasslands, prairies, steppes, deserts, and agricultural lands. Nests in prairie dog colonies. About 1,932,000 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	83,786 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 359 acres of potentially suitable habitat in area of indirect effect	Small overall impact.. Avoidance of prairie dog colonies would further reduce the potential for impact.
Upland Game Birds					
Mourning dove (*Zenaida macroura*)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 3,071,900 acres of potentially suitable habitat occurs in the SEZ region	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	93,404 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	21 acres of potentially suitable habitat in area of potential direct effect and 1,957 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area.

[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 4,734 acres of direct effect within the SEZ was assumed.

Footnotes continued on next page.

TABLE 10.4.11.2-1 (Cont.)

[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 4,734 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For access road development, direct effects were estimated within a 3-mi (4.8-km), 60-ft (18-m) wide access road ROW from the SEZ to the nearest existing highway. As the access road corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the access road.

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDOW (2009); NatureServe (2009); NDCNR (2002); USGS (2004, 2005, 2007).

disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (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, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for bird species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

10.4.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

The successful implementation of programmatic design features presented in Appendix A, Section A.2.2, would reduce the potential for effects on birds, especially species that depend on habitat types that could be avoided (e.g., washes). Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While some SEZ-specific design features important to reducing impacts on birds are best established when project details are considered, some design features can be identified at this time, as follows:

- For solar energy facilities 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.

- The access road should be sited and constructed to minimize impacts on wetlands and riparian areas (if present within the finalized access road location).

- Appropriate engineering controls should be used to minimize impacts resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition.

- If present, prairie dog colonies (which could provide habitat or a food source for some bird species) should be avoided to the extent practicable.

If these SEZ-specific design features are implemented in addition to other 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, because 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.

10.4.11.3 Mammals

10.4.11.3.1 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 Los Mogotes East SEZ. The list of mammal species potentially present in theSEZ 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. 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 Los Mogotes East 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 10.4.11.3-1 provides a description of the various activity areas that have been mapped for the big game species in Colorado. Table 10.4.11.3-2 provides habitat information for representative big game species that could occur within the proposed Los Mogotes East 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 Los Mogotes East 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 distances of the SEZ to these American black bear activity areas are fall concentration area, 6 mi (10 km), and summer concentration area, 9 mi (15 km). Because the American black bear inhabits montane shrublands and forests and subalpine forests at moderate elevations in Colorado (CDOW 2009), it is not expected to frequent the Los Mogotes East SEZ.

TABLE 10.4.11.3-1 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 two worst winters out of ten. 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 five winters out of ten.
Winter range	That part of the overall range where 90% of the individuals are located during an average of five winters out of ten from the first heavy snowfall to spring green-up.

Source: CDOW (2008).

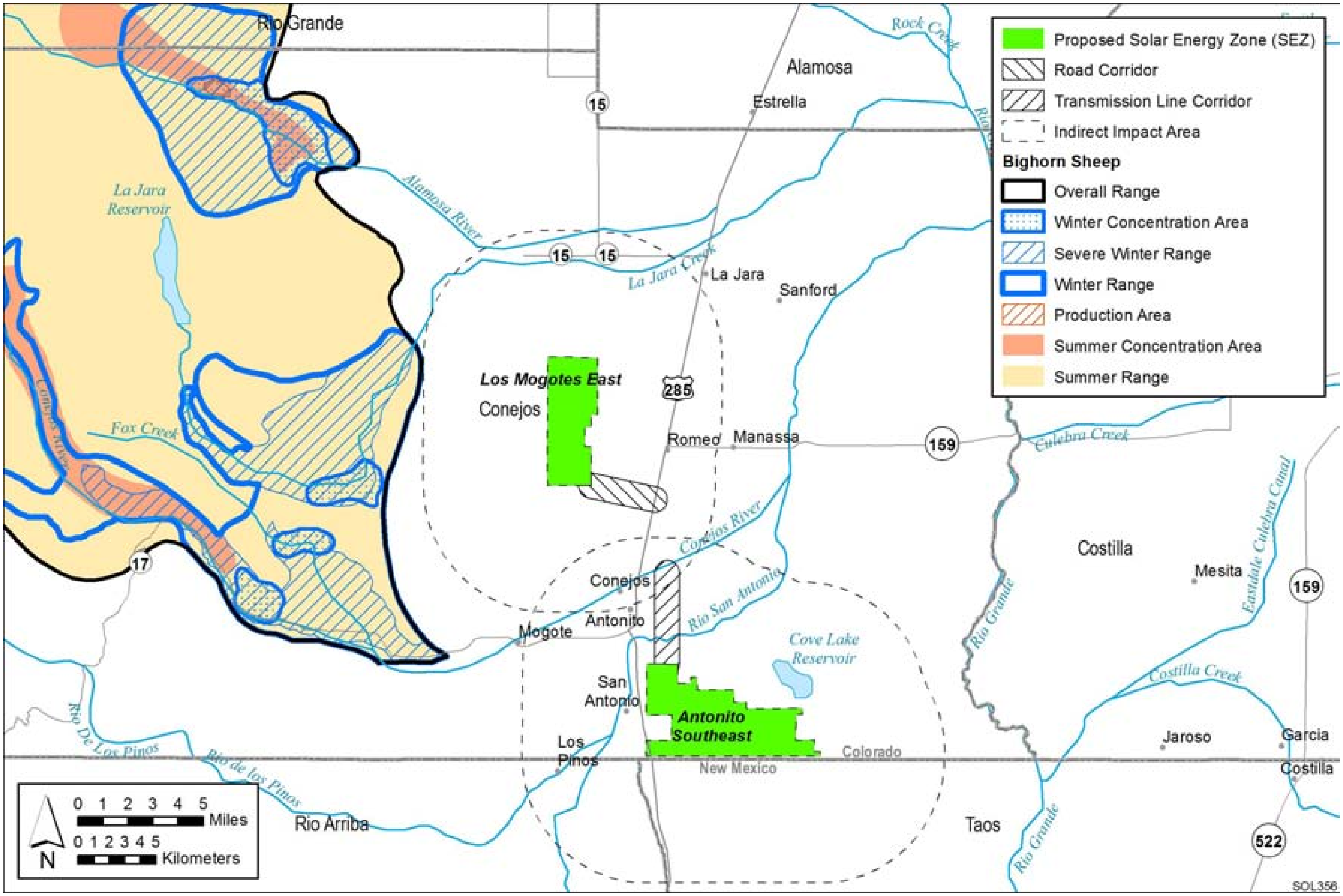

FIGURE 10.4.11.3-1 Bighorn Sheep Activity Areas within the Region That Encompasses the Proposed Los Mogotes East SEZ (Source: CDOW 2008)

Bighorn Sheep. No mapped activity areas for the bighorn sheep occur in the Los Mogotes East SEZ (Figure 10.4.11.3-1). Several bighorn sheep activity areas occur about 5 mi (8 km) from the SEZ: overall range, 5 mi (8 km); winter range, 5.0 mi (8.0 km); severe winter range, 5 mi (8 km); and summer range, 5 mi (8 km). All these activity areas are west of the Los Mogotes East SEZ (Figure 10.4.11.3-1). Since bighorn sheep typically inhabit mountains and foothills in Colorado (CDW 2009), they are not expected to frequent the Los Mogotes East SEZ.

Cougar. The proposed Los Mogotes East SEZ occurs within the overall range of the cougar (CDOW 2008). Within Colorado, cougars mostly occur in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands (CDOW 2009). Thus, they are not expected to frequent the SEZ.

Elk. The proposed Los Mogotes East SEZ occurs within the overall range, winter range, and severe winter range of the elk (Figure 10.4.11.3-2). The SEZ also occurs 3 mi (5 km) east of a winter concentration area and 4 mi (6 km) northwest of a resident population area (Figure 10.4.11.3-2). No other mapped elk activity areas occur within 5 mi (8 km) of the SEZ.

Mule Deer. The proposed Los Mogotes East SEZ occurs within the overall range and winter range of the mule deer. Other mapped mule deer activity areas that occur within 5 mi (8 km) of the SEZ are severe winter range, 3 mi (5 km) southwest of the SEZ, and a resident population area, 3 mi (5 km) southeast of the SEZ (Figure 10.4.11.3-3).

Pronghorn. The proposed Los Mogotes East SEZ occurs within the overall range, winter range, severe winter range, and a winter concentration area of the pronghorn Figure 10.4.11.3-4). No other mapped pronghorn activity areas occur within 5 mi (8 km) of the Los Mogotes East SEZ.

Other Mammals

A number of furbearers and small game species occur within the area of the proposed Los Mogotes East SEZ. Among those species that are fairly common to abundant within Conejos County and that could occur within the area of the Los Mogotes East SEZ are the American badger (*Taxidea taxus*, fairly 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.

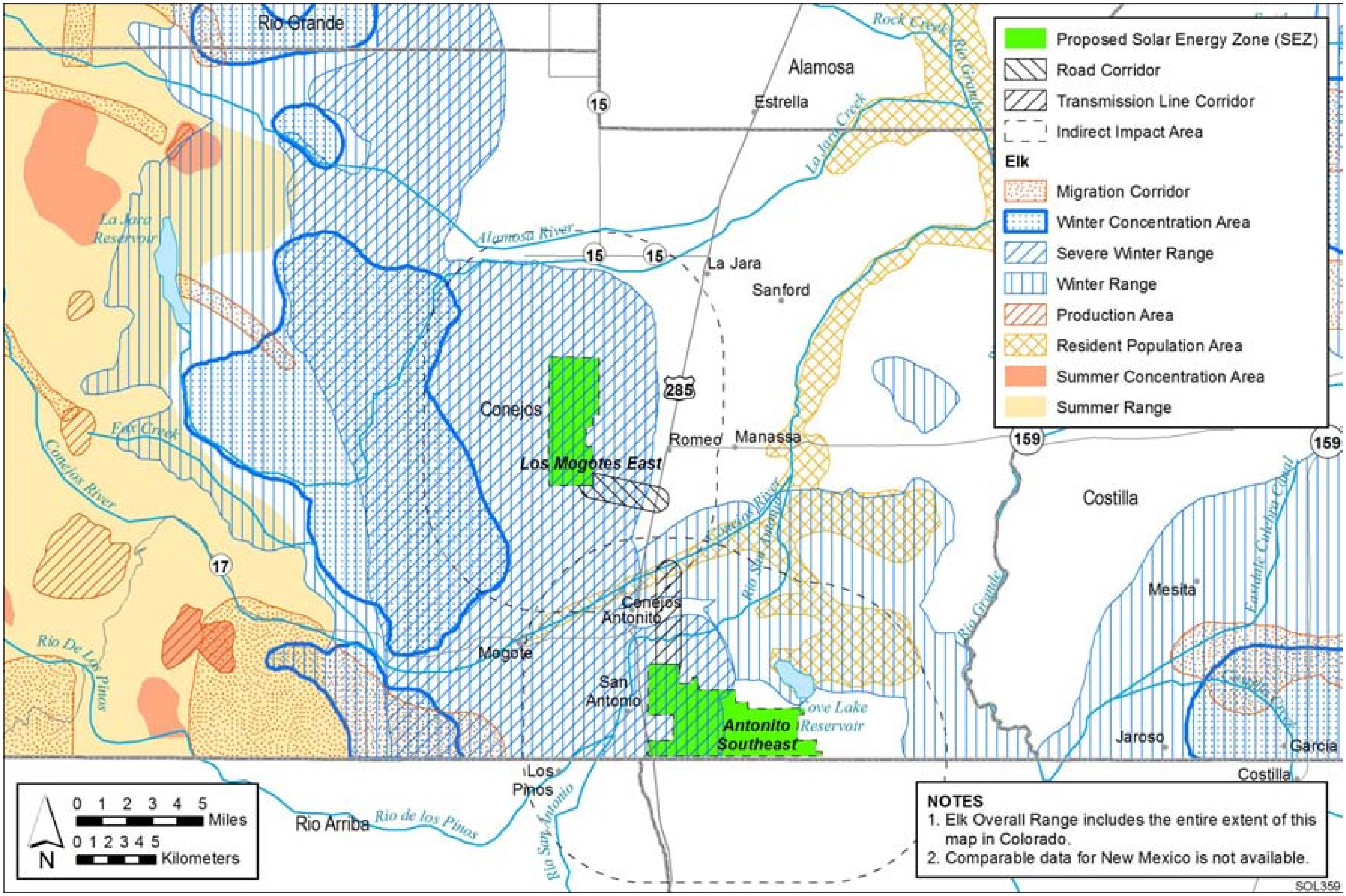

FIGURE 10.4.11.3-2 Elk Activity Areas within the Region That Encompasses the Proposed Los Mogotes East SEZ (Source: CDOW 2008)

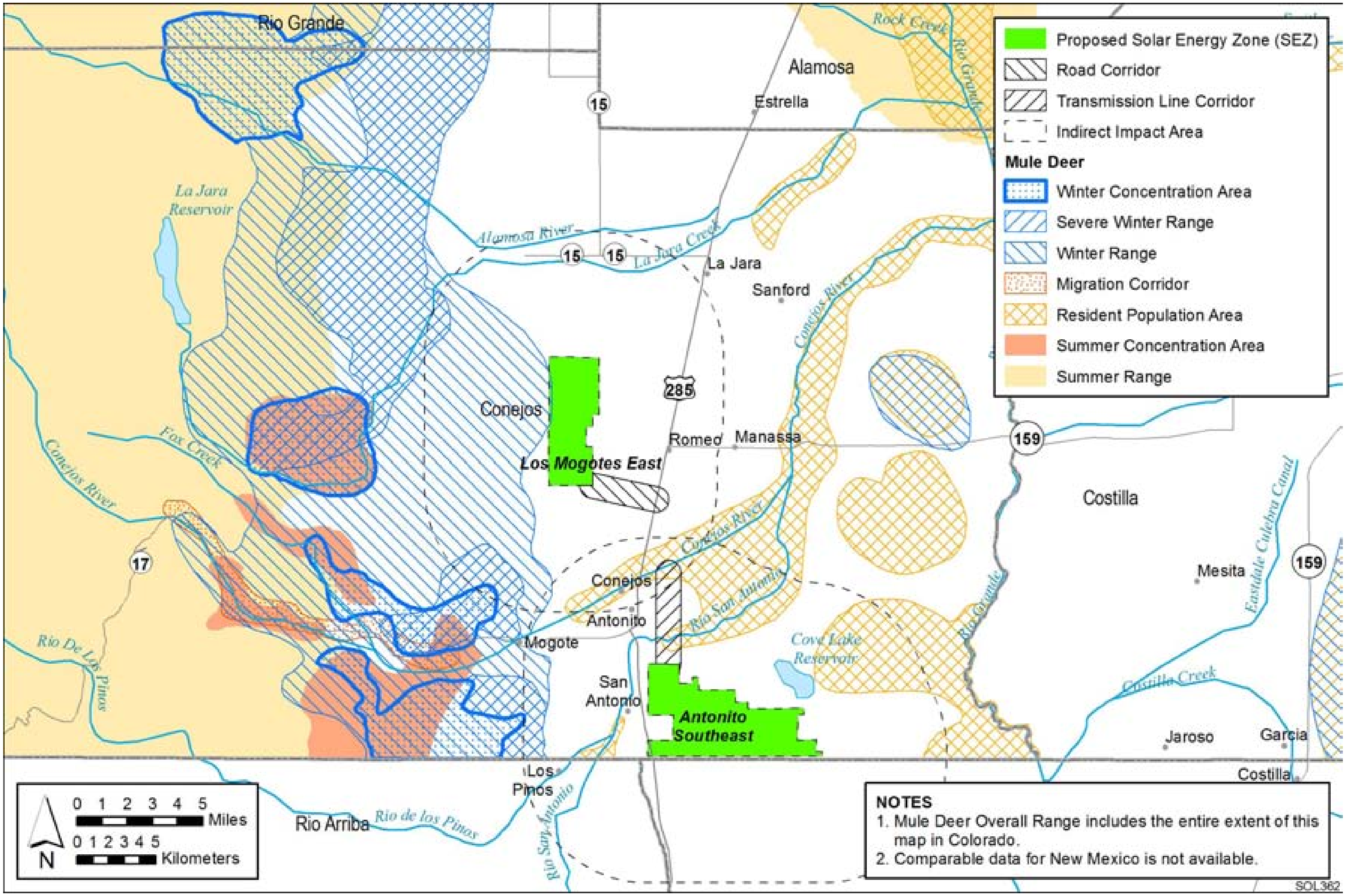

FIGURE 10.4.11.3-3 Mule Deer Activity Areas within the Region That Encompasses the Proposed Los Mogotes East SEZ (Source: CDOW 2008)

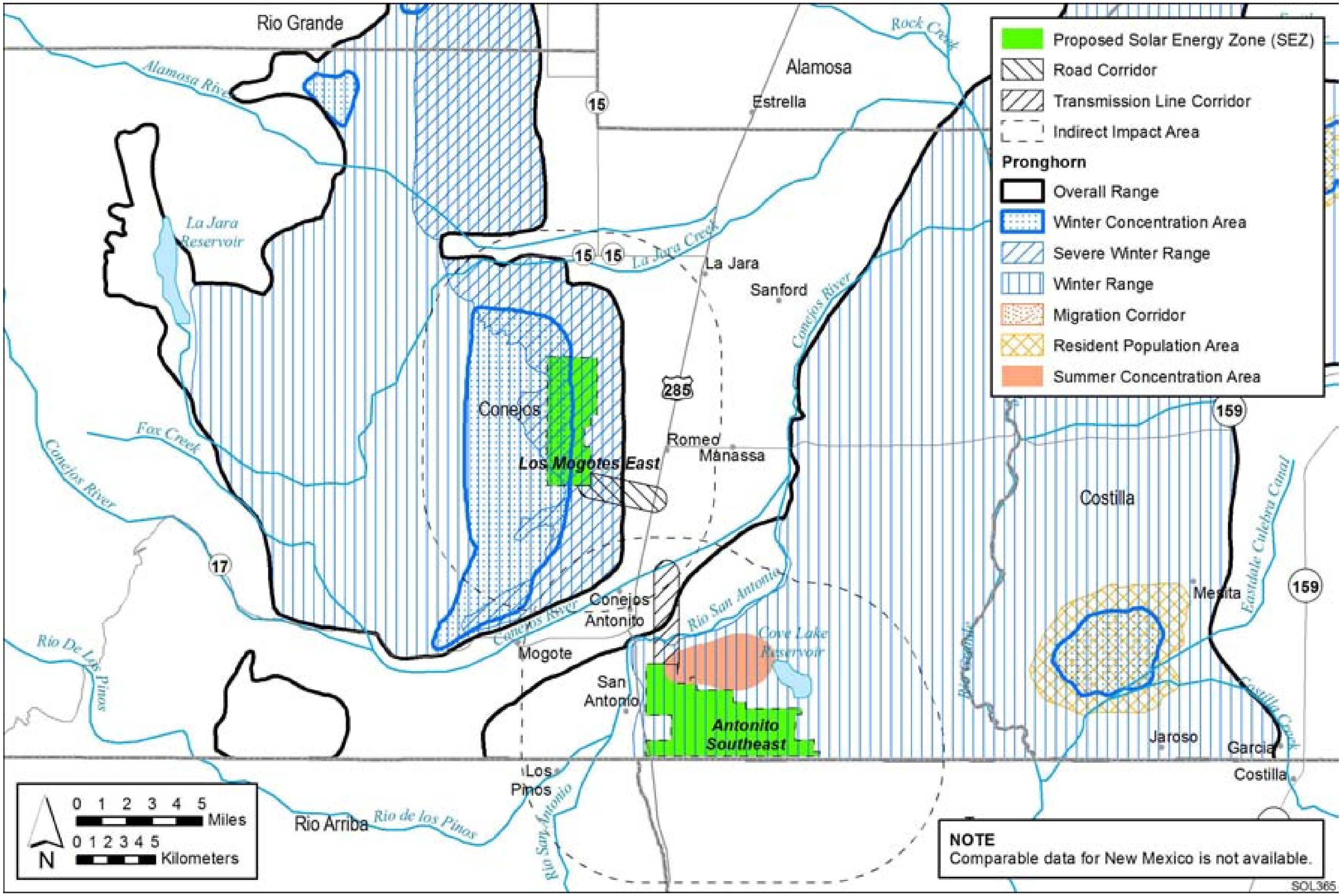

FIGURE 10.4.11.3-4 Pronghorn Activity Areas within the Region That Encompasses the Proposed Los Mogotes East SEZ (Source: CDOW 2008)

The small nongame mammal species generally include bats, rodents, and shrews. Those species that are common or abundant within Conejos County and that could occur within the area of the proposed Los Mogotes East 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 10.4.12.

Table 10.4.11.3-2 provides habitat information for these other mammal species that could occur within the proposed Los Mogotes East SEZ.

10.4.11.3.2 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 throughthe application of any additional mitigation measures. Section 10.4.11.3.3 below identifies SEZ-specific mitigation measures of particular relevance to the proposed Los Mogotes East 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 10.4.11.3.1, 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 10.4.11.3.3).

Table 10.4.11.3-2 summarizes the potential impacts on representative mammal species resulting from solar energy development (with the implementation of required programmatic design features) in the proposed Los Mogotes East SEZ.

American Black Bear

Based on potentially suitable land cover, up to 428 acres (1.7 km^2) of potentially suitable American black bear habitat could be lost by solar energy development within the proposed Los Mogotes East SEZ and another 1 acre (0.004 km^2) by access road construction. This represents 0.02% of potentially suitable American black bear habitat within the SEZ region. More than 12,200 acres (49 km^2) of potentially suitable American black bear habitat occurs within the area of indirect effects. Because desert-like shrublands are not the preferred habitat for the American black bear, it is unlikely that impacts on the SEZ would represent an actual loss of occupied

TABLE 10.4.11.3-2 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Los Mogotes East SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	
Big Game					
American black bear (*Ursus americanus*)	Montane shrublands and forests, and subalpine forests at moderate elevations. Fairly common in Conejos County. About 2,641,300 acres[h] of potentially suitable habitat occurs in the SEZ region.	428 acres[g] of potentially suitable habitat lost (0.02% of available habitat)	12,246 acres of habitat (0.5% of available potentially suitable habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 98 acres of potentially suitable habitat in area of indirect effect	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 3,303,400 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available habitat)	41,304 acres of habitat (1.3% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 386 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Cougar (*Puma concolor*)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. Uncommon in Conejos County. About 3,902,800 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available habitat)	47,236 acres of habitat (1.2% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 382 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 10.4.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigationg[g]
Big Game (Cont.)					
Elk (*Cervis canadensis*)	Semi-open forest, mountain meadows, foothills, plains, valleys, and alpine tundra. Uses open spaces such as alpine pastures, marshy meadows, river flats, brushy clean cuts, forest edges, and semidesert areas. Abundant in Conejos County. About 3,008,600 acres of potentially suitable habitat occurs in the SEZ region.	0.0 acres of potentially suitable habitat lost (0.0% of available habitat)	4,499 acres of habitat (0.1% of available potentially suitable habitat)	1 acre of potentially suitable habitat in area of potential direct effect and 76 acres of potentially suitable habitat in area of indirect effect	Small to no overall impact.
Mule deer (*Odocoileus hemionus*)	Most habitats including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provide abundant browse and cover. Common in Conejos County. About 4,409,500 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available habitat)	89,299 acres of habitat (2.0% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 5,878 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Pronghorn (*Antilocapra americana*)	Grasslands and semidesert shrublands on rolling topography that affords good visibility. Most abundant in shortgrass or midgrass prairies and least common in xeric habitats. Common in Conejos County. About 2,458,600 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available habitat)	86,229 acres of habitat (3.5% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,487 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 10.4.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers					
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 3,865,200 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	49,757 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 411 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Coyote (*Canis latrans*)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 4,964,800 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	95,787 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	22 acres of potentially suitable habitat in area of potential direct effect and 2,007 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Desert cottontail (*Sylvilagus audubonii*)	Grasslands, especially in prairie dog colonies. Also in other habitats such as montane shrublands, riparian lands, semidesert shrublands, pinyon-juniper woodlands, and various woodland-edge habitats. Can occur in areas with minimal vegetation as long as adequate cover is present. About 3,014,800 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	88,434 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,478 acres of potentially suitable habitat in area of indirect effect	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 effects.

TABLE 10.4.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers (Cont.)					
Red fox (*Vulpes vulpes*)	Most common in open woodlands, pasturelands, riparian, and agricultural lands. It prefers areas with a mixture of these vegetation types occurring in small mosaics with good development of ground cover. Also common in open space and other undeveloped areas adjacent to cities. Also occurs in mountains in montane and subalpine meadows and alpine and forest edges usually near water. About 3,962,200 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	88,929 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,524 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
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 4,248,700 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	90,058 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,513 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 10.4.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigationg[g]
Small Game and Furbearers (Cont.)					
White-tailed jackrabbit (*Lepus townsendii*)	Occurs mostly in prairies, open parkland, and alpine tundra. Also occurs in semidesert shrublands and may migrate to such areas from other habitats in winter. About 2,533,700 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2 % of available potentially suitable habitat)	46,715 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 406 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Nongame (Small) Mammals					
Deer mouse (*Peromyscus maniculatus*)	Most habitats (except well-developed wetlands) that contain cover including burrows of other animals, rock cracks and crevices, surface debris and litter, and man-made structures. About 4,444,600 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	90,732 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	17 acres of potentially suitable habitat in area of potential direct effect and 1,526 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Least chipmunk (*Tamias minimus*)	Low-elevation semidesert shrublands, montane shrublands and woodlands, forest edges, and alpine tundra. About 3,804,800 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	47,562 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 362 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

TABLE 10.4.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigationg[g]
Nongame (Small) Mammals (Cont.)					
Northern pocket gopher (*Thomomys talpoides*)	Various habitats such as agricultural and pasture lands, semidesert shrublands, and grasslands. Most common in meadows and grasslands. About 3,917,200 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	88,250 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,510 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 where vegetation is sparse. Most common on sandy soils that allow for easy digging and construction of burrow systems. About 1,844,500 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	39,163 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	4 acres of potentially suitable habitat in area of potential direct effect and 338 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.
Thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*)	Short and mid-length grasslands. Also occur in other habitats that are heavily grazed, mowed, or otherwise modified, including prairie dog colonies. About 2,161,500 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	77,767 acres of potentially suitable habitat (3.6% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,462 acres of potentially suitable habitat in area of indirect effect	Small overall impact.. Avoidance of prairie dog colonies would further reduce the potential for impacts.

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TABLE 10.4.11.3-2 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Road Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (Small) Mammals (Cont.)					
Western small-footed myotis (*Myotis ciliolabrum*)	Broken terrain of canyons and foothills, commonly in areas with tree or shrub cover. Summer roosts include rock crevices, caves, dwellings, burrows, among rocks, under bark, and beneath rocks scattered on the ground. About 4,233,500 acres of potentially suitable habitat occurs in the SEZ region.	4,734 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	89,478 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	16 acres of potentially suitable habitat in area of potential direct effect and 1,515 acres of potentially suitable habitat in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effects.

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area.

[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 4,734 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 4,734 acres of direct effect was also added to the area of indirect effect. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[e] For access road development, direct effects were estimated within a 3-mi (4.8-km), 60-ft (18-m) wide access road ROW from the SEZ to the nearest existing highway. As the access road corridor exists within the area of indirect effects for the SEZ, no additional area of indirect effects were determined for the access road.

Footnotes continued on next page.

TABLE 10.4.11.3-2 (Cont.)

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] To convert acres to km^2, multiply by 0.004047.

Sources: CDOW (2009); NatureServe (2009); NDCNR (2002); USGS (2004, 2005, 2007).

habitat. Overall, impacts on the American black bear from solar energy development in the proposed Los Mogotes East SEZ would be small.

Bighorn Sheep

Based on potentially suitable land cover, up to 4,734 acres (19.2 km^2) of potentially suitable bighorn sheep habitat could be lost by solar energy development within the proposed Los Mogotes East SEZ and another 4 acres (0.02 km^2) by access road construction. This represents about 0.1% of potentially suitable bighorn sheep habitat within the SEZ region. More than 41,300 acres (167 km^2) of potentially suitable bighorn sheep habitat occurs within the area of indirect effects. Overall, impacts on bighorn sheep from solar energy development in the SEZ would be small.

Cougar

Based on potentially suitable land cover, up to 4,734 acres (19.2 km^2) of potentially suitable cougar habitat could be lost by solar energy development within the proposed Los Mogotes East SEZ and another 4 acres (0.02 km^2) by access road construction. This represents about 0.1% of potentially suitable cougar habitat within the SEZ region. More than 47,200 acres (191 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 elk habitat would be lost by solar energy development within the proposed Los Mogotes East SEZ and only 1 acre (0.004 km^2) by access road construction. About 4,500 acres (18.2 km^2) of potentially suitable elk habitat occurs within the area of indirect effects. Based on mapped activity areas, 4,734 acres (19.2 km^2) of elk overall range, winter range, and severe winter range could be directly affected by SEZ development (Table 10.4.11.3-3). Direct loss of overall range would account for about 0.1% of the overall range occurring within Colorado portion of the SEZ region; direct loss of winter range would account for 0.3% of the winter range within the Colorado portion of the SEZ region; and direct loss of severe winter range would account for 0.9% of the severe winter range within the Colorado portion of the SEZ region.. No direct impacts on other mapped activity areas for the elk would occur (Table 10.4.11.3-4). Overall, impacts on elk from solar energy development in the SEZ would be small.

Mule Deer

Based on potentially suitable land cover, up to 4,734 acres (191 km^2) of potentially suitable mule deer habitat could be lost by solar energy development within the proposed Los Mogotes East SEZ and another 16 acres (0.06 km^2) by access road construction. This represents

TABLE 10.4.11.3-3 Potential Magnitude of Impacts on Elk Activity Areas Resulting from Solar Energy Development within the Proposed Los Mogotes East SEZ

	Amount of Activity Area Affected				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[b]	Assumed Access Road Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	4,734 acres[g] (0.1% of overall range)	94,815 acres (2.8% of overall range)	22 acres of overall range in area of potential direct effect and 2,034 acres in area of indirect effect	3,357,402 acres	Small
Summer range	0 acres	0 acres	0 acres	1,531,363 acres	None
Summer concentration area	0 acres	0 acres	0 acres	316,326 acres	None
Winter range	4,734 acres (0.3% of winter range)	70,936 acres (5.2% of winter range)	16 acres of winter range in area of potential direct effect and 1,487 acres in area of indirect effect	1,362,815 acres	Small
Winter concentration area	0 acres	10,642 acres (2.3% of winter concentration area)	0 acres	458,293 acres	None
Severe winter range	4,734 acres (0.9% of severe winter range)	67,310 acres (12.5% of severe winter range)	16 acres of severe winter range in area of potential direct effect and 1,487 acres in area of indirect effect	537,780 acres	Small
Production area	0 acres	0 acres	0 acres	269,007 acres	None
Migration corridor	0 acres	0 acres	0 acres	166,476 acres	None

TABLE 10.4.11.3-3 (Cont.)

Activity Area[a]	Amount of Activity Area Affected: Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Assumed Access Road Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Resident population area	0 acres	2,010 acres (1.7% of resident population area)	0 acres	118,256 acres	None

[a] Activity areas are described in Table 10.4.11.3-1.

[b] 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 4,734 acres (19.2 km^2) would be developed in the SEZ.

[c] 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 access road line ROW.

[d] For the access road, direct effects were estimated within a 3-mi (5-km) long, 60-ft (18-m) wide corridor for an assumed new access road connecting to the nearest existing U.S. highway. Indirect effects were estimated within a 1-mi (1.6-km) wide corridor to the existing highway, less the assumed area of direct effects.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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)

about 0.1% of potentially suitable mule deer habitat within the SEZ region. More than 86,000 acres (348 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effects. Based on mapped activity areas, 4,734 acres (191 km^2) of mule deer overall range and 135 acres (0.5 km^2) of mule deer winter range could be directly affected by solar energy development in the SEZ (Table 10.4.11.3-4). Direct loss of overall range would account for about 0.1% of the overall range occurring within Colorado portion of the SEZ region; and direct loss of winter range would account for about 0.01% of the winter range occurring within Colorado portion of the SEZ region. No direct impacts on other mapped activity areas for the mule deer would occur (Table 10.4.11.3-4). Overall, impacts on mule deer from solar energy development in the SEZ would be small.

TABLE 10.4.11.3-4 Potential Magnitude of Impacts on Mule Deer Activity Areas Resulting from Solar Energy Development within the Proposed Los Mogotes East SEZ

	Amount of Activity Area Affected				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Assumed Access Road Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	4,734 acres[g] (0.1% of overall range)	94,815 acres (2.8% of overall range)	22 acres of overall range in area of potential direct effect and 2,034 acres in area of indirect effect	3,357,402 acres	Small
Summer range	0 acres	0 acres	0 acres	1,657,325 acres	None
Summer concentration area	0 acres	0 acres	0 acres	122,458 acres	None
Winter range	135 acres (0.01% of winter range)	32,061 acres (3.5% of winter range)	0 acres	905,746 acres	Small
Winter concentration area	0 acres	161 acres (0.02% of winter concentration area)	0 acres	99,234 acres	None
Severe winter range	0 acres	3,402 acres (0.08% of severe winter range)	0 acres	415,526 acres	None
Migration corridor	0 acres	0 acres	0 acres	26,104 acres	None
Resident population area	0 acres	4,116 acres (2.3% of resident population area)	0 acres	182,733 acres	None

a Activity areas are described in Table 10.4.11.3-1.

b 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 4,734 acres (19.2 km^2) would be developed in the SEZ.

Footnotes continued on next page.

TABLE 10.4.11.3-4 (Cont.)

[c] 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 access road ROW.

[d] For the access road, direct effects were estimated within a 3-mi (5-km) long, 60-ft (18-m) wide corridor for an assumed new access road connecting to the nearest existing U.S. highway. Indirect effects were estimated within a 1-mi (1.6-km) wide corridor to the existing highway, less the assumed area of direct effects.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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).

Pronghorn

Based on potentially suitable land cover, up to 4,734 acres (191 km^2) of potentially suitable pronghorn habitat could be lost by solar energy development within the proposed Los Mogotes East SEZ and another 16 acres (0.0.6 km^2) by access road construction. This represents about 0.2% of potentially suitable pronghorn habitat within the SEZ region. Over 86,000 acres (348 km^2) of potentially suitable pronghorn habitat occurs within the area of indirect effects. Based on mapped pronghorn activity areas, solar development in the proposed Los Mogotes East SEZ would directly affect 4,734 acres (191 km^2) of pronghorn overall range, winter range, and severe winter range (about 0.4, 0.5, and 3.7%, respectively, of each range occurring within the Colorado portion of the SEZ region); and 3,145 acres (12.7 km^2) of winter concentration area (about 2.8% of the winter concentration area occurring within the Colorado portion of the SEZ region) (Table 10.4.11.3-5). No direct impacts on other pronghorn activity areas would occur. Overall, impacts on pronghorn from solar energy development in the SEZ would be small to moderate.

Other Mammals

Direct impacts on small game, furbearers, and nongame (small) mammal species would be small, because only 0.3% or less of potentially suitable habitats identified for each species would be lost by solar energy development in the proposed Los Mogotes East SEZ (Table 10.4.11.3-2). Larger areas of potentially suitable habitat for these species occur within the area of potential indirect effects (e.g., up to 3.6% of available potentially available habitat for the thirteen-lined ground squirrel).

TABLE 10.4.11.3-5 Potential Magnitude of Impacts on Pronghorn Activity Areas Resulting from Solar Energy Development within the Proposed Los Mogotes East SEZ

	Amount of Activity Area Affected				
Activity Area[a]	Within SEZ (Direct Effects)[b]	Outside SEZ (Indirect Effects)[c]	Assumed Access Road Corridor[d]	Amount of Activity Area within SEZ Region[e]	Overall Impact Magnitude[f]
Overall range	4,734 acres[g] (0.4% of overall range)	57,475 acres (5.1% of overall range)	10 acres of overall range in area of potential direct effect and 959 acres in area of indirect effect	1,131,671 acres	Small
Summer concentration area	0 acres	0 acres	0 acres	50,468 acres	None
Winter range	4,734 acres (0.5% of winter range)	57,475 acres (5.9% of winter range)	10 acres of winter range in area of potential direct effect and 959 acres of habitat in area of indirect effect	975,990 acres	Small
Winter concentration area	3,145 acres (2.8% of winter concentration area)	24,669 acres (21.6% of winter concentration area)	0 acres	114,140 acres	Moderate
Severe winter range	4,734 acres (3.7% severe winter range)	27,649 acres (21.4% of severe winter range)	10 acres of severe winter range in area of potential direct effect and 959 acres in area of indirect effect	129,343 acres	Moderate
Resident population area	0 acres	0 acres	0 acres	50,485 acres	None

a Activity areas are described in Table 10.4.11.3-1.

b 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 4,734 acres (19.2 km^2) would be developed in the SEZ.

c 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 access road ROW.

Footnotes continued on next page.

TABLE 10.4.11.3-5 (Cont.)

[d] For the access road, direct effects were estimated within a 3-mi (5-km) long, 60-ft (18-m) wide corridor for an assumed new access road connecting to the nearest existing U.S. highway. Indirect effects were estimated within a 1-mi (1.6-km) wide corridor to the existing highway, less the assumed area of direct effects.

[e] The SEZ region is the area within a 50-mi (80-km) radius of the center of the SEZ. Activity area data available only for the Colorado portion of the SEZ region.

[f] Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of activity area for the species would be potentially lost; (2) *moderate*: >1 but ≤10% of activity area for the species would be lost; and (3) *large*: >10% of activity area for the species would be lost. 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).

Summary

Based on land cover analyses, direct impacts on mammal species would be small for all species, as only 0.3% or less of potentially suitable habitat for the representative mammal species would be lost (Table 10.4.11.3-2). Larger areas of potentially suitable habitat for mammal species occur within the area of potential indirect effects (e.g., up to 3.6% for the thirteen-lined ground squirrel). Based on mapped activity areas, direct impacts on big game species would be mostly small to none, although moderate impacts on pronghorn winter concentration area and severe winter range could occur. Other impacts on mammals could result from collision with fences and vehicles, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. These indirect impacts are expected to be negligible with implementation of required programmatic design features.

Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if suitable habitats were restored in previously disturbed areas. Section 5.10.2 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.

10.4.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce the potential for effects on mammals. While some SEZ-specific design features are best established when project details are considered 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.

- Construction should be curtailed during winter when big game species are present.

- Where big game winter ranges intersect or are close to the SEZ, motorized vehicles and other human disturbances should be controlled (e.g., through temporary road closures when big game are present)..

- Development in the 135-acre (0.55-km^2) portion of the SEZ that overlaps the mule deer winter range should be avoided.

- Loss of pronghorn winter concentration area should be minimized.

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.

10.4.11.4 Aquatic Biota

10.4.11.4.1 Affected Environment

This section addresses aquatic habitats and biota that are known to occur on the Los Mogotes East SEZ itself or within an area that could be affected, either directly or indirectly, by activities associated with solar energy development within the SEZ. It was assumed that an access road 3-mi (5-km) long would be constructed to connect to U.S. 285 east of the SEZ to support construction and operation of solar facilities. The area of direct effects was considered to be the entire SEZ area and the area of the new road corridor. A 1-mi (1.6-km) wide corridor was identified for the new access road to account for uncertainty in the actual path of the road. The area of potential indirect impacts on aquatic biota from SEZ development was considered to extend up to 5 mi (8 km) beyond the SEZ boundary. The area of potential indirect impacts for the access road was considered to be included within the 1-mi (1.6-km) wide corridor identified above.

There are no permanent water bodies or perennial streams within the assumed area of potential direct effects associated with the Los Mogotes East SEZ, although rain events may give rise to ephemeral pools on occasion. In addition, the NWI does not identify any wetlands within the SEZ. A number of washes pass through the SEZ; they are usually dry but convey water during precipitation events. These washes do not extend directly to nearby perennial streams, and no significant aquatic habitats are present in them.

Approximately 19 mi (31 km) of perennial stream habitat associated with three streams (the Alamosa River, the Conejos River, and La Jara Creek) falls within the assumed area of indirect effects (Figure 10.4.11.3-1). Of these three streams, La Jara Creek is the closest to the boundaries of the SEZ, approximately 4 mi (6 km) to the north. Water in La Jara Creek is largely regulated by La Jara Reservoir, which is about 14 mi (23 km) northwest of the SEZ. La Jara Creek, immediately downstream of the reservoir, supports a coolwater trout fishery containing brown trout. Approximately 9 mi (14 km) of the lower portion of La Jara Creek passes through the indirect effects area for the Los Mogotes East SEZ.

A 5-mi (8-km) section of the Conejos River passes through the area of indirect effects associated with the Los Mogotes East SEZ. At its nearest point, the Conejos River is more than 4 mi (6 km) from the southeastern SEZ boundary. Upstream of the area of indirect effects, beginning near the confluence with Fox Creek, the Conejos River supports a coolwater trout fishery. The coolwater portions of the river are at least 10 mi (16 km) southwest of and upgradient from the SEZ boundary.

A 4-mi (6-km) segment of the lower Alamosa River between County Road 10 and U.S. 285 passes through the northern extent of the area of indirect effects assumed for the Los Mogotes East SEZ (Figure 10.4.11.3-1). This segment of the river is usually dry during late fall, winter, and early spring when water for irrigation is being captured and held within Terrace Reservoir (CWCB 2005). Consequently, the development of aquatic communities is limited, and fish populations cannot be maintained in this segment of the Alamosa River. Further upstream, where water is present year-round, water quality and the presence of aquatic biota have been severely affected by contamination associated with past mining activities (CWCB 2005).

A number of small wetlands occur outside the SEZ but within the assumed area of indirect effects (Sections 10.4.9.1.1 and 10.4.10.1). Based upon the classification of these wetlands, surface water is usually absent but may be present for variable periods during the year. There is a more extensive network of palustrine wetlands beginning about 3 mi (5 km) south and southeast (Section 10.4.9.1.1). These wetlands are primarily associated with the Conejos River.

Outside of the area of indirect effects but within 50 mi (80.5 km) of the SEZ, there are approximately 1,063 mi (1,711 km) of perennial streams, 281 mi (452 km) of intermittent streams, and 191 mi (307 km) of canals.

There are approximately 10,900 acres (44 km^2) of lake and reservoir habitat within 50 mi of the SEZ, although there are no lakes or reservoirs within the areas considered for analysis of direct or indirect effects. The nearest such habitat is the 1,650-acre (6.7-km^2) La Jara Reservoir, approximately 14 mi (23 km) to the northwest of the SEZ.

10.4.11.4.2 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 particularly important. 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 on aquatic habitats and biota that could occur from development of utility-scale solar energy facilities are identified in Section 5.10.2.4. Aquatic habitats, including wetland areas, present on or near the Los Mogotes East 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.

Although direct disturbance of aquatic habitats has the greatest potential to negatively affect populations of aquatic biota, indirect effects (e.g., caused by surface runoff or dust from the SEZ) have the potential to degrade affected aquatic communities and may reduce biodiversity by promoting the decline or elimination of species sensitive to disturbance or by providing competitive advantages to nonnative species. High impact levels could result in the elimination of specific types of organisms from affected areas. The proper implementation of programmatic design features, however, would reduce indirect effects to a minor/small level of impact.

Because there are no permanent water bodies, perennial streams, or wetlands associated with the Los Mogotes East SEZ, there would be no direct impacts on aquatic habitats from construction of utility-scale solar energy facilities within the SEZ.

Disturbance of land areas at the SEZ in order to construct solar energy facilities could increase the amount of sediment in nearby wetland areas because of deposition of water- and airborne soils from disturbed areas. Because there is a relatively small amount of wetland habitat less than 3 mi (5 km) away, it is likely that only a small portion of the airborne dust associated with SEZ activities would settle in wetlands. Introduction of waterborne sediments to nearby drainages could be controlled through commonly used mitigation measures, such as settling basins and silt fences, or by directing water draining from the developed areas away from these surface water features. Maintaining undisturbed 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 are utilized for power plant cooling water, for mirror washing, or for other needs. The greatest need for water would occur if technologies employing wet cooling, such as parabolic trough or power tower, are developed at the site; the associated impacts would ultimately depend on the water source used (including groundwater from various depth aquifers). There are no water bodies in the immediate vicinity of the SEZ that would be capable of meeting significant water needs. Withdrawing water from the La Jara Reservoir, La Jara Creek, the Conejos River, or other perennial surface water features in the region could affect water levels and, as a consequence, aquatic organisms in those water bodies. Additional details regarding the volume of water required and the types of organisms present in potentially affected water bodies would be required in order to further evaluate the potential for impacts from water withdrawals.

As described in Section 5.10.2.4, water quality in aquatic habitats could be affected by the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site characterization, construction, operation, or decommissioning for a solar energy facility. However, because the nearest perennial streams, ponds, or reservoirs are more than 4 mi (6 km) from the Los Mogotes East SEZ, the potential for solar energy development activities within the SEZ to introduce contaminants into those water bodies would be negligible.

In summary, there are no aquatic habitats within the Los Mogotes East SEZ or in the presumed access road corridor that would be directly affected by development or operation of solar energy facilities. Within the area of potential indirect effects, there is a small amount of aquatic habitat associated with perennial streams and wetlands. Because these habitat features are in different drainages from the SEZ in most cases and because the amount of such habitat within the area of indirect effects is much less than 1% of the amount of similar habitat features within 50 mi (80 km) of the SEZ, the potential for impacts would be small.

10.4.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for effects on aquatic biota and aquatic habitats from development and operation of solar energy facilities. While some SEZ-specific design features are best established whenproject details are considered, a design feature that can be identified at this time is as follows:

- Undisturbed buffer areas and sediment and erosion controls should be maintained around drainages associated with wetland areas located in the immediate vicinity of the SEZ.

If this SEZ-specific design feature is 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 Los Mogotes East SEZ would be negligible.

10.4.12 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 Los Mogotes East 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 states of Colorado or the USFWS; hereafter referred to as "rare" species.

Special status species known to occur within 50 mi (80 km) of the Los Mogotes East 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, Archuleta, Conejos, Costilla, Huerfano, Mineral, Rio Grande, and Saguache Counties in Colorado, as well as Rio Arriba and Taos Counties in New Mexico. However, the SEZ and affected area occur only in Conejos County, Colorado. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

10.4.12.1 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 Los Mogotes East SEZ, the area of direct effect included the SEZ and the areas within the access

[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 2008). 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.

road corridor where ground-disturbing activities are assumed to occur. No new transmission lines are expected to be needed to serve development on the SEZ due to the proximity of existing transmission infrastructure (refer to Section 10.4.1.2 for development assumptions). The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and the portion of the access road corridor where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect. Indirect effects considered in the assessment included effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ and access road, but do not include ground-disturbing activities. The potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

The primary habitat types within the affected area are agriculture and semiarid shrub steppe (see Section 10.4.10). Potentially unique habitats in the affected area in which special status species may reside include rocky cliffs and outcrops, sand dunes, and woodlands. As discussed in Section 10.4.11.4, there are no permanent water bodies or perennial streams within the Los Mogotes East SEZ; however, portions of the Alamosa River, Conejos River, and La Jara Creek intersect the area of indirect effects within 5 mi (8 km) of the SEZ. In addition, small palustrine emergent wetlands may occur within the access road corridor and within the area of indirect effects (Figure 10.4.12.1-1).

All special status species known to occur within the proposed Los Mogotes East SEZ region (i.e., within 50 mi [80 km] of the center of the SEZ) and their status, nearest location, and habitats are listed in Appendix J. Of these species, there are 51 that could occur in the affected area, based on recorded occurrences or the presence of potentially suitable habitat in the area. These species, their status, and their habitats are presented in Table 10.4.12.1-1. 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 over 20 mi (32 km) away from the SEZ.

Quad-level occurrences for the following seven special status species intersect the affected area of the Los Mogotes East SEZ: rock-loving aletes, Rio Grande chub, bald eagle, ferruginous hawk, mountain plover, Gunnison's prairie dog, and Townsend's big-eared bat. According to the CNHP, no other species have been recorded in the affected area. There are no groundwater-dependent species in the vicinity of the SEZ based upon CNHP records, comments provided by the USFWS (Stout 2009), and the evaluation of groundwater resources in the Los Mogotes East SEZ region (Section 10.4.9).

TABLE 10.4.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Los Mogotes East 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]: Road Corridor (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants							
Aztec milkvetch	*Astragalus proximus*	CO-S2	Rocky Mountain ponderosa pine woodland, Colorado Plateau pinyon-juniper woodland, Intermountain-basins, semidesert shrub-steppe, and Rocky Mountain Gambel oak-mixed montane shrublands at elevations between 5,400 and 7,300 ft[i]. Nearest known occurrences are 11 mi[j] from the SEZ. About 1,537,154 acres[k] of potentially suitable shrubland habitat occur within the SEZ region.	5,439 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	4 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	35,916 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the areas of direct effects; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigations apply to all special status plants.s
Blue-eyed grass	*Sisyrinchium demissum*	CO-S2	Moist areas, springs, streambanks, meadows, and forest seeps at elevations between 1,600 and 9,500 ft. Nearest occurrences are approximately 22 mi from the SEZ. About 91,667 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	868 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

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TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Bodin milkvetch	*Astragalus bodinii*	CO-S2	Open forest clearings in association with aspen, pinyon-juniper, and ponderosa pine woodlands. Nearest known occurrences are 13 mi from the SEZ. Occurrences within the region are known from elevations between 7,500 and 7,875 ft. About 1,100,773 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,390 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of woodlands in the sroad corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Brandegee's milkvetch	*Astragalus brandegeei*	BLM-S; CO-S1	Sandy or gravelly banks, flats, and stony meadows within pinyon-juniper woodlands. Substrates are usually sandstone with granite or occasional basalt. Elevation ranges between 5,400 and 8,800 ft. Nearest occurrences are located 8 mi southwest of the SEZ. About 769,336 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,389 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows and woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Colorado larkspur	*Delphinium ramosum* var. *alpestre*	CO-S2	Meadows, aspen woodlands, and sagebrush scrub communities at elevations between 6,900 and 10,500 ft. Nearest known occurrences are approximately 50 mi from the SEZ. About 1,076,791 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,020 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows and woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Fragile rockbrake	*Cryptogramma stelleri*	BLM-S; CO-S2	Moist soils on shaded limestone cliffs at elevations greater than 7,000 ft, and often in association with mosses. The nearest known occurrences are located in the San Juan Mountains, approximately 20 mi to the west of the SEZ. About 19,646 acres of potentially suitable habitat occurs within the SEZ region in the San Juan Mountains.	0 acres	0 acres	16 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Grassy slope sedge	*Carex oreocharis*	CO-S1	Regionally endemic to the southern Rocky Mountains. Granitic soils on dry slopes at elevations between 7,200 and 10,800 ft. Nearest known occurrences are approximately 35 mi from the SEZ. About 319,357 acres of potentially suitable habitat occurs within the SEZ region in the San Juan Mountains.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	805 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassy slopes in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Gray's Townsend-daisy	*Townsendia glabella*	CO-S2	Endemic to Colorado where known occurrences are restricted to Archuleta, La Plata, and Montezuma Counties within a range of 915 mi^2. Steeply sloping shale slopes with pines between 6,900 and 8,500 ft. Nearest occurrences are approximately 48 mi from the SEZ. About 746,522 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,389 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
James' cat's-eye	*Oreocarya cinerea* var. *Pustulosa*	CO-S1	Gypsum and sandy substrates within sagebrush, pinyon-juniper, oak mountain brush, and ponderosa pine communities at elevations between 5,400 and 8,500 ft. Nearest known occurrences are approximately 15 mi from the SEZ. About 1,373,293 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,230 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Least moonwort	*Botrychium simplex*	CO-S1	Open habitats, including pastures, meadows, orchards, prairies, wetlands, fens, sand dunes, and in lake and stream edge vegetation. Nearest known occurrences are 35 mi from the SEZ. About 691,076 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	9,956 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grasslands and meadows in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Leathery grape fern	*Botrychium multifidum*	CO-S1	Wet meadows, forest edges, lake shores, stony lake margins, and trail sides at elevations between 6,300 and 11,500 ft. Sites are usually flat, open, and have acidic soils that are seasonally wet. Nearest known occurrences are approximately 35 mi from the SEZ. About 278,653 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,228 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Many-flowered gilia	*Ipomopsis multiflora*	CO-S1	Open sites, desert shrublands, and woodlands. Nearest known occurrences are approximately 12 mi from the SEZ. About 3,928,911 acres of potentially suitable habitat occurs within the SEZ region.	5,893 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	4 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	45,954 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	Small overall impact. Small overall impact. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Many-stemmed spider-flower	*Cleome multcaulis*	BLM-S; CO-S2; FWS-SC	San Luis Valley on saturated soils created by waterfowl management on public lands. Primarily known from the Blanca Wetlands as near as 25 mi northeast of the SEZ. About 4,025 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	4 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Marsh cinquefoil	*Comarum palustre*	CO-S1	Lake shores, bogs, swamps, and streambanks in mucky, peaty soil. Nearest known occurrences are approximately 25 mi from the SEZ. About 274,628 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,244 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of marsh habitat in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Mingan's moonwort	*Botrychium minganense*	CO-S1	Dense forest to open meadow and from summer-dry meadows to permanently saturated fens and seeps but most common in moist meadows and woodlands in association with riparian corridors. Recorded sites are often associated with old (>10 year) disturbances. Nearest known occurrences are approximately 30 mi from the SEZ. About 2,342,624 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	3,806 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
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 22 mi from the SEZ. About 1,366,929 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,426 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows and woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
New Mexico butterfly weed	*Oenothera coloradensis* ssp. *neomexicana*	CO-S1	A small forb that grows in subirrigated alluvial soils on level or slightly sloping terrain. Occurs in floodplains, drainage bottoms, and old stream channels at elevations between 5,000 and 6,000 ft. Nearest occurrences are approximately 50 mi from the SEZ. About 29,044 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	863 acres of potentially suitable habitat (3.0% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
New Mexico cliff fern	*Woodsia neomexicana*	CO-S2	Cliffs and rocky slopes usually on sandstone or igneous substrates. Elevations range between 7,875 and 11,500 ft. Nearest occurrences are from the Sangre de Cristo Mountains, approximately 45 mi east of the SEZ. About 19,646 acres of potentially suitable habitat occurs within the SEZ region in the San Juan Mountains.	0 acres	0 acres	16 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Northern moonwort	*Botrychium pinnatum*	CO-S1	Grassy slopes, streambanks, and woodlands at elevations below 8,200 ft. Nearest known occurrences are approximately 30 mi from the SEZ. About 384,370 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	809 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grassy slopes and woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
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 40 mi from the SEZ. About 189,288 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	5 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	5,931 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows, grasslands, and woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
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 50 mi from the SEZ. About 1,523,791 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,582 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grasslands and woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Retrorse sedge	*Carex retrorsa*	CO-S1	Perennially wet areas, with a strong preference for banks along small channels, small to mid-size depressional wetlands, open mudflats at pond margins, and surface drying mud. Occurs at elevations between 5,000 and 10,000 ft. Nearest known occurrences are approximately 35 mi from the SEZ. About 62,623 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	4 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Ripley's milkvetch	*Astragalus ripleyi*	BLM-S; CO-S2; FWS-SC	Mixed conifer and shrubland habitats on rocky substrates at elevations above 8,000 ft. The nearest known occurrences are located 9 mi to the west of the SEZ. About 375,332 acres of potentially suitable habitat occurs within the SEZ region in the San Juan Mountains.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	12 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of woodlands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Rock sandwort	*Alsinanthe stricta*	CO-S1	Moist, granitic gravel sedge meadows, heath, alpine or arctic tundra at elevations between 300 and 12,500 ft. Nearest occurrences are within the Sangre de Cristo Mountians approximately 45 mi east of the SEZ. About 197,830 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,361 acres of potentially suitable habitat (0.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Rock-loving aletes[l]	***Neoparrya lithophila***	BLM-S; CO-S2	Endemic to southcentral Colorado on igneous rock outcrops on north-facing cliffs and ledges. Found within pinyon-juniper woodlands at elevations greater than 7,000 ft. Quad-level occurrences intersect the affected area approximately 5 mi west of the SEZ. About 366,037 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,338 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of woodlands in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Rocky Mountain bladderpod	*Lesquerella calcicola*	CO-S2	Shale bluffs, limy hillsides, gypseous knolls and ravines, and various calcareous substrates at elevations between 5,000 and 7,500 ft. Nearest known occurrences are approximately 11 mi from the SEZ. About 19,646 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	16 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Rocky Mountain blazing-star	*Liatris ligulistylis*	CO-S1	Dry, rocky slopes, rocky woodlands, gravelly ground in valleys, pine barrens, aspen clearings, granite depressions, stream sides, prairies, and open moist sites at elevations below 7,900 ft. Nearest known occurrences are approximately 18 mi from the SEZ. About 2,645,165 acres of potentially suitable habitat occurs within the SEZ region.	5,867 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	4 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	44,464 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grasslands, meadows, wetlands, and woodlands in the area of direct effects could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Slender sedge	*Carex lasiocarpa*	CO-S1	Very wet sites, including sedge meadows, fens, bogs, lakeshores, and streambanks. A dominant species of boreal wetlands where it often forms large floating mats. Nearest known occurrences are approximately 40 mi from the SEZ. About 220,055 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,228 acres of potentially suitable habitat (1.0% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.
Smith whitlow-grass	*Draba smithii*	CO-S2	Endemic to the mountains of southern Colorado. Talus slopes providing shaded and protected crevices at elevations between 8,000 and 11,000 ft. Nearest known occurrences are from the western escarpment of the Sangre de Cristo Mountains, approximately 35 mi northeast of the SEZ. About 55,759 acres of potentially suitable habitat occurs within the SEZ region in the San Juan Mountains.	0 acres	0 acres	16 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Tundra saxifrage	*Muscaria monticola*	CO-S1	Rock outcrops, crevices, talus, scree slopes, rocky tundra, fellfields, nunataks, and streambanks at elevations below 14,700 ft. Nearest known occurrences are approximately 50 mi east of the SEZ in the Sangre de Cristo Mountains. About 62,209 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	16 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Variegated scouringrush	*Hippochaete variegata*	CO-S1	Wet meadows, bogs, alluvial thickets, and sandy soil of river banks, ditches or lakes. Nearest known occurrences are approximately 50 mi west of the SEZ. About 278,653 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,228 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
Western moonwort	*Botrychium hesperium*	CO-S2	Early successional habitats that undergo periodic disturbance. These include 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 17 mi from the SEZ. About 111,691 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	5 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	4,490 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of grasslands in the road corridor could reduce impacts. See Aztec milkvetch for a list of potential mitigations applicable to all special status plant species.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Arthropods							
Great Basin silverspot butterfly	*Speyeria nokomis nokomis*	BLM-S; CO-S1	Streamside meadows and open seepage areas associated with violets (Viola spp.). Nearest potentially suitable habitat is located on BLM lands in the La Jara Front Range approximately 9 mi northwest of the SEZ. About 502,789 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	<1 acre of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	2,165 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of meadows in the road corridor could reduce impacts. 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.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Arthropods (Cont.)							
Sphinx moth	*Sphinx dollii*	CO-S2	Madrean oak woodland, arid brushlands, and desert foothills with woody broad-leafed shrubs.Nearest occurrences are from the Great Sand Dunes National Park, approximately 40 mi northeast of the SEZ. About 1,364,041 acres of potentially suitable habitat occurs within the SEZ region.	5,458 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	4 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	35,189 acres of potentially suitable habitat (2.6% 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 chub	***Gila pandora***	BLM-S; CO-S1	Clear, cool, fast-flowing water over rubble or gravel substrates. The nearest known occurrences are located in the Conejos River, approximately 4 mi south of the SEZ. About 742 mi of potentially suitable habitat occurs in the SEZ region.	0 acres	0 acres	19 mi (2.6% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]			Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
				Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	
Fish (Cont.)							
Rio Grande sucker	*Catostomus plebeius*	CO-E; CO-S1	Restricted to streams of the Rio Grande Basin. Channels and backwaters near rapidly flowing waters. The nearest known occurrences are located in the Alamosa River in the Rio Grande National Forest, approximately 15 mi northwest of the SEZ. About 874 mi of potentially suitable habitat occurs in the SEZ region.	0 acres	0 acres	19 mi (2.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Amphibians							
Northern leopard frog	*Rana pipiens*	ESA-UR; BLM-S; CO-SC	Low gradient creeks, moderate gradient rivers, pools, springs, canals, floodplains, reservoirs, shallow lakes, and wet meadows (especially with rooted aquatic vegetation), and fields. Known to occur in Conejos County, Colorado. About 37,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	400 acres of potentially suitable habitat (1.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Reptiles							
Milk snake	*Lampropeltis triangulum*	BLM-S	Shortgrass prairie, sandhills, shrubby hillsides, pinyon-juniper woodlands, and arid river valleys at elevations below 8,000 ft. The species is known to occur in Conejos County, Colorado. About 752,029 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	685 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds							
American peregrine falcon	*Falco peregrinus anatum*	BLM-S; CO-SC; CO-S2; FWS-SC	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 approximately17 mi northwest of the SEZ. About 3,653,800 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	13 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	47,723 acres of potentially suitable habitat (1.3% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.
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. Occurs locally in semiarid shrubland habitats where there is an abundance of small mammal prey. Quad-level occurrences intersect the affected area approximately 5 mi east of the SEZ. About 1,645,504 acres of potentially suitable habitat occurs within the SEZ region.	5,358 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	69,426 acres of potentially suitable habitat (4.2% 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 effects
Barrow's goldeneye	*Bucephala islandica*	BLM-S; CO-S2	Winter resident in the SEZ region on larger lakes and rivers. Known to occur in the San Luis Valley. About 149,000 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	0 acres	2,300 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]			Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
				Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	
Birds (Cont.)							
Ferruginous hawk	***Buteo regalis***	BLM-S; CO-SC	Summer resident in the affected area, but year-round resident in the SEZ region. Grasslands, sagebrush, and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands throughout the San Luis Valley. Quad-level occurrences intersect the affected area approximately 5 mi west of the SEZ. About 1,388,420 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	12 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	43,448 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
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 5 mi southeast of the SEZ. About 1,344,723 acres of potentially suitable habitat occurs within the SEZ region.	5,918 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	82,764 acres of potentially suitable habitat (6.2% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Short-eared owl	*Asio flammeus*	CO-S2	Year-round resident in the SEZ region. Grasslands, agricultural areas, and marshes. Rarely observed in sagebrush shrubland or pinyon-juniper woodland. Nearest occurrences are approximately 15 mi from the SEZ. About 2,082,766 acres of potentially suitable habitat occurs within the SEZ region.	5,918 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	78,518 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied nests and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Southwestern willow flycatcher	*Empidonax traillii extimus*	ESA-E; CO-E	Nests in thickets, scrubby and brushy areas, open second growth, swamps, and open woodlands in the Alamosa National Wildlife Refuge along the Rio Grande, approximately 18 mi northeast of the SEZ. About 426,247 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	3,459 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 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds (Cont.)							
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; CO-T; FWS-SC	Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Known to occur in Conejos County, Colorado. About 2,036,700 acres of potentially suitable habitat occurs in the SEZ region.	5,918 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	83,900 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied burrows and habitats in the area of direct effects or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mammals							
Big free-tailed bat	*Nyctinomops macrotis*	BLM-S; CO-S1; FWS-SC	Year-round resident in the SEZ region. Roosts in rock crevices on cliff faces or in buildings. Forages primarily in coniferous forests and arid shrublands to feed on moths. May occur in the San Luis Valley. About 2,648,405 acres of potentially suitable habitat occurs within the SEZ region.	5,918 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	84,845 acres of potentially suitable habitat (3.2% 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 effects.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Gunnison's prairie dog	***Cynomys gunnisoni***	ESA-C; CO-SC	Mountain valleys, plateaus, and open brush habitats in the project area at elevations between 6,000 and 12,000 ft. Known to occur in the San Luis Valley about 5 mi south and west of the SEZ. About 1,831,120 acres of potentially suitable habitat occurs within the SEZ region.	5,540 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	3 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	38,614 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of active colonies in the area of direct effects; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats scould reduce impacts. Mitigation should be developed in coordination with the USFWS and CDOW.

TABLE 10.4.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Road Corridor (Direct Effects)[e]	Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Pale Townsend's big-eared bat	***Corynorhinus townsendii pallescens***	BLM-S; CO-S2; CO-SC; FWS-SC	Year-round resident in the SEZ region. Forages in semiarid shrublands, pinyon-juniper woodlands, and montane forests to elevations of 9,500 ft. Roosts in caves, mines, rock crevices, under bridges, or within buildings. Known to occur in the San Luis Valley about 5 mi east of the SEZ. About 2,682,530 acres of potentially suitable habitat occurs within the SEZ region.	5,918 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat)	16 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	85,742 acres of potentially suitable habitat (3.2% 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 effects.
Spotted bat	*Euderma maculatum*	BLM-S; CO-S2	Year-round resident in the SEZ region. Forages in ponderosa pine forests, pinyon-juniper woodlands, and open semiarid shrublands. Roosts in exposed rocky cliff faces. May occur in the San Luis Valley in the SEZ region of the SEZ. About 1,145,531 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	1,162 acres of potentially suitable habitat (0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 10.4.12.1-1 (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]: Road Corridor (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Yuma myotis	*Myotis yumanensis yumanensis*	BLM-S; FWS-SC	Year-round resident in the SEZ region. Primarily associated with canyonlands and mesas at lower elevations. Forages in relatively dry shrubland habitats. Roosts in rock crevices, buildings, and mines. Known to occur in Conejos County, Colorado. About 2,234,328 acres of potentially suitable habitat occurs within the SEZ region.	5,871 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	4 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	44,809 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.s

[a] BLM-S = listed as a sensitive species by the BLM; CO-E = listed as endangered by the State of Colorado; CO-S1 = ranked as S1 in the State of Colorado; CO-S2 = ranked as S2 in the State of Colorado; CO-SC = species of special concern in the State of Colorado; CO-T = listed as threatened by the State of Colorado; ESA-C = candidate for listing under the ESA; ESA-E = listed as endangered under the ESA; FWS-SC = USFWS species of concern.

[b] For plant and invertebrate species, potentially suitable habitat was determined using SWReGAP land cover types. For fish species, potentially suitable habitat was determined from USFWS ECOS, USFWS Recovery Plans, and USFS Conservation Assessments. For reptile, bird, and mammal species, potentially suitable habitat was determined using SWReGAP habitat suitability models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[c] Maximum area of potential habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the SEZ region 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 transmission line developments are assumed to be needed due to the proximity of existing transmission infrastructure to the SEZ.

[d] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[e] For access road development, direct effects were estimated within a 60-ft (18-m) wide, 3-mi (5-km) long access road from the SEZ to the nearest state highway. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide road corridor.

Footnotes continued on next page.

TABLE 10.4.12.1-1 (Cont.)

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[f] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portion of the access road corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from facilities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[g] Overall impact magnitude categories were based on professional judgment and include (1) small: $\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; large: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[h] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[i] To convert ft to m, multiply by 0.3048.

[j] To convert mi to km, multiply by 1.609.

[k] To convert acres to km^2, multiply by 0.004047.

[l] Species in bold text have been recorded or have designated critical habitat in the affected area.

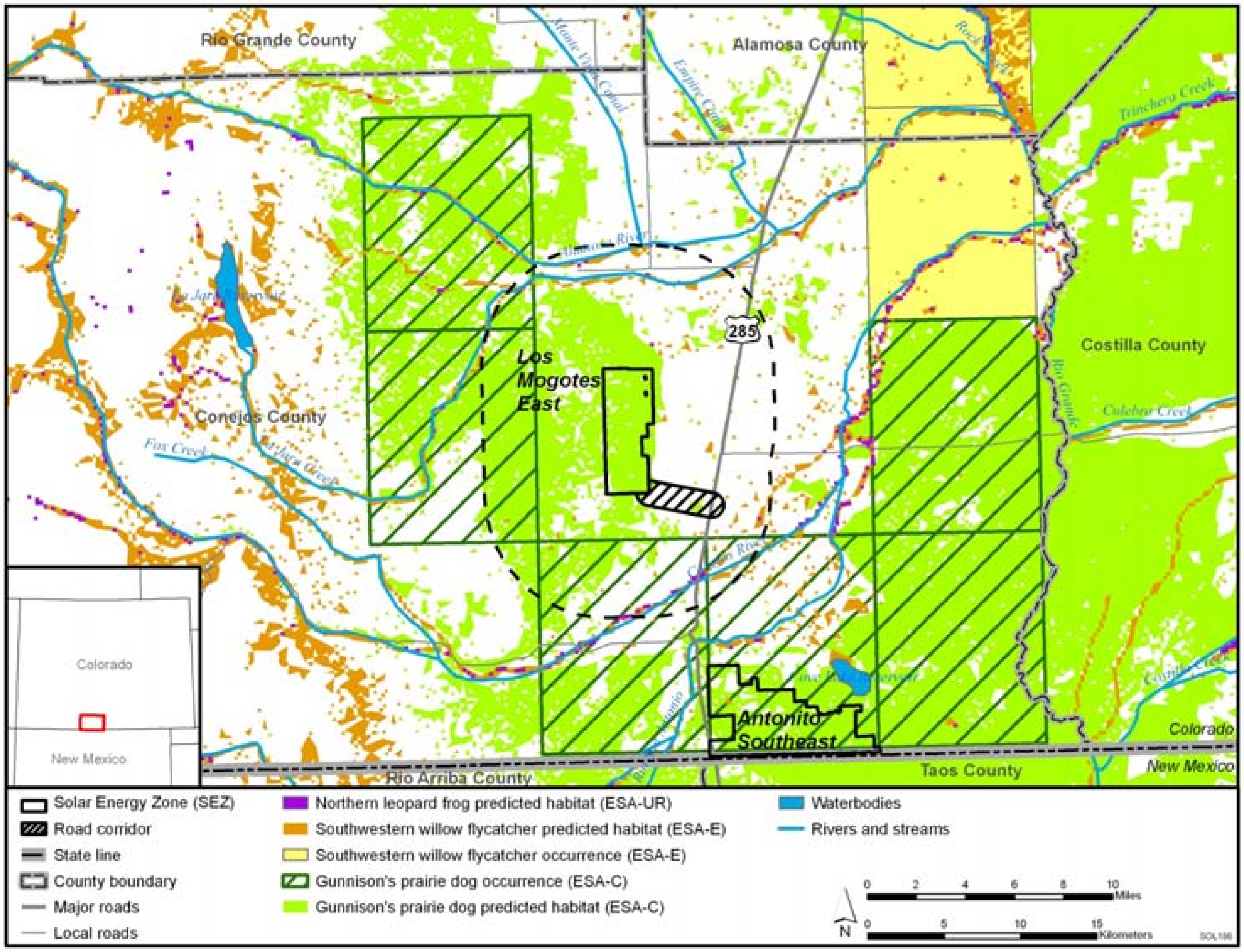

FIGURE 10.4.12.1-1 Locations of Species Listed as Endangered, Threatened, Candidates for Listing, or Species under Review for Listing under the ESA That May Occur in the Proposed Los Mogotes East SEZ Affected Area (Sources: CNHP 2009; NatureServe 2010; USGS 2007)

10.4.12.1.1 Species Listed under the ESA That Could Occur in the Affected Area

In scoping comments on the proposed Los Mogotes East SEZ, the USFWS did not identify any ESA-listed species that may occur within the affected area of the SEZ (Stout 2009). However, one species listed under the ESA, the southwestern willow flycatcher, has the potential to occur within the affected area of the proposed Los Mogotes East SEZ on the basis of observed occurrences near the affected area and the presence of apparently suitable habitat in the area of indirect effects (Table 10.4.12.1-1; Figure 10.4.12.1-1). Basic information on life history, habitat needs, and threats to this species is provided in Appendix J.

The southwestern willow flycatcher is known to breed in riparian habitats along the Rio Grande in the Alamos National Wildlife Refuge, approximately 18 mi (29 km) northeast of the Los Mogotes East SEZ. This area is considered to be outside of the areas of direct and indirect effects. According to the CNHP, the species has not been recorded on the SEZ or within the affected area, and, according to the SWReGAP habitat suitability model for the southwestern willow flycatcher, potentially suitable habitat does not occur on the SEZ or within the access road corridor. However, potentially suitable habitat does occur outside of the SEZ in the area of indirect effects, particularly along riparian habitats associated with the Alamosa River, the Conejos River, and La Jara Creek (Table 10.4.12.1-1; Figure 10.4.12.1-1). Designated critical habitat for this species does not occur in the SEZ region.

10.4.12.1.2 Species That Are Candidates for Listing under the ESA

In scoping comments on the proposed Los Mogotes East 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 Los Mogotes East SEZ (Table 10.4.12.1-1). The known and potential distribution of this species relative to the SEZ is shown in Figure 10.4.12.1-1. In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

Gunnison’s prairie dog occurs in the San Luis Valley and has been recorded in the vicinity of the Los Mogotes East SEZ. According to the CNHP, quad-level occurrences of this species intersect the western and southern portions of the affected area outside of the SEZ. Suitable habitat for the species exists on the SEZ, and Gunnison’s prairie dog burrows were observed on the SEZ during a site visit in July 2009. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs throughout the affected area and SEZ region (Table 10.4.12.1-1; Figure 10.4.12.1-1).

10.4.12.1.3 Species That Are under Review for Listing under the ESA

In scoping comments on the proposed Los Mogotes East SEZ, the USFWS did not identify any species under review for listing under the ESA that may occur in the affected area of the SEZ (Stout 2009). However, the northern leopard frog, which is under review for ESA listing in the western United States, may occur near the SEZ (Table 10.4.12.1-1). The known or potential distribution of this species relative to the SEZ is shown in Figure 10.4.12.1-1. In Appendix J, basic information is provided on life history, habitat needs, and threats to populations of this species.

The northern leopard frog is an amphibian widely distributed throughout North America. The western distinct population segment (DPS) of the northern leopard frog, which includes populations in Colorado, is currently under review for ESA listing. Within this DPS, the species is known to occur in various wetland communities, including creeks, rivers, pools, springs, canals, and flooded fields. The northern leopard frog is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model for the species, suitable habitat does not occur on the SEZ or within the access road corridor. However, potentially suitable habitat is predicted to occur within the area of indirect effects (Table 10.4.12.1-1).

10.4.12.1.4 BLM-Designated Sensitive Species

There are 18 BLM-designated sensitive species that may occur in the affected area of the proposed Los Mogotes East SEZ (Table 10.4.12.1-1). These BLM-designated sensitive species include the following (1) plants: Brandegee's milkvetch, fragile rockbrake, many-stemmed spider-flower, Ripley's milkvetch, and rock-loving aletes; (2) arthropods: Great Basin silverspot butterfly; (3) fish: Rio Grande chub; (4) amphibians: northern leopard frog; (5) reptiles: milk snake; (6) birds: American peregrine falcon, Barrow's goldeneye, ferruginous hawk, mountain plover, and western burrowing owl; and (7) mammals: big free-tailed bat, pale Townsend's big-eared bat, spotted bat, and Yuma myotis. Habitats in which these species are found, the amount of potentially suitable habitat in the affected area, and known locations of the species relative to the SEZ are presented in Table 10.4.12.1-1. The northern leopard frog is discussed in Section 10.4.12.1.3 because it is under review for listing under the ESA. The remaining 17 species as related to the SEZ are described in the remainder of this section. Additional life history information for these species is provided in Appendix J.

Brandegee's Milkvetch

The Brandegee's milkvetch is a perennial forb that is known from disjunct locations in Arizona, Colorado, New Mexico, and Utah. The species inhabits sandy or gravelly banks, flats, and rocky meadows within pinyon-juniper woodlands at elevations between 5,400 and 8,800 ft (1,645 and 2,680 m). The nearest quad-level occurrences of this species are approximately 8 mi (13 km) southwest of the Los Mogotes East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable pinyon-juniper woodland and mesic meadow habitats may occur in the access road corridor and area of indirect effects (Table 10.4.12.1-1).

Fragile Rockbrake

The fragile rockbrake is a perennial forb that is widespread across North America, Europe, and Asia. The species inhabits moist soils on shaded limestone cliffs at elevations greater than 7,000 ft (2,130 m). Nearest quad-level occurrences of this species are from the San Juan Mountains, approximately 20 mi (32 km) west of the Los Mogotes East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or access road corridor. However, potentially suitable rocky cliffs and outcrops may occur within the area of indirect effects (Table 10.4.12.1-1).

Many-Stemmed Spider-Flower

The many-stemmed spider-flower is an annual forb that is known from disjunct locations from central Wyoming, south-central Colorado, southeast Arizona, and southwest Texas. The species inhabits saturated soils of saline depressions, such as alkali sinks, alkaline meadows, and playa margins. Within the San Luis Valley of south-central Colorado, the species is known from saturated soils created by waterfowl management on public lands. Nearest quad-level occurrences of this species are from the Blanca Wetlands, approximately 25 mi (40 km) northeast of the Los Mogotes East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ or access road corridor. However, potentially suitable marsh habitat may occur within the area of indirect effects (Table 10.4.12.1-1).

Ripley's Milkvetch

The Ripley's milkvetch is a perennial forb that is restricted to a range of less than 1,000 mi^2 (<2,590 km^2) in Conejos County, Colorado, and Taos and Rio Arriba Counties, New Mexico. The species inhabits mixed conifer woodlands on rocky volcanic substrates at elevations above 8,000 ft (2,440 m). Nearest quad-level occurrences of this species are approximately 9 mi (14 km) west of the Los Mogotes East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable pinyon-juniper woodland habitat may occur within the access road corridor and area of indirect effects (Table 10.4.12.1-1).

Rock-Loving Aletes

The rock-loving aletes is a perennial forb that is endemic to south-central Colorado. The species occurs on volcanic rock substrates such as outcrops, cracks, or ledges. It is associated with pinyon-juniper woodlands on these substrates at elevations greater than 7,000 ft (2,130 m). Quad-level occurrences of this species intersect the affected area approximately 5 mi (8 km) west of the Los Mogotes SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable pinyon-juniper woodland habitat may occur within the access road corridor and area of indirect effects.

Potentially suitable rocky cliffs and outcrops may also occur in the area of indirect effects (Table 10.4.12.1-1).

Great Basin Silverspot Butterfly

The Great Basin silverspot butterfly occurs in northeastern Arizona, western Colorado, northern New Mexico, and eastern Utah. Within Colorado, this species occurs in isolated populations in streamside meadows and open seepage areas associated with violets (*Viola* spp.). Quad-level occurrence records for this species are known from the La Jara Front Range, approximately 9 mi (14 km) northwest of the Los Mogotes East SEZ. According to the SWReGAP land cover model, potentially suitable habitat for this species does not occur on the SEZ; however, potentially suitable mesic meadow habitat may occur within the access road corridor and area of indirect effects (Table 10.4.12.1-1).

Rio Grande Chub

The Rio Grande chub occurs in the Conejos River approximately 4 mi (6 km) south of the Los Mogotes East SEZ. The species is considered extirpated from the main stem Rio Grande (USFS 2005), but it is known to occur in tributary streams and some impoundments in the San Luis Valley. No suitable habitat for the species occurs on the SEZ or within the access road corridor; however, potentially suitable habitat occurs in the area of indirect effects within the Alamosa River, Conejos River, and La Jara Creek (Table 10.4.12.1-1).

Milk Snake

The milk snake occurs in a variety of habitats, including shortgrass prairie, sandhills, shrubby hillsides, woodlands, and river valleys. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the Los Mogotes East SEZ or within the assumed access road corridor; however, potentially suitable habitat may occur in the area of indirect effects (Table 10.4.12.1-1).

American Peregrine Falcon

The American peregrine falcon occurs 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. The nearest quad-level occurrences of this species are from the Rio Grande National Forest, approximately 17 mi (27 km) northwest of the Los Mogotes East SEZ (Table 10.4.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat for the American peregrine falcon does not occur on the SEZ. However, potentially suitable year-round foraging and summer nesting habitat may occur on the access road corridor and throughout portions of the area of indirect effects. On the basis of an evaluation of SWReGAP land cover types, however, potentially suitable nesting habitat (cliffs or outcrops) does not occur within the area of direct effects but approximately 16 acres (<0.1 km^2) of cliff and rock outcrop habitat that may be potentially suitable nesting habitat occurs in the area of indirect effects.

Barrow's Goldeneye

The Barrow's goldeneye is a diving duck that occurs in Colorado on larger lakes and rivers. The species is known to occur in the San Luis Valley, and, 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 Los Mogotes East SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the access road corridor; however, potentially suitable habitat may occur in the area of indirect effects (Table 10.4.12.1-1). The potentially suitable habitat within the area of indirect effects is particularly associated with the Conejos River and La Jara Creek.

Ferruginous Hawk

The ferruginous hawk is a summer resident in the Los Mogotes East SEZ affected area and a year-round resident in portions of the SEZ region. The species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper woodlands. Quad-level occurrences of the ferruginous hawk intersect the affected area approximately 5 mi (8 km) west of the Los Mogotes East SEZ. 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 access road corridor and within the area of indirect effects (Table 10.4.12.1-1). Most of this suitable habitat is represented by foraging habitat (shrublands). On the basis of an evaluation of SWReGAP land cover types, approximately 12 acres (<0.1 km^2) of forested habitat within the access road corridor and 1,400 acres (6 km^2) of forested habitat within the area of indirect effects may provide potentially suitable nesting habitat for the ferruginous hawk. In addition, approximately 16 acres (<0.1 km^2) of rocky cliffs and outcrops within the area of indirect effects may be potentially suitable nesting habitat.

Mountain Plover

The mountain plover inhabits prairie grasslands and arid plains and fields, and nests in shortgrass prairie habitats associated with prairie dogs, bison, and cattle. The species occurs within the San Luis Valley, and the nearest quad-level occurrences are about 5 mi (8 km) southeast of the Los Mogotes East SEZ. According to the SWReGAP habitat suitability model, potentially suitable summer habitat for this species may occur on the SEZ, access road corridor, and within the area of indirect effects (Table 10.4.12.1-1). The availability of nest sites within the affected area has not been determined.

Western Burrowing Owl

The western burrowing owl occurs 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 the San Luis Valley. According to the SWReGAP habitat suitability model, potentially suitable summer habitat for this species may occur in the SEZ, access road corridor, and in portions of the area of indirect effects (Table 10.4.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009, and shrubland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident in the Los Mogotes East SEZ region where it forages in a variety of habitats, including coniferous forests and desert shrublands. The species roosts in rock crevices or in buildings. The species is known to occur in the San Luis Valley of southern Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the big free-tailed bat occurs on the SEZ, access road corridor, and in portions of the area of indirect effects (Table 10.4.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects. However, approximately 16 acres (<0.1 km^2) of rocky cliffs and outcrops within the area of indirect effects may be potentially suitable roosting habitat.

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 Los Mogotes East SEZ region. The species roosts in caves, mines, tunnels, buildings, and other man-made structures. Quad-level occurrences of this species intersect the affected area approximately 5 mi (8 km) east of the Los Mogotes East SEZ. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the pale Townsend's big-eared bat occurs on the SEZ, access road corridor, and in portions of the area of indirect effects (Table 10.4.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects. However, approximately 16 acres (<0.1 km^2) of rocky cliffs and outcrops within the area of indirect effects may be potentially suitable roosting habitat.

Spotted Bat

The spotted bat is a year-round resident in the Los Mogotes East SEZ region where it occurs in desert shrublands, grasslands, and mixed coniferous forests. The species roosts in caves, rock crevices, and buildings. This species is known to occur in Conejos County, Colorado.

According to the SWReGAP habitat suitability model, potentially suitable habitat for the spotted bat does not occur on the SEZ or within the access road corridor. However, potentially suitable habitat may occur in portions of the area of indirect effects (Table 10.4.12.1-1).

Yuma Myotis

The Yuma myotis is a year-round resident in the Los Mogotes East SEZ region where it occurs in canyonlands, mesas, and arid shrubland habitats. The species roosts in mines, rock crevices, and buildings. This species is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable foraging habitat for the Yuma myotis occurs on the SEZ, access road corridor, and in portions of the area of indirect effects (Table 10.4.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects. However, approximately 16 acres (<0.1 km^2) of rocky cliffs and outcrops within the area of indirect effects may be potentially suitable roosting habitat.

10.4.12.1.5 State-Listed Species

There are five species listed by the State of Colorado that may occur in the Los Mogotes East SEZ affected area (Table 10.4.12.1-1). Three species (southwestern willow flycatcher, western burrowing owl, and spotted bat) were discussed in Section 10.4.12.1.1 and Section 10.4.12.1.3 because of their status under the ESA and BLM. Other state-listed species that may occur in the Los Mogotes East SEZ affected area include the Rio Grande sucker and bald eagle. These two species as related to the SEZ are described in the remainder of this section and are presented in Table 10.4.12.1-1. Additional life history information for these species is provided in Appendix J.

Rio Grande Sucker

The Rio Grande sucker is restricted to streams of the Rio Grande Basin, from south-central Colorado to southern New Mexico. Nearest quad-level occurrences of this species are from the Alamosa River, approximately 15 mi (24 km) northwest of the Los Mogotes East SEZ. The species is not known to occur in the SEZ affected area and suitable habitat does not occur in the area of direct effects. However, potentially suitable habitat may occur in the area of indirect effects in the Alamos River, Conejos River, and La Jara Creek (Table 10.4.12.1-1).

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. Quad-level occurrences of the bald eagle intersect the affected area approximately 5 mi (8 km) east of the Los Mogotes East SEZ.

According to the SWReGAP habitat suitability model, potentially suitable habitat for the bald eagle could occur on the SEZ, within the access road corridor, and throughout the area of indirect effects. Most of this potentially suitable habitat is potentially suitable foraging habitat (shrublands). On the basis of an evaluation of SWReGAP land cover types, potentially suitable nesting habitat (riparian woodlands) for the bald eagle does not occur on the SEZ or within the access road corridor; however, approximately 850 acres (3.5 km^2) of riparian woodlands that may be potentially suitable nesting habitat occur in the area of indirect effects.

10.4.12.1.6 Rare Species

There are 49 species that have 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 Los Mogotes East SEZ (Table 10.4.12.1-1). Of these species, 29 have not been discussed as ESA-listed (Section 10.4.12.1.1), candidates for listing under the ESA (Section 10.4.12.1.2), under review for ESA listing (Section 10.4.12.1.3), BLM-designated sensitive (Section 10.4.12.1.4), or state-listed (Section 10.4.12.1.5).

10.4.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Los Mogotes East SEZ is presented in this section. The types of impacts that special status species could incur from construction and operation of utility-scale solar energy facilities are discussed in Section 5.10.4.

The assessment of impacts on special status species is based on available information on the presence of species in the affected area as presented in Section 10.4.12.1 following the analysis approach described in Appendix M. It is assumed that, prior to development, surveys would be conducted to determine the presence of special status species and their habitats in and near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA consultations, and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid, minimize, or mitigate impacts on special status species (see Section 10.4.12.3).

Solar energy development within the Los Mogotes East SEZ could affect a variety of habitats (see Section 10.4.10). Based on CNHP records, occurrences for the following seven special status species intersect the Los Mogotes East SEZ affected area: rock-loving aletes, Rio Grande chub, bald eagle, ferruginous hawk, mountain plover, Gunnison's prairie dog, and pale Townsend's big-eared bat. Suitable habitat for each of these species may occur in the affected area. Other special status species may occur on the SEZ or within the affected area based on the presence of potentially suitable habitat. As discussed in Section 10.4.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur in the affected area, and may therefore overestimate impacts on some special status species.

Potential direct and indirect impacts on special status species within the SEZ and in the area of indirect effect outside the SEZ are presented in Table 10.4.12.1-1. In addition, the overall potential magnitude of impacts on each species (assuming programmatic design features are in place) is presented along with any potential species-specific mitigation measures that could further reduce impacts.

Impacts on special status species could occur during all phases of development (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy project within the SEZ. Construction and operation activities could result in short- or long-term impacts on individuals and their habitats, especially if these activities are sited in areas where special status species are known to or could occur. As presented in Section 10.4.1.2, a 3-mi (5-km) access road is needed to serve solar facilities within this SEZ. No new transmission lines are assumed to be needed due to the proximity of existing transmission infrastructure.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ and within the assumed road corridor where ground-disturbing activities are expected to occur. Indirect impacts could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, harassment, and lighting. No ground-disturbing activities associated with project facilities are anticipated to occur within the area of indirect effects. Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if original land contours and native plant communities were restored in previously disturbed areas.

The successful implementation of programmatic design features (discussed in Appendix A) would reduce direct impacts on some special status species, especially those that depend on habitat types that can be easily avoided. Indirect impacts on special status species could be reduced to negligible levels by implementing programmatic design features especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust.

10.4.12.2.1 Impacts on Species Listed under the ESA

In scoping comments on the proposed Los Mogotes East SEZ, the USFWS did not express concern for impacts of project development within the SEZ on any ESA-listed species (Stout 2009). However, on the basis of CNHP recorded occurrences and the presence of potentially suitable habitat, the southwestern willow flycatcher has the potential to occur in the affected area. The species has not been recorded on the SEZ or in the area of indirect effects, and, according to the SWReGAP habitat suitability model, suitable habitat does not occur on the SEZ or within the access road corridor. However, approximately 3,459 acres (14 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 0.8% of the available potentially suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the southwestern willow flycatcher from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

10.4.12.2.2 Impacts on Species That Are Candidates for Listing under the ESA

In scoping comments on the proposed Los Mogotes East 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 could occur in the affected area of the Los Mogotes East SEZ. Quad-level occurrences of this species are known to intersect the affected area of the SEZ, and Gunnison's prairie dog burrows were observed on the SEZ during a site visit in July 2009. According to the SWReGAP habitat suitability model, approximately 5,540 acres (22.5 km^2) of potentially suitable shrubland habitat on the SEZ and 3 acres (<0.1 km^2) of potentially suitable habitat within the assumed road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents about 0.3% of available suitable habitat in the SEZ region. About 38,614 acres (156 km^2) of suitable habitat occurs in the area of potential indirect impacts; this area represents about 2.1% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the Gunnison's prairie dog from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East 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 programmatic 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 the Gunnison's prairie dog is not a feasible means of mitigating impacts because these habitats (shrublands) are widespread throughout the area of direct effect. However, direct impacts could be reduced by avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Development of mitigation for the Gunnison's prairie dog, including development of a survey protocol, avoidance and minimization measures, and, potentially, translocation or compensatory mitigation, should be developed in coordination with the USFWS per Section 7 of the ESA. Consultation with the CDOW should also occur to determine any state mitigation requirements.

10.4.12.2.3 Impacts on Species That Are under Review for Listing under the ESA

In scoping comments on the proposed Los Mogotes East SEZ, the USFWS did not express concern for impacts of project development within the SEZ on any species that are under review for listing under the ESA (Stout 2009). However, on the basis of CNHP recorded occurrences and the presence of potentially suitable habitat, the northern leopard frog has the potential to occur in the affected area and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, potentially suitable habitat for the northern leopard frog does not occur on the SEZ or within the access road corridor. However, about 400 acres (1.5 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 1.1% of the available suitable habitat in the region (Table 10.4.12.1-1).

The overall impact on the northern leopard frog from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

If deemed necessary, development of mitigation for the northern leopard frog, including development of a survey protocol, avoidance and minimization measures, and, potentially, translocation or compensatory mitigation, should be developed in coordination with the USFWS per Section 7 of the ESA. Consultation with the CDOW should also occur to determine any state mitigation requirements.

10.4.12.2.4 Impacts on BLM-Designated Sensitive Species

Of the 18 BLM-designated sensitive species that could occur in the affected area of the Los Mogotes East SEZ, there is 1 species (northern leopard frog) that was discussed in Section 10.4.12.1.3 because of its pending status under the ESA. Impacts on the remaining BLM-designated sensitive species that have potentially suitable habitat within the affected area are discussed below.

Brandegee's Milkvetch

The Brandegee's milkvetch is known to occur approximately 8 mi (13 km) southwest of the Los Mogotes East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable pinyon-juniper woodland and mesic meadow habitats do not occur on the SEZ. However, less than 1 acre (<0.1 km^2) of potentially suitable pinyon-juniper woodland habitat in the in the access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. Approximately 1,389 acres (6 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents 0.2% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the Brandegee's milkvetch from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoiding or minimizing disturbance of all woodland habitat or occupied habitat in the area of direct effects could reduce direct impacts on this species. If avoidance or minimization are not feasible options, plants could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Fragile Rockbrake

The fragile rockbrake is known to occur approximately 20 mi (32 km) west of the Los Mogotes East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable rocky cliffs and outcrops do not occur on the SEZ or within the access road corridor. However, approximately 16 acres (< 0.1 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents 0.1% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the fragile rockbrake from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Many-Stemmed Spider-Flower

The many-stemmed spider-flower is known to occur approximately 25 mi (40 km) northeast of the Los Mogotes East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the access road corridor. However, approximately 4 acres (< 0.1 km^2) of potentially suitable marsh habitat may occur in the area of indirect effects; this area represents 0.1% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the many-stemmed spider-flower from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Ripley's Milkvetch

The Ripley's milkvetch is known to occur approximately 9 mi (14 km) west of the Los Mogotes East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ. However, less than 1 acre (<0.1 km^2) of potentially suitable pinyon-juniper woodland habitat in the access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. Approximately 12 acres (< 0.1 km^2) of potentially suitable woodland habitat occurs in the area of indirect effects; this area represents less than 0.1% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the Ripley's milkvetch from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance or minimizing disturbance of all woodland habitat or occupied habitat in the area of direct effects could reduce direct impacts on this species. In addition, the implementation of mitigation measures described previously for the Brandegee's milkvetch could further reduce direct impacts on this species. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Rock-Loving Aletes

The rock-loving aletes is known to occur approximately 5 mi (8 km) west of the Los Mogotes East SEZ, and potentially suitable habitat occurs in the affected area. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ. However, less than 1 acre (<0.1 km^2) of potentially suitable pinyon-juniper woodland habitat in the access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. Approximately 1,338 acres (5.5 km^2) of potentially suitable woodland habitat and rocky cliffs and outcrops occurs in the area of indirect effects; this area represents 0.4% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the rock-loving aletes from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because <1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoiding or minimizing disturbance of all woodland habitat or occupied habitat in the area of direct effects could reduce direct impacts on this species. In addition, the implementation of mitigation measures described previously for the Brandegee's milkvetch could further reduce direct impacts on this species. 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.

Great Basin Silverspot Butterfly

The Great Basin silverspot butterfly is known to occur approximately 9 mi (14 km) northwest of the Los Mogotes East SEZ, and potentially suitable habitat occurs in the affected area of the SEZ. According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ. However, less than 1 acre (<0.1 km^2) of potentially suitable mesic meadow habitat in the in the access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. Approximately 2,165 acres (9 km^2) of potentially suitable mesic meadow and marsh habitat occurs in the area of indirect effects; this area represents 0.4% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the Great Basin silverspot butterfly from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoiding or minimizing disturbance of all meadow habitat in the road corridor could reduce direct impacts on this species. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. 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.

Rio Grande Chub

The Rio Grande chub historically inhabited the Conejos River approximately 4 mi (6 km) south of the Los Mogotes East SEZ. The Rio Grande chub is considered extirpated from the main stem Rio Grande (USFS 2005), and suitable habitat for the species does not occur on the SEZ or within the access road corridor. However, approximately 19 mi (30 km) of potentially suitable habitat occurs within the area of indirect effects within the Alamosa River, Conejos River, and La Jara Creek; this habitat represents about 2.6% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the Rio Grande chub from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Milk Snake

The milk snake is known to occur in Conejos County, Colorado, although the species is not known to occur in the affected area of the Los Mogotes East SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species is not expected to occur on the SEZ or within the access road corridor. However, approximately 685 acres (3 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents less than 0.1% of the available suitable habitat in the region (Table 10.4.12.1-1).

The overall impact on the milk snake from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

American Peregrine Falcon

The American peregrine falcon is a year-round resident in the Los Mogotes East SEZ region and is known to occur in the Rio Grande National Forest, approximately 17 mi (27 km) northwest of the SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ. However, approximately 13 acres (<0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents less than 0.1% of potentially suitable habitat in the SEZ region. About 47,723 acres (193 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.3% of the potentially suitable habitat in the SEZ region (Table 10.4.12.1-1). 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 access road corridor, but approximately 16 acres (<0.1 km^2) of this habitat may occur in the area of indirect effects.

The overall impact on the American peregrine falcon from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of impacts on all 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. According to CNHP, the species has not been recorded on the 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 or within the access road corridor. However, about 2,300 acres (9 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 1.5% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1).

The overall impact on the Barrow's goldeneye from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Ferruginous Hawk

The ferruginous hawk is a summer breeding resident in the affected area of the Los Mogotes East SEZ, but is a year-round resident in the region. The species is known to occur approximately 5 mi (8 km) west of the SEZ. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ. However, approximately 12 acres (<0.1 km^2) of potentially suitable habitat within the assumed access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents less than 0.1% of available suitable habitat in the SEZ region. About 43,448 acres (176 km^2) of potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 3.1% of the available suitable habitat in the region (Table 10.4.12.1-1). Most of this area could serve as foraging habitat (i.e., open shrublands and grasslands). On the basis of an evaluation of SWReGAP land cover data, approximately 12 acres (<0.1 km^2) of woodland habitat within the access road corridor and 1,400 acres (6 km^2) of forested habitat within the area of indirect effects may be potentially suitable nesting habitat for the ferruginous hawk. In addition, approximately 16 acres (<0.1 km^2) of rocky cliffs and outcrops within the area of indirect effects may be potentially suitable nesting habitat.

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of direct impacts on all foraging habitat (shrublands) is not feasible because suitable foraging habitat (shrublands) is widespread in the area of direct effect and may be readily available in other portions of the affected area. However, avoiding or minimizing disturbance of all potential nesting habitat (woodlands) or occupied nests within the access road corridor is feasible and could reduce impacts. If avoiding or minimizing disturbance of all suitable nesting habitat or occupied habitat are not feasible options, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat within the area of direct effects.

Mountain Plover

The mountain plover is a summer breeding resident in the Los Mogotes East SEZ region and is known to occur as near as 5 mi (8 km) southeast of the SEZ. According to the SWReGAP habitat suitability model, approximately 5,918 acres (24 km^2) of potentially suitable habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable habitat within the assumed access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents 0.4% of available suitable habitat in the SEZ region. About 82,764 acres (335 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 6.2% of the available suitable habitat in the region (Table 10.4.12.1-1). Most of this area could serve as foraging or nesting habitat. The abundance of suitable nest sites on the SEZ and throughout the affected area has not been determined.

The overall impact on the mountain plover from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of all potentially suitable foraging and nesting habitats is not feasible because potentially suitable habitats are widespread throughout the area of direct effect and may be readily available in other portions of the SEZ region. Direct impacts on the mountain plover could be reduced by avoiding or minimizing disturbance to occupied nests and suitable habitat in the area of direct effects. If avoiding or minimizing disturbance of all occupied habitat are not feasible options, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than design features, should be determined by conducting pre-disturbance surveys for the species and its habitat within the area of direct effects.

Western Burrowing Owl

The western burrowing owl is a summer breeding resident within the Los Mogotes East SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 5,918 acres (24 km^2) of potentially suitable habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable habitat in the access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents about 0.3% of potentially suitable habitat in the SEZ region. About 83,900 acres (340 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 4.1% of the potentially suitable habitat in the SEZ region (Table 10.4.12.1-1). 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 Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging and nesting habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging and nesting habitat in the region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of all potentially suitable habitats is not feasible to mitigate impacts on the western burrowing owl because potentially suitable shrubland habitats are widespread throughout the area of direct effect and may be readily available in other portions of the SEZ region. However, impacts on the western burrowing owl could be reduced by avoiding or minimizing disturbance to occupied burrows and habitat in the area of direct effects. If avoiding or minimizing disturbance of all occupied habitat are not feasible options, a compensatory mitigation plan could be developed and implemented to mitigate direct effects. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance 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 Los Mogotes East SEZ region and is known to occur in the San Luis Valley. According to the SWReGAP habitat suitability model, approximately 5,918 acres (24 km^2) of potentially suitable foraging habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable foraging habitat within the assumed access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents about 0.2% of available suitable foraging habitat in the SEZ region. About 84,845 acres (343 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect impacts; this area represents about 3.2% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1). 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 16 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the big free-tailed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Pale Townsend's Big-Eared Bat

The pale Townsend's big-eared bat is a year-round resident within the Los Mogotes East SEZ region and is known to occur approximately 5 mi (8 km) east of the SEZ. According to the SWReGAP habitat suitability model, approximately 5,918 acres (24 km^2) of potentially suitable foraging habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable foraging habitat within the assumed access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents about 0.2% of available suitable foraging habitat in the SEZ region. About 85,742 acres (347 km^2) of potentially suitable foraging habitat occurs in the area of potential indirect impacts; this area represents about 3.2% of the available potentially suitable foraging habitat in the SEZ region (Table 10.4.12.1-1). 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 16 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the pale Townsend's big-eared bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not feasible because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Spotted Bat

The spotted bat is a year-round resident within the Los Mogotes East SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ or within the access road corridor. However, about 1,162 acres (5 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 0.1% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1). 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, approximately 16 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the spotted bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Yuma Myotis

The Yuma myotis is a year-round resident within the Los Mogotes East SEZ region and is known to occur in Conejos County, Colorado. According to the SWReGAP habitat suitability model, approximately 5,871 acres (23.8 km^2) of potentially suitable foraging habitat on the SEZ and 4 acres (<0.1 km^2) of potentially suitable foraging habitat within the assumed access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents about 0.3% of available suitable foraging habitat in the SEZ region. About 44,809 acres (181 km^2) of potentially suitable habitat occurs in the area of indirect impacts; this area represents about 2.0% of the available potentially suitable foraging habitat in the SEZ region (Table 10.4.12.1-1). 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 16 acres (<0.1 km^2) of cliffs and rock outcrops that might be potentially suitable roost habitat occurs in the area of indirect effects.

The overall impact on the Yuma myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the

SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of 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.

10.4.12.2.5 Impacts on State-Listed Species

There are five state-listed species that could occur in the affected area of the Los Mogotes East SEZ; three of these species (southwestern willow flycatcher, western burrowing owl, and spotted bat) were discussed in Section 10.4.12.2.1 and Section 10.4.12.2.3 because of their status under the ESA and BLM. Of the remaining state-listed species, the Rio Grande sucker and bald eagle may occur in the affected area due to the presence of suitable habitat. Impacts on these species from solar development within the Los Mogotes East SEZ are discussed below.

Rio Grande Sucker

The Rio Grande sucker is restricted to streams in the Rio Grande Basin and is known to occur in the Alamosa River, approximately 15 mi (24 km) northwest of the Los Mogotes East SEZ. Suitable habitat for this species does not occur on the SEZ or within the access road corridor. However, approximately 19 mi (30 km) of potentially suitable habitat occurs within the area of indirect effects within the Alamosa River, Conejos River, and La Jara Creek; this habitat represents about 2.2% of the available suitable habitat in the region (Table 10.4.12.1-1).

The overall impact on the Rio Grande sucker from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Bald Eagle

The bald eagle is a year-round resident within the Los Mogotes East SEZ region and is known to occur approximately 5 mi (8 km) east of the SEZ. According to the SWReGAP habitat suitability model, approximately 5,358 acres (22 km^2) of potentially suitable habitat on the SEZ and 16 acres (<0.1 km^2) of potentially suitable habitat within the assumed access road corridor could be directly affected by construction and operations (Table 10.4.12.1-1). This direct impact area represents 0.3% of available suitable habitat in the SEZ region. About 69,426 acres (281 km^2) of potentially suitable habitat occurs in the area of potential indirect effect; this area represents about 4.2% of the available suitable habitat in the SEZ region (Table 10.4.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover types, riparian woodland habitats that could provide nesting sites do not occur within the area of direct effects;

however, approximately 850 acres (3.5 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 Los Mogotes East SEZ is considered small because the amount of potentially suitable foraging and nesting habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Los Mogotes East SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of 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.

10.4.12.2.6 Impacts on Rare Species

There are 49 species with a state status of S1 or S2 in the state of Colorado or species of concern by Colorado or the USFWS that may occur in the affected area of the Los Mogotes East SEZ. Impacts have been previously discussed for 20 of these species that are also listed under the ESA (Section 10.4.12.2.1), candidates for listing under the ESA (Section 10.4.12.2.2), under review for ESA listing (Section 10.4.12.2.3) BLM-designated sensitive (Section 10.4.12.2.4), or state-listed species (Section 10.4.12.2.5). Impacts on the remaining 29 rare species that do not have any other special status designation are presented in Table 10.4.12.1-1.

10.4.12.3 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 and access road corridor to determine the presence and abundance of special status species, including those identified in Table 10.4.12.1-1; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to occupied habitats is not possible, translocation of individuals from areas of direct effect (where appropriate); 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 in the area of direct effects could reduce impacts on the grassy slope sedge, least moonwort, northern moonwort, Philadelphia fleabane, prairie violet, Rocky Mountain blazing-star, western moonwort, mountain plover, and short-eared owl.

- Avoiding or minimizing impacts on marshes and mesic meadows in the area of direct effects could reduce impacts on the Brandegee's milkvetch, Colorado larkspur, least moonwort, leathery grape fern, marsh cinquefoil, Mingan's moonwort, mountain whitlow-grass, Philadelphia fleabane, rock sandwort, Rocky Mountain blazing-star, slender sedge, variegated scouringrush, and Great Basin silverspot butterfly.

- Avoiding or minimizing impacts on woodland habitat in the area of direct effects could reduce impacts on the Brandegee's milkvetch, Colorado larkspur, Gray's Townsend-daisy, James' cat's-eye, mountain whitlow-grass, northern moonwort, Philadelphia fleabane, prairie violet, Ripley's milkvetch, rock-loving aletes, Rocky Mountain blazing-star, and ferruginous hawk.

- Coordination with the USFWS and CDOW should be conducted to address the potential for impacts on the Gunnison's prairie dog and northern leopard frog—species that are either 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 USFWS and CDOW.

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on special status species could be reduced.

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10.4.13 Air Quality and Climate

10.4.13.1 Affected Environment

10.4.13.1.1 Climate

The proposed Los Mogotes East SEZ is located near central portion of the Conejos County in the south-central Colorado. The SEZ, with an average elevation of about 7,860 ft (2,396 m), is located in the southern part of the San Luis Valley in south-central Colorado. The valley lies in a broad depression between the Sangre de Cristo Mountain Range to the east and the San Juan and La Garita Mountain Range to the west; they converge to the north. As a result of these barriers, the valley experiences an arid climate, which is marked by cold winters and moderate summers, light precipitation, a high rate of evaporation, and abundant sunshine due to the thin atmosphere of its high elevation (NCDC 2009a). Meteorological data collected at the San Luis Valley Regional Airport and Manassa, which are about 17 mi (27 km) north–northeast and 5 mi (8 km) east of the Los Mogotes East SEZ, respectively, are summarized below.

A wind rose from the San Luis Valley Regional Airport in Alamosa, Colorado, for the 5-year period 2004 to 2008 taken at a level of 33 ft (10 m) is presented in Figure 10.4.13.1-1 (NCDC 2009b). During this period, the annual average wind speed at the airport was about 7.4 mph (3.3 m/s), with a relatively weak prevailing wind direction from the southwest (about 7.9% of the time). Winds that ranged from south to west–southwest accounted for about 30.5% of the time and occurred more frequently throughout the year, except in July and August when east-southeast winds prevailed. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (about one-fifth of the time) because of the stable conditions caused by strong radiative cooling from late night to sunrise. Average wind speeds were highest in spring at 9.6 mph (4.3 m/s); lower in summer and fall at 7.4 mph (3.3 m/s) and 6.7 mph (3.0 m/s), respectively; and lowest in winter at 6.1 mph (2.7 m/s).

In Colorado, topography plays a large role in determining the temperature of any specific location (NCDC 2009c). The San Luis Valley sits at a higher elevation, so temperatures there are lower than at lower elevations of comparable latitude. For the 1893 to 2009 period, the annual average temperature at Manassa was 42.5°F (5.8°C) (WRCC 2009). January was the coldest month, with an average minimum temperature of 2.0°F (–16.7°C), and July was the warmest month with an average maximum of 80.4°F (26.9°C). In summer, daytime maximum temperatures higher than 90°F (32.2°C) were infrequent, and minimums were in the low 40s. On most days of colder months (November through March), the minimum temperatures recorded were below freezing (≤32°F [0°C]); subzero temperatures also were common in January and December. During the same period, the highest temperature, 95°F (35.0°C), was reached in August 1919, and the lowest, –37°F (–38.3°C) was reached in January 1948. Each year, less than 1 day had a maximum temperature of ≥90°F (32.2°C), while about 213 days had minimum temperatures at or below freezing.

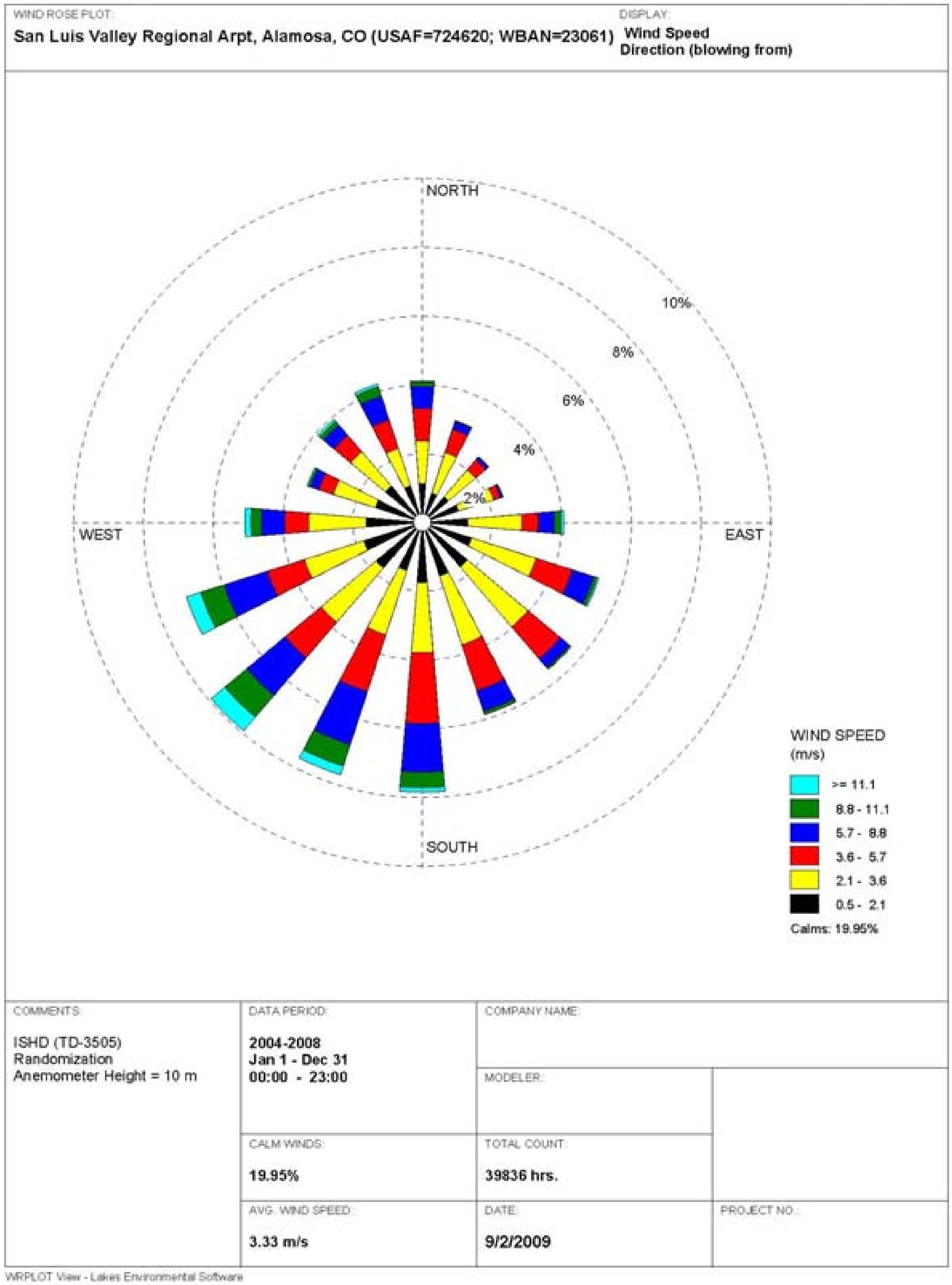

FIGURE 10.4.13.1-1 Wind Rose at 33-ft (10-m) Height at San Luis Valley Regional Airport, Alamosa, Colorado, 2004–2008 (Source: NCDC 2009b)

In Colorado, precipitation patterns are largely controlled by mountain ranges and elevation (NCDC 2009c). Because the San Luis Valley is so far from major sources of moisture and is surrounded by mountain ranges, precipitation is relatively light there. The valley is the driest area in Colorado. For the 1893 to 2009 period, annual precipitation at Manassa averaged about 7.30 in. (18.5 cm) (WRCC 2009). On average, 47 days a year have measurable precipitation (0.01 in. [0.025 cm] or higher). Nearly half of the annual precipitation occurs during summer months when the Southwest Monsoon is most active (NCDC 2009c). Most of it is in the form of scattered, light showers and thunderstorms that develop over the mountains and move into the valley from the southwest. Scattered afternoon thunderstorms can accompany locally heavy rain and occasional hail. Snow occurs mainly in light falls that start as early as September and continue as late as May; most of the snow falls from November through March. The annual average snowfall at Manassa is about 24.6 in. (62.5 cm).

Because the San Luis Valley is so far from major water bodies and because surrounding mountain ranges block air masses from penetrating into the area, severe weather events, such as tornadoes, are a rarity there (NCDC 2010).

In 1994, one flash flood, which occurred near Manassa, was reported in Conejos County (NCDC 2010); this flash flood did cause minor property damage.

In Conejos County, seven hailstorms in total have been reported since 1961, none of which caused property or crop damage (NCDC 2010). Hail measuring 1.75 in. (4.4 cm) in diameter was reported in 1961. In Conejos County, no high-wind or thunderstorm-wind events have been reported (NCDC 2010). However, considering that these wind events have been reported in Alamosa and Saguache Counties in San Luis Valley, there is a possibility that these winds could occur in Conejos County as well.

No dust storm was reported in Conejos County (NCDC 2010). However, the ground surface of the SEZ is covered predominantly with very stony and cobbly loams, which have relatively low-to-moderate dust storm potential. High winds can trigger large amounts of blowing dust in areas of Conejos County with dry and loose soils with sparse vegetation. Dust storms can deteriorate air quality and visibility and may have adverse effects on health, particularly for people with asthma or other respiratory problems.

Infrequently, remnants from a decayed Pacific hurricane may dump heavy, widespread rains in Colorado (NCDC 2009c). Tornadoes in Conejos County, which encompasses the proposed Los Mogotes East SEZ, occur infrequently. In the period 1950 to June 2010, a total of four tornadoes (0.1 per year) were reported in Conejos County (NCDC 2010). However, most tornadoes occurring in Conejos County were relatively weak (i.e., three were F0 and one was F2 on the Fujita tornado scale), one of which caused minor property damage. These tornadoes occurred near the SEZ, ranging from 4 mi (6 km) to 10 mi (16 km) from the SEZ.

10.4.13.1.2 Existing Air Emissions

Conejos County has only a few industrial emission sources, and the amount of their emissions is relatively low. Because of the sparse population, only a handful of major roads, such as U.S. 285, and several state routes exist in Conejos County. Thus, onroad mobile source emissions are not substantial. Data on annual emissions of criteria pollutants and VOCs in Conejos County, which encompasses the proposed Los Mogotes East SEZ, are presented in Table 10.4.13.1-1 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). In 2002, fire sources (mostly wildfires) were predominant contributors to all criteria pollutants and accounted for about one-third of VOC emissions. Biogenic sources (i.e., vegetation—including trees, plants, and crops—soils) that releases naturally occurring emissions accounted for about two-thirds of VOC emissions. Area sources accounted for the rest of county emissions of PM_{10} and $PM_{2.5}$, and onroad and nonroad sources were primary contributors to the remainder of the SO_2, NO_x, and CO emissions. In Conejos County, point sources were minor contributors to criteria pollutants and VOCs.

TABLE 10.4.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Conejos County, Colorado, Encompassing the Proposed Los Mogotes East SEZ, 2002[a]

Pollutant[b]	Emissions (tons/yr)
SO_2	928
NO_x	4,073
CO	160,018
VOCs	21,966
PM_{10}	16,041
$PM_{2.5}$	13,126

a Includes point, area, onroad and nonroad mobile, biogenic, and fire emissions.

b Notation: CO = carbon monoxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

Source: WRAP (2009).

In 2005, Colorado produced about 118 MMt of *gross*[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%) 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.

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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.

10.4.13.1.3 Air Quality

Colorado State Ambient Air Quality Standards (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 National Ambient Air Quality Standards (NAAQS) for annual NO_2, CO, 1-hour O_3, and 24-hour PM_{10} (EPA 2010), but Colorado has no standards for 1-hour, 24-hour, and annual SO_2, 1-hour NO_2, 8-hour O_3, $PM_{2.5}$, and calendar-quarter and rolling 3-month Pb. Colorado has more stringent standards than the NAAQS for 3-hour SO_2 and 1-month Pb, and it still maintains an annual average PM_{10} standard, for which the national standard was revoked by the EPA on December 18, 2006. The NAAQS/SAAQS for criteria pollutants are presented in Table 10.4.13.1-2.

Conejos County, which encompasses the proposed Los Mogotes East SEZ, is located administratively within the San Luis Intrastate AQCR (Title 40, Part 81, Section 176 of the *Code of Federal Regulations* [40 CFR 81.176]), which is exactly the same as Colorado State AQCR 8, along with other counties in and around the San Luis Valley, such as Alamosa, Costilla, Mineral, Rio Grande, and Saguache Counties. Currently, Colorado State AQCR 8 is designated as being in unclassifiable/attainment for all criteria pollutants (40 CFR 81.306).

Because of the low population density, low level of industrial activities (except for agriculture-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. High PM_{10} concentrations in Alamosa 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 10.4.13.1-2 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.

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 locate within 62 mi (100 km) of a Class I area. There are several Class I areas

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[8] As a direct result of the phaseout of leaded gasoline in automobiles in the 1970s, average Pb concentrations throughout the country have decreased dramatically. Accordingly, Pb is not an air quality concern except at certain locations, such as lead smelters, waste incinerators, and lead-acid battery facilities, where the highest levels of lead in air are found.

TABLE 10.4.13.1-2 Applicable Ambient Air Quality Standards and Background Concentration Levels Representative of the Proposed Los Mogotes East SEZ in Conejos County, Colorado

Pollutant[a]	Averaging Time	NAAQS/ SAAQS[b]	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 County Road 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 10.4.13.1-2 (Cont.)

[g] Colorado has also established increments limiting the allowable increase ambient concentrations over an established baseline.

[h] Colorado state standard for 3-hour SO_2 is 700 μg/m^3 (0.267 ppm).

[i] Effective April 12, 2010.

[j] The EPA revoked the 1-hour O_3 standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").

[k] Effective December 18, 2006, the EPA revoked the annual PM_{10} standard of 50 μg/m^3.

[l] The Colorado Pb standard is 1-month average of 1.5 μg/m^3.

[m] Effective January 12, 2009.

Sources: CDPHE (2008); Chick (2009); EPA (2009b, 2010); 5 *Code of Colorado Regulations* 1001-14.

around the Los Mogotes East SEZ, four of which are situated within the 62-mi (100-km) range. The nearest Class I area is the Great Sand Dunes WA, about 35 mi (57 km) north-northeast of the Los Mogotes East SEZ (40 CFR 81.406). This Class I area is located downwind of prevailing winds at the Los Mogotes East SEZ (see Figure 10.4.13.1-1). The other two Class I areas in Colorado are the Weminuche and La Garita WA, which is about 44 mi (71 km) west–northwest and 55 mi (89 km) northwest of the Los Mogotes East SEZ. The Wheeler Peak WA in New Mexico is located about 50 mi (80 km) southeast of the SEZ (40 CFR 81.421). These three Class I areas are not located downwind of the prevailing winds at the Los Mogotes East SEZ.

10.4.13.2 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 of fugitive dust emissions from soil disturbances on ambient air quality are anticipated, although they are expected to be of short duration. During the operation phase, only a few emission sources with generally low-level emissions would exist for the four types of solar technologies evaluated. A solar facility would either not burn any 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, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific to the Los Mogotes East 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 10.4.13.3, below, identifies SEZ-specific design features of particular relevance to the Los Mogotes East SEZ.

10.4.13.2.1 Construction

The terrain at Los Mogotes East SEZ is relatively flat, thus only a minimum amount 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 large areas would be disturbed in a region that has problems with windblown dust. Fugitive dusts, which are released near ground level, typically have more localized impacts than similar emissions from an elevated stack with additional plume rise induced by buoyancy and momentum effects.

Methods and Assumptions

Air quality modeling for PM_{10} and $PM_{2.5}$ emissions associated with construction activities was performed using the EPA-recommended AERMOD model (EPA 2009c). Details for emissions estimation, the description of AERMOD, input data processing procedures, and modeling assumption are described in Section M.13 of Appendix M. Estimated air concentrations were compared with the applicable NAAQS/SAAQS levels at the site boundaries and nearby communities and with PSD increment levels at nearby Class I areas.[9] For the Los Mogotes East SEZ, the modeling was conducted based on the following assumptions and input:

- Uniformly distributed emissions over the 3,000 acres (12.1 km^2) in the eastern half of the SEZ, close to the nearest residence and the towns of Romeo and Manassa,

- Surface hourly meteorological data from the San Luis Valley Regional Airport in Alamosa and upper air sounding data from Denver for the 2004 to 2008 period,

- A regularly spaced receptor grid over a modeling domain of 62 mi × 62 mi (100 km × 100 km) centered on the proposed SEZ, and

- Additional discrete receptors at the SEZ boundaries and at the nearest Class I area—Geat Sand Dunes WA.

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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.

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 10.4.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled at the site boundaries would be about 477 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. Total 24-hour PM_{10} concentrations of 504 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 0.4 mi (0.6 km) east of the SEZ's southeastern corner; about 40 μg/m^3 at Antonito, Conejos, and Romeo; about 30 μg/m^3 at La Jara and Manassa; and about 20 μg/m^3 at Estrella, Sanford, and San Antonio. Annual modeled and total PM_{10} concentration increments at the SEZ boundary would be about 95.6 μg/m^3 and 109 μg/m^3, respectively, which are higher than the standard level of 50 μg/m^3. Annual PM_{10} increments would be much lower for the mentioned locations, about 15 μg/m^3 at the nearest residence, about 2.5 μg/m^3 at Romeo, about 1.5 μg/m^3 at Manassa, and about 1 μg/m^3 at Antonito, Conejos, La Jara, and Sanford. Total 24-hour $PM_{2.5}$ concentrations would be 49.4 μg/m^3 at the SEZ boundary, which is about 141% of its standard level of 35 μg/m^3; these modeled concentrations are about two times background concentrations. The total annual average $PM_{2.5}$ concentration at the SEZ boundary would be 13.6 μg/m^3, which is 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 10 and 1.5 μg/m^3, respectively.

TABLE 10.4.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Los Mogotes East SEZ

			Concentration (μg/m^3)				Percentage of NAAQS/SAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background	Total	NAAQS/ SAAQS	Increment	Total
PM_{10}	24 hours	H6H	477	27	504	150	318	336
	Annual	–	95.6	13	109	50	191	217
$PM_{2.5}$	24 hours	H8H	33.4	16	49.4	35	96	141
	Annual	–	9.6	4	13.6	15	64	90

[a] $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm.

[b] Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the 5-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

Source: Chick (2009) for background concentration data.

Predicted 24-hour and annual PM_{10} concentration increments at the nearest Class I area, Great Sand Dunes WA, would be about 10 and 0.20 $\mu g/m^3$, or 131% and 5%, respectively, of the allowable PSD increment levels for Class I areas. Considering distance, prevailing winds, and topography, concentration increments at the other three Class I areas (La Garita WA and Weminuche WA in Colorado, and Wheeler Peak WA in New Mexico) would be much lower than those at the Great Sand Dunes WA.

In conclusion, predicted 24-hour and annual PM_{10} and 24-hour $PM_{2.5}$ concentration levels could exceed air quality standard levels at the SEZ boundaries and areas immediately surrounding them 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. Additionally, potential air quality impacts on neighboring communities would be much lower. Predicted total concentrations for annual $PM_{2.5}$ would be below their respective standard levels. Modeling indicates that construction activities could result in exceeding the maximum allowable Class I PSD PM_{10} increment levels at the nearest federal Class I area (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 gage the size of the potential impact. Therefore, it is anticipated that 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 have an impact 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. The NO_x emissions from engine exhaust would be the primary contributors to potential impacts on AQRVs. Construction-related emissions are temporary in nature and thus would cause some unavoidable but short-term impacts.

It is assumed that the existing regional 69-kV transmission line located within the SEZ would serve to transport solar energy generated on-site to the regional grid and thus construction of new transmission lines outside of the SEZ was not assessed. 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.

10.4.13.2.2 Operations

Emission sources associated with the operation of a solar facility include auxiliary boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for parabolic trough or power tower technology if wet cooling is 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 Los Mogotes East SEZ are presented in Table 10.4.13.2-2. Total power generation capacity ranging from 526 to 947 MW was estimated for the Los Mogotes East SEZ for various solar technologies (see Section 10.4.1.2). The estimated amount of emissions avoided for the solar technologies evaluated depends solely on the megawatts of conventional fossil fuel–generated power that would be displaced, because a composite emission factor per megawatt-hour of power by conventional technologies is assumed (EPA 2009d). If the Los Mogotes East SEZ is fully developed, it is expected that the amount of emissions avoided would be somewhat substantial. Development of 526 to 947 MW of solar power in the SEZ would result in avoided air emissions ranging from 1.9 to 3.5% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power

TABLE 10.4.13.2-2 Annual Emissions from Combustion-Related Power Generation Displaced by Full Solar Development of the Proposed Los Mogotes East 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
5,918	526–947	922–1,659	1,219–2,194	1,405–2,529	0.008–0.014	910–1,639
Percentage of total emissions from electric power systems in the state of Colorado[d]			1.9–3.5%	1.9–3.5%	1.9–3.5%	1.9–3.5%
Percentage of total emissions from all source categories in the state of Colorado[e]			1.0–1.9%	0.34–0.62%	–[f]	0.88–1.6%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.49–0.87%	0.38–0.68%	0.27–0.48%	0.35–0.63%
Percentage of total emissions from all source categories in the six-state study area[e]			0.26–0.47%	0.05–0.09%	–	0.11–0.20%

[a] Assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.02 km^2) per MW (parabolic trough) to 9 acres (0.04 km^2) per MW (power tower, dish engine, and PV) 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^{-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).

systems in the state of Colorado (EPA 2009d). Avoided emissions would be up to 0.9% 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 1.9% of SO_2, 0.6% of NO_x, and 1.6% of CO_2 emissions in the state of Colorado (EPA 2009a; WRAP 2009). These emissions would be up to 0.5% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for more than 96% of the total electric power generation in Colorado. The contribution of coal combustion is about 72%, followed by that of natural gas combustion, about 24%. Thus, solar facilities to be built in the Los Mogotes East 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 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 Los Mogotes East SEZ is located in an arid desert environment, these emissions would be small, and potential impacts on ambient air quality would be negligible, considering the infrequent occurrences and small emissions of corona discharges.

10.4.13.2.3 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 design features adopted during the construction phase would also be implemented during the decommissioning phase (Section 5.11.3).

10.4.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. Limiting dust generation during construction and operations at the Los Mogotes East SEZ (e.g., by increased watering frequency or road paving or treatment) is a required design feature under BLM's Solar Energy Program. These extensive fugitive dust control measures would keep off-site PM levels (particularly at Great Sand Dunes WA) as low as possible during construction.

10.4.14 Visual Resources

10.4.14.1 Affected Environment

10.4.14.1.1 Regional Setting

The Los Mogotes East proposed SEZ is located approximately 11 mi (17.6 km) north of the Colorado–New Mexico border on the western side of the San Luis Valley in Conejos County in southern Colorado. Section 10.4.7.1.1 discusses the regional setting (San Luis Valley) for Los Mogotes East and the other Colorado proposed SEZs.

10.4.14.1.2 Los Mogotes East SEZ

The Los Mogotes East proposed SEZ encompasses 5,918 acres (24 km^2) over an area of approximately 5.1 mi (8.3 km) north to south (at greatest extent) and 1.8 mi (2.9 km) east to west, and is located approximately 5.2 mi (8.4 km) (at closest approach) north-northwest of the town of Antonito, Colorado, 4.3 mi (7.0 km) north–northwest of the unincorporated community of Conejos, and 3.0 mi (4.8 km) west of the community of Romeo. U.S. 285 roughly parallels the eastern boundary of the SEZ at a distance of 2.7 to 3.5 mi (4.3 to 5.7 km). The SEZ ranges in elevation from 7,715 ft (2,352 m) in the northeastern portion to 8,015 ft (2,443 m) in the southwestern portion of the SEZ.

The SEZ is in a gently sloping treeless plain, with the strong horizon line being the dominant visual feature. The western part of the SEZ slopes slightly upward to the west toward the San Juan Mountains; however, the view of the mountains is blocked in some parts of the proposed SEZ by a slightly steeper foreground slope immediately west of the SEZ. Vegetation is primarily low shrubs (generally less than 1 ft [0.3 m]) and grasses, with many areas of bare, generally tan soil. During a July 2009 site visit, the vegetation presented a range of light greens and grays, with banding and other variation sufficient to add slight visual interest. Some or all of the vegetation might be snow-covered in winter, and this might significantly affect the visual qualities of the area by changing the color contrasts associated with the vegetation and could in turn change the contrasts associated with the introduction of solar facilities into the landscape.

Very few roads cross the SEZ. A two-track road roughly bisects the SEZ east to west. The SEZ is dissected by dry washes, generally running sloping from the southwest or northwest to east, with several washes converging into a large wash that drains out of the eastern side of the SEZ just north of the east-west road. No permanent water features are present on the SEZ. This landscape type is common within the region.

Other than the few unpaved roads on the SEZ, some household debris apparently dumped off the east-west road, and wire fences, there is little evidence of cultural modifications that detract from the SEZ's scenic quality. In general, the SEZ is natural in appearance. Panoramic views of the SEZ are shown in Figures 10.4.14.1-1 and 10.4.14.1-2.

FIGURE 10.4.14.1-1 Approximately 90° Panoramic View of the Proposed Los Mogotes East SEZ, Facing East, Including Agricultural Lands, San Luis Hills, and Sangre de Cristo Range in Background

FIGURE 10.4.14.1-2 Approximately 180° Panoramic View of the Proposed Los Mogotes East SEZ Facing West, Including San Antonio Mountains on Far Left (South) and San Juan Mountains in Background

Off-site views include distant mountains (the San Juan Mountains to the west and north and the San Luis Hills and the Sangre de Cristo Range to the east). Views to the south are partially blocked by foreground slopes, but a solitary mountain (San Antonio Mountain) is visible.

East of the SEZ (less than 0.5 mi [0.8 km]) is an extensive agricultural area, utilizing primarily center-pivot irrigation; the area is plainly visible from the SEZ and presents a line (during the growing season) along the horizon of darker green shrubs and trees with some low buildings. An existing 69-kV transmission line runs to the SEZ from the east, ending just inside the SEZ boundary. Some of these cultural modifications are visible in Figure 10.4.14.1-1. In general, these off-site cultural modifications detract slightly from the area's scenic quality. Undeveloped land is visible directly north, west, and south of 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 8410-1 (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, and the relative commonness of the landscape type within the region. 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 relatively low levels of use and public interest in the SEZ and its immediate vicinity. Uses noted include grazing, hunting, and some recreation. Despite the low use levels and public interest, the SEZ and surrounding area received a "High" sensitivity rating, primarily because the SEZ is within the viewshed of the Los Caminos Antiguos Scenic Byway. The SEZ is also within the viewshed of the West Fork of the North Branch of the Old Spanish Trail. This portion of the trail has yet to receive a congressional designation; however, its viewshed is sensitive. Finally, the SEZ is within the Sangre de Cristo NHA, also increasing its sensitivity.

Lands within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ contain (88,696 acres [358.94 km^2]) of VRI Class II areas, primarily west and southwest of the SEZ; and (452,381 acres [1,830.72 km^2]) of Class III areas, surrounding the SEZ. There are no VRI Class IV lands in the La Jara FO within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ.

The VRI map for the SEZ and surrounding lands is shown in Figure 10.4.14.1-3. More information about VRI methodology is available in Section 5.7 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The San Luis RMP (BLM 1991) indicates that the entire SEZ is managed as VRM Class III. VRM Class III objectives include partial retention of 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 10.4.14.1-4. More information about BLM's VRM program is available in Section 5.7 and in BLM's *Visual Resource Management*, BLM Manual Handbook 8400 (BLM 1984).

10.4.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Los Mogotes East SEZ and surrounding lands, as well as the impacts of related projects (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.

Potential Glint and Glare Impacts. Similarly, the nature and magnitude of potential glint- and glare-related visual impacts for a given solar facility is highly dependent on viewer position, sun angle, the nature of the reflective surface and its orientation relative to the sun and the viewer, atmospheric conditions and other variables. The determination of potential impacts from glint and glare from solar facilities within a given proposed SEZ would require precise knowledge of these variables, and is not possible given the scope of this PEIS. Therefore, the following analysis does not describe or suggest potential contrast levels arising from glint and glare for facilities that might be developed within the SEZ; however, it should be assumed that glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size, landscape setting, or technology type. For more information about potential glint and glare impacts associated with utility-scale solar energy facilities, see Section 5.12 of this PEIS.

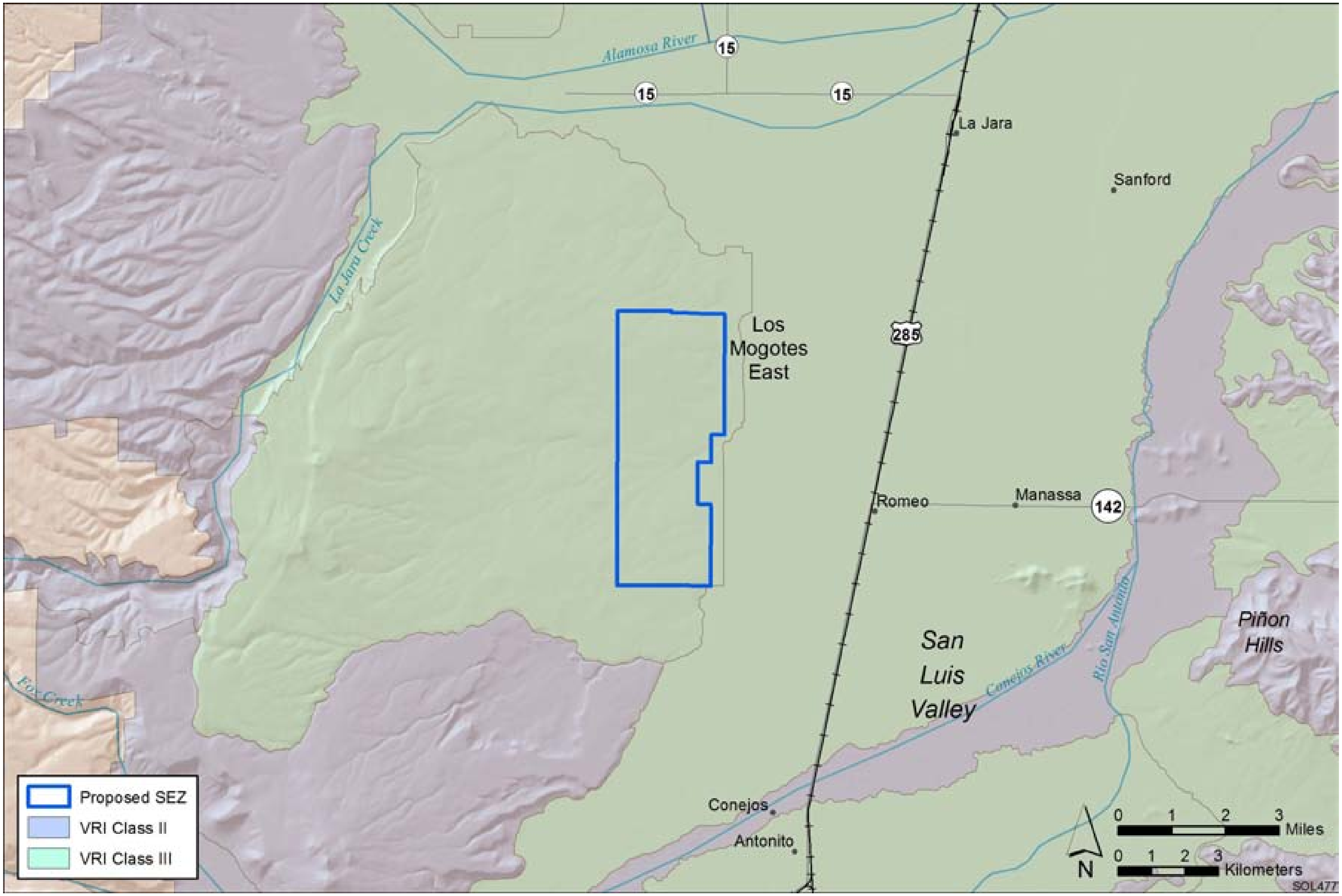

FIGURE 10.4.14.1-3 Visual Resource Inventory Values for the Proposed Los Mogotes East SEZ and Surrounding Lands

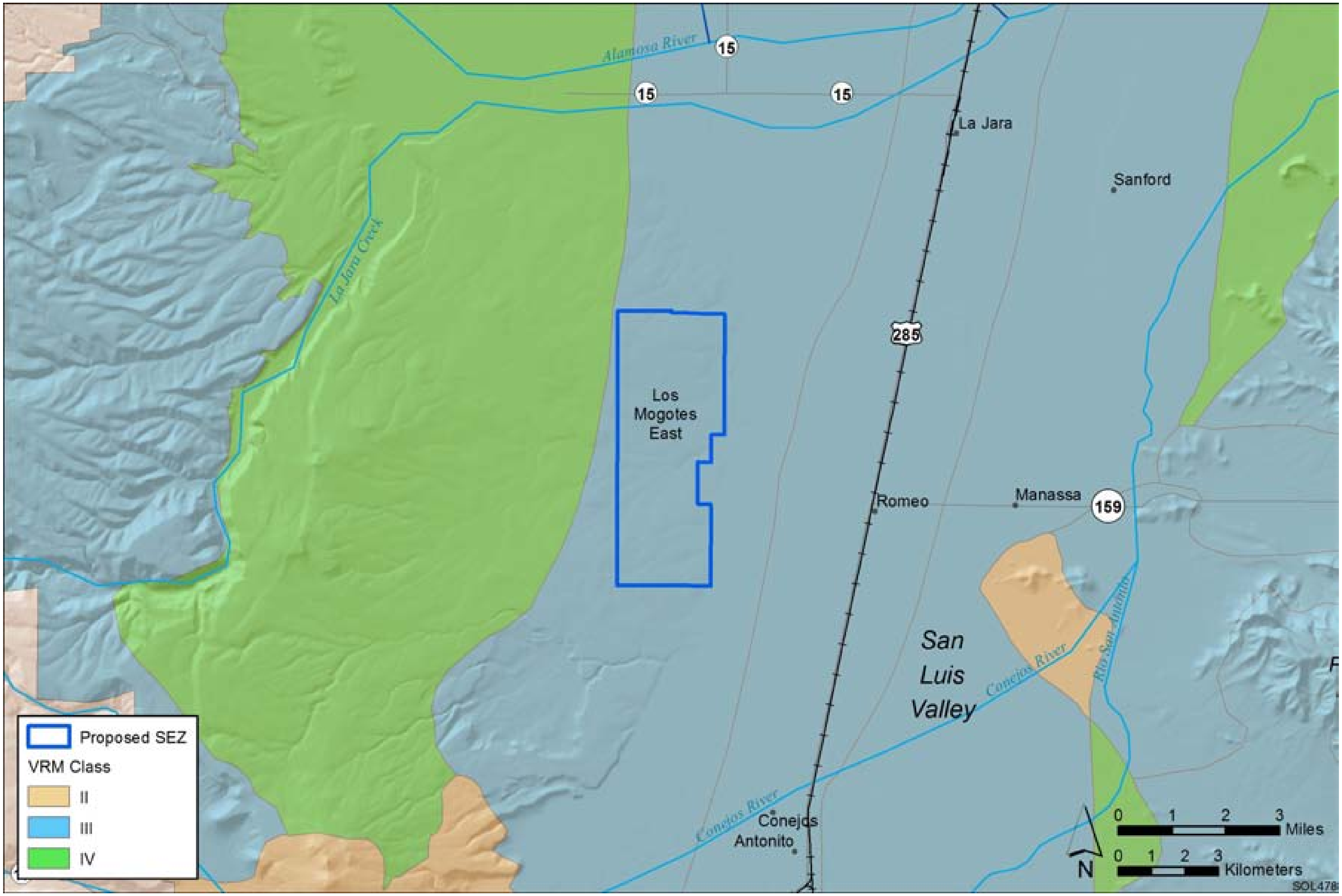

FIGURE 10.4.14.1-4 Visual Resource Management Classes for the Proposed Los Mogotes East SEZ and Surrounding Lands

10.4.14.2.1 Impacts on the Proposed Los Mogotes East 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 and other projects that may occur on other public or private lands within the SEZ viewshed, and are subject to cumulative effects. For discussion of cumulative impacts, see Section 10.4.22.4.13of this 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 10.4.14.1-4, 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 Los Mogotes East 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).

10.4.14.2.2 Impacts on Lands Surrounding the Proposed Los Mogotes East 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 on 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 10.4.14.2-1 shows the combined results of the viewshed analyses for all four solar technologies. The colored portions 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 light brown and the additional areas shaded 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 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 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, respectively, for solar energy technologies analyzed in this PEIS. Viewsheds for solar dish and CSP technology power blocks (38 ft [11.6 m]) and for transmission towers and short solar power towers (150 ft [45.7 m]) are presented in Appendix N. The visibility of these facilities would fall between that for tall power towers and for PV and parabolic trough arrays.

Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual Resource Areas

Figure 10.4.14.2-2 shows the results of a GIS analysis that overlays selected federal-, state-, and BLM-designated sensitive visual resource areas onto the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds, in order to illustrate which of these sensitive visual resource areas could have views of solar facilities within the SEZ and therefore potentially would be subject to visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-specified foreground-middleground distance (5 mi [8 km]), background distance (15 mi [24 km]), and a 25-mi (40-km) distance

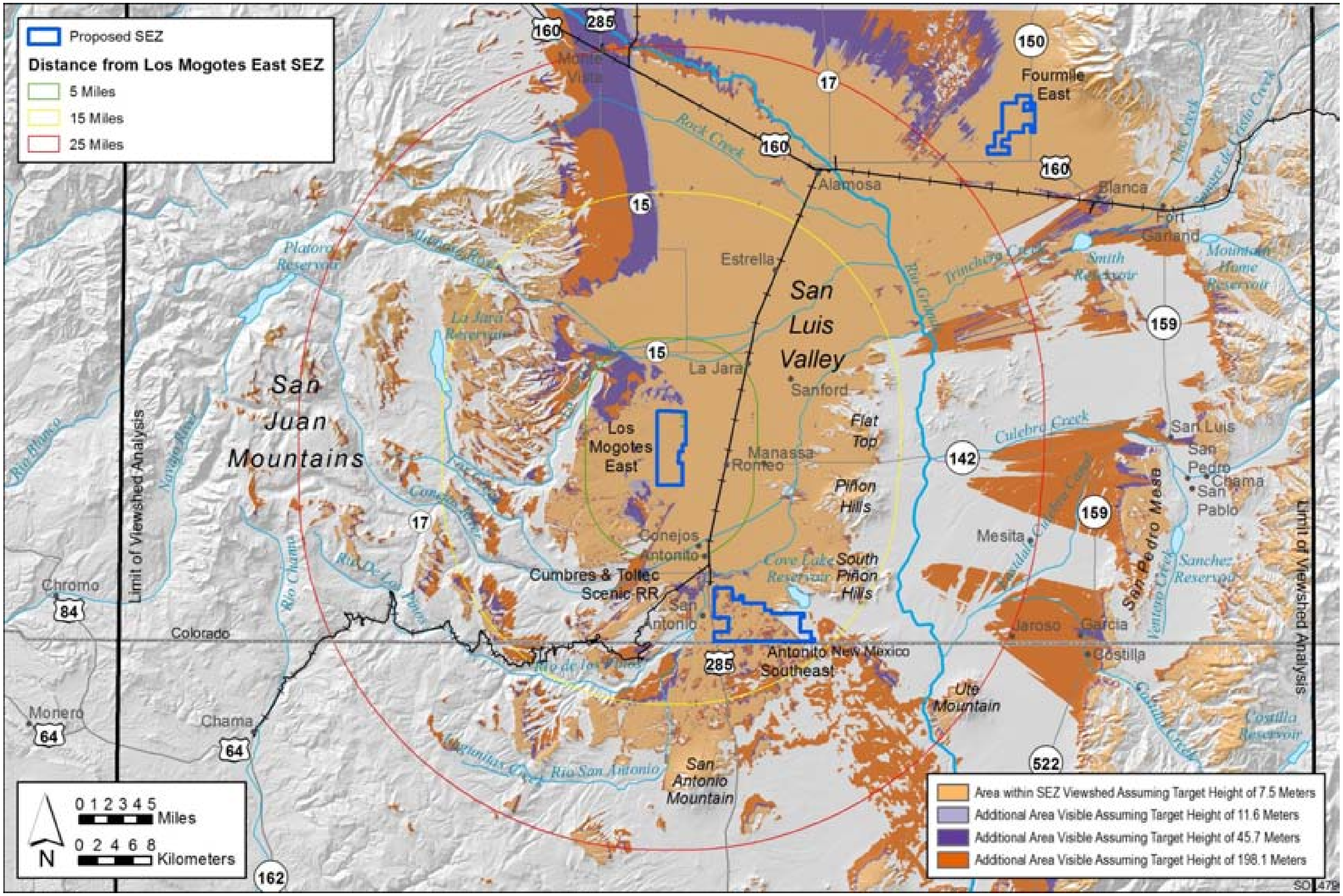

FIGURE 10.4.14.2-1 Viewshed Analyses for the Proposed Los Mogotes East SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

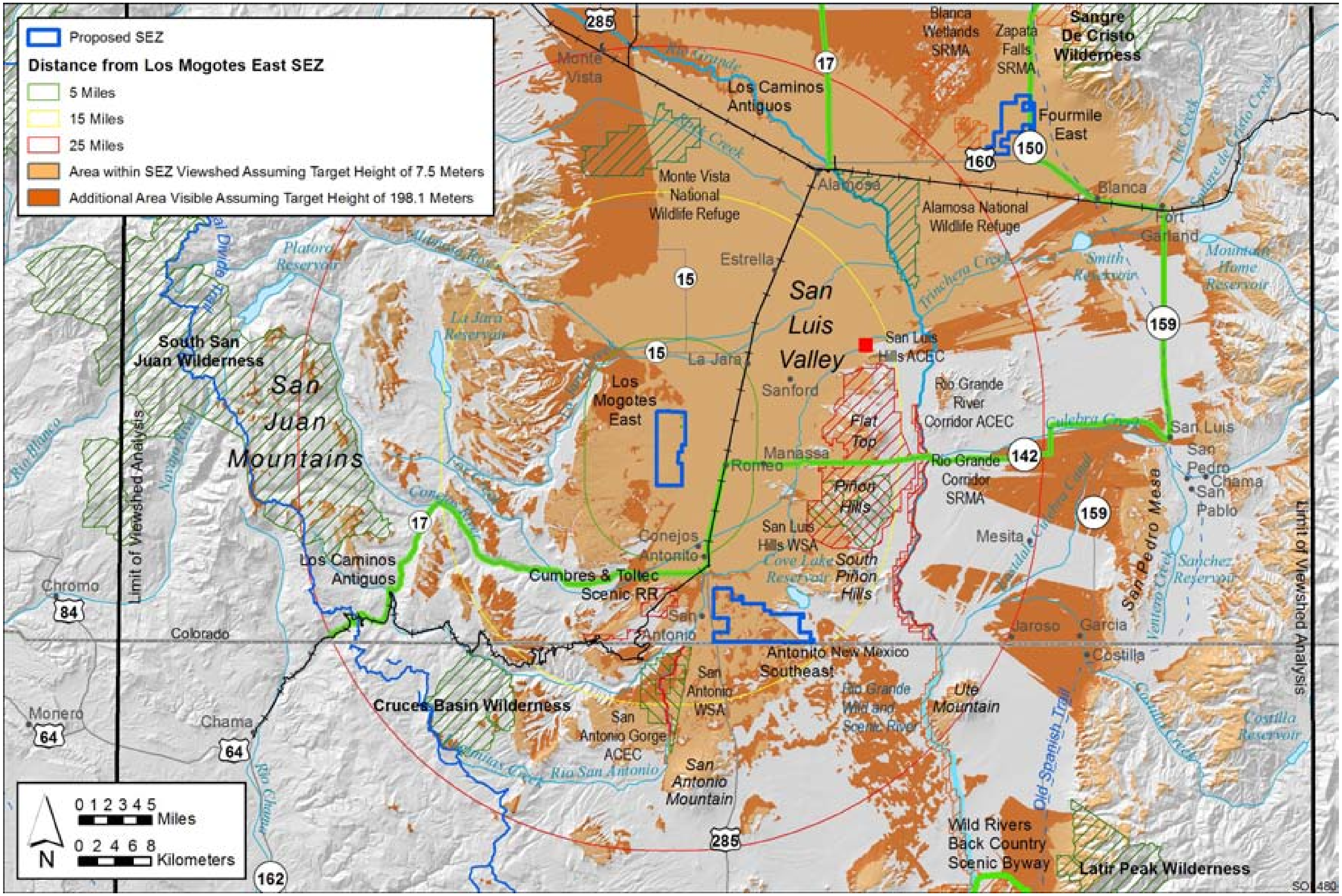

FIGURE 10.4.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds

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 km) of the proposed Los Mogotes East SEZ are discussed below. The results of this analysis are also summarized in Table 10.4.14.2-1. Further discussion of impacts on these areas is available in Sections 10.4.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and 10.4.17 (Cultural Resources) of this PEIS.

The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are changes in the seen landscape, including changes in the forms, lines, colors, and textures of objects seen in the landscape. A measure of *visual impact* includes potential human reactions to the visual contrasts arising from a development activity, based on viewer characteristics, including attitudes and values, expectations, and other characteristics that that are viewer- and situation-specific. Accurate assessment of visual impacts requires knowledge of the potential types and numbers of viewers for a given development and their characteristics and expectations; specific locations where the project might be viewed from; and other variables that were not available or not feasible to incorporate in this 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 this PEIS.

TABLE 10.4.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi (40.2-km) Viewshed of the Proposed Los Mogotes East SEZ, Assuming a Viewshed Analysis Target Height of 650 ft (198.1 m)

Feature Type	Feature Name (Total Acreage/Linear Distance)	Feature Area or Linear Distance[a]		
			Visible between	
		Visible within 5 mi	5 and 15 mi	15 and 25 mi
WAs	Cruces Basin (18,876 acres)	0 acres	0 acres	1,029 acres (5%)[b]
	South San Juan (160,832 acres)	0 acres	0 acres	3,809 acres (2%)
WSAs	San Antonio (7,321 acres)	0 acres	4,171 acres (57%)	1,898 acres (26%)
	San Luis Hills (10,896 acres)	0 acres	3,311 acres (30%)	0 acres
National Scenic Trail	Continental Divide	0 mi	0 mi	0.4 mi (0.6 km)
NHLs	Pike's Stockade (4 acres)	0 acres	4 acres (100%)	0 acres
NWRs	Alamosa (12,098 acres)	0 acres	0 acres	12,098 acres (100%)
	Monte Vista (14,761 acres)	0 acres	0 acres	14,761 acres (100%)
ACECs designated for outstanding scenic values	San Luis Hills (39,421 acres)	0 acres	15,604 acres (40%)	6 acres (0.02%)
	CTSR Corridor (3,868 acres)	0 acres	1,564 acres (40%)	6 acres (0.02%)
	San Antonio Gorge (377 acres)	0 acres	140 acres (37%)	28 acres (7%)
Scenic Highways/ Byways	Los Caminos Antiguos	8.4 mi (13.5 km)	15 mi (24 km)	3.7 mi (6.0 km)

[a] To convert acres to km^2, multiply by 0.004047. To convert mi to km, multiply by 1.609.

[b] Percentage of total feature acreage or road length viewable.

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section utilizes three-dimensional Google Earth™ perspective visualizations of hypothetical solar facilities placed within the SEZ. The visualizations include simplified wireframe models of a hypothetical solar power tower facility. The models were placed at various locations within the SEZ as visual aids for assessing the approximate size and viewing angle of utility-scale solar facilities. The visualizations are intended to show the apparent size, distance, and configuration of the SEZ, as well as the apparent size of a typical utility-scale solar power tower project and its relationship to the surrounding landscape, as viewed from potentially sensitive visual resource areas within the viewshed of the SEZ.

The visualizations are not intended to be realistic simulations of the actual appearance of the landscape or of proposed utility-scale solar energy projects. The placement of models within the SEZ did not reflect any actual planned or proposed projects within the SEZ, and did not take into account engineering or other constraints that would affect the siting or choice of facilities for this particular SEZ. The number of facility models placed in the SEZ does not reflect the 80% development scenario analyzed in this PEIS, but the discussion of expected visual contrast levels does account for the 80% development scenario. A solar power tower was chosen for the models because the unique height characteristics of power tower facilities make their visual impact potential extend beyond other solar technology types.

Wilderness Areas

- *Cruces Basin*—The Cruces Basin Wilderness is an 18,876-acre (76.389-km^2) congressionally designated WA located 17 mi (27 km) at the point of closest approach west–southwest of the SEZ in New Mexico. As shown in Figure 10.4.14.2-2, from the WA, solar energy facilities within the SEZ could be visible from higher elevations within the WA. Approximately 1,029 acres (4.164 km^2), or 5% of the total WA acreage, is within the 650-ft (198.1-m) viewshed of the proposed SEZ. Approximately 41 acres (0.17 km^2), or 0.2% of the total WA acreage, is within the 24.6-ft (7.5-m) viewshed. 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 are not forested, and hikers in these meadow areas would have views of the SEZ, though in most areas views would be limited to the upper parts of power tower receivers, if sufficiently tall power towers are located at particular locations within the SEZ. Where there were views of the SEZ, because of the relatively long distance and partial screening of the SEZ by intervening topography, solar energy development within the SEZ would be expected to create minimal to weak visual contrasts as viewed from the WA.

- *South San Juan*—The South San Juan Wilderness is a 160,832-acre (650.864-km^2) congressionally designated WA located 18 mi (29 km) at the point of closest approach west of the SEZ. As shown in Figure 10.4.14.2-2, within the 25-mi (40-km) viewshed of the SEZ, solar energy facilities within the SEZ could be visible from a very small portion of the WA. Approximately 3,809 acres (15.42 km^2) of the WA is within the 650-ft (198.1-m) viewshed (3% of the total WA acreage), and 1,844 acres (7.462 km^2), or 1% of the total

WA acreage, is within the 24.6-ft (7.5-m) viewshed. However, the WA in the visible area is heavily forested, and views of the SEZ are screened by trees in most locations. Some higher elevation meadows are not forested, and hikers in these meadow areas would have

Views of the SEZ. Views in some of these meadow areaswould be limited to the upper parts of power tower receivers, if sufficiently tall power towers are located at particular locations within the SEZ. Where there were views of the SEZ, because of the relatively long distance, solar energy development within the SEZ would be expected to create minimal to weak visual contrasts as viewed from the WA.

Wilderness Study Areas

- *San Antonio*—The San Antonio WSA is located in New Mexico, approximately 11 mi (18 km) south of the SEZ at the point of closest approach. The WSA encompasses 7,321 acres (29.63 km^2). Most of the WSA (approximately 6,069 acres [24.56 km^2], or 83% of the total WSA acreage) is within the 650-ft (198.1-m) viewshed of the SEZ, and 2,999 acres (12.14 km^2), or 41% of the total WSA acreage, is within the 24.6-ft (7.5-m) viewshed. About 60% of the WSA is within the BLM-designated background distance of 15 mi (24.1 km) from the SEZ. Portions of the WSA within the viewshed extend approximately 11 mi (18 km) from the southwest corner of the SEZ to approximately 19 mi (31 km) from the SEZ. Viewpoints within the WSA are generally 0 to 700 ft (0 to 200 m) higher in elevation than the nearest portion of the SEZ, with viewpoint elevation increasing as the distance from the SEZ increases.

  Figure 10.4.14.2-3 is a three-dimensional perspective visualization created with Google Earth depicting the SEZ (highlighted in orange) as it would be seen from a point in the northeast portion of the WSA, approximately 11 mi (18 km) south of the SEZ's southern boundary. The viewpoint is about 260 ft (80 m) higher than the SEZ.

  The visualization includes simplified wireframe models of a hypothetical solar power tower facility. The models were placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities. The receiver towers depicted in the visualizations are properly scaled models of a 459-ft (139.9-m) power tower with an 867-acre (3.5-km^2) field of 12 ft (3.7 m) heliostats, representing approximately 100 MW of electric generating capacity. Three power tower models were placed in the SEZ for this and other visualizations shown in this section of this PEIS. In the visualization, the SEZ area is depicted in orange, the heliostat fields in blue. The far northeast portion of the WSA has open but low-angle views of the SEZ, with little vegetative screening. At the relatively long distance involved,

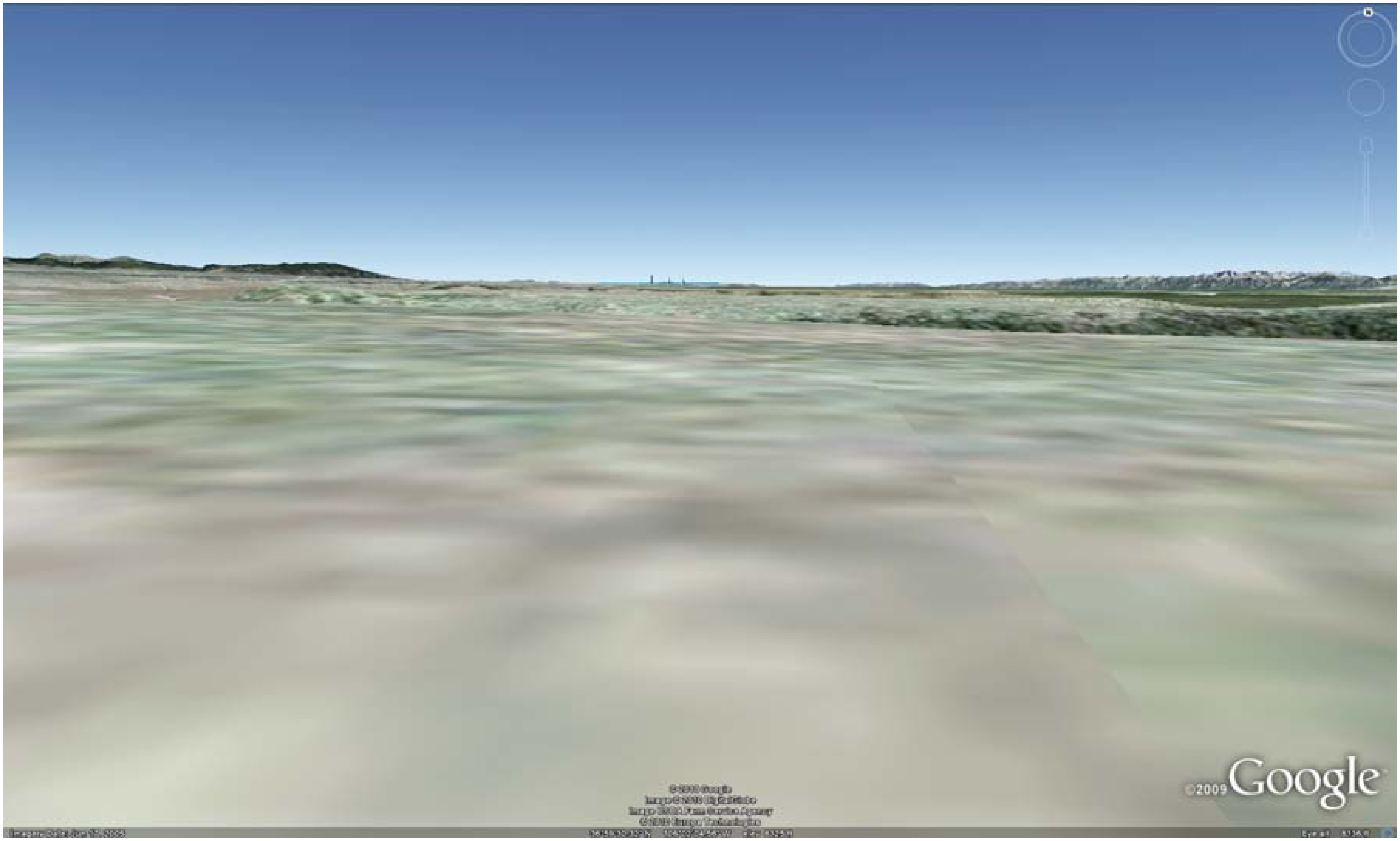

FIGURE 10.4.14.2-3 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the San Antonio WSA

and because the direction of view is along the SEZ's relatively narrow north–south axis, the SEZ occupies a very small portion of the field of view. Because of the very low angle of view, lower height facilities such as solar collector/reflector arrays, if visible at all, would appear as short and very thin lines on the horizon, which would tend to diminish apparent visual contrast. The receivers of operating power towers in the SEZ could be appear as points of light atop discernable tower structures just above the northern horizon.

At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances, and would likely be visible from this viewpoint. Other lighting associated with solar facilities in the SEZ could be visible as well.

In addition to power tower structures, plumes from power plants and other taller structures might be visible projecting above the horizon. Farther south in the WSA, the viewpoints are higher in elevation, but the distance to the SEZ is longer. Solar collector arrays would still be viewed at a low enough angle that they would repeat the line of the plain in which the SEZ is located. The apparent visual contrast would be highly dependent on viewer location within the WSA and other visibility factors, but under the development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create minimal to weak visual contrasts as viewed from the WSA.

- *San Luis Hills*—The San Luis Hills WSA is located approximately 8.8 mi (14.2 km) east–southeast of the SEZ at the point of closest approach and encompasses 10,896 acres (44.095 km^2). The WSA encompasses most of the Pinyon Hills. The San Luis Hills WSA is located entirely within the San Luis Hills ACEC, and both the ACEC and the WSA were designated in part for their scenic values and opportunities for solitude. The WSA provides panoramic views of the San Luis Valley and the surrounding mountain ranges. The SEZ viewshed includes the west-facing slopes of the Pinyon Hills and some lower elevation areas west of the Pinyon Hills. Portions of the WSA within the viewshed include approximately 3,273 acres (13.25 km^2) (or 30% of the total WSA acreage) within the 650-ft (198.1-m) viewshed, and 3,050 acres (12.34 km^2) (or 28% of the total WSA acreage) within the 24.6-ft (7.5-m) viewshed. Visible areas within the WSA extend from approximately 8.8 mi (14.2 km) from the eastern boundary of the SEZ to approximately 13 mi (21 km) from the SEZ.

  The upper slopes and peaks of the Pinyon Hills are sparsely vegetated and have relatively open views of both the Los Mogotes East and Antonito Southeast SEZs. Figure 10.4.14.2-4 is a Google Earth visualization of the SEZ as seen from a peak in the far western Pinyon Hills within the WSA, approximately 10 mi (16 km) east of the SEZ's eastern boundary. The

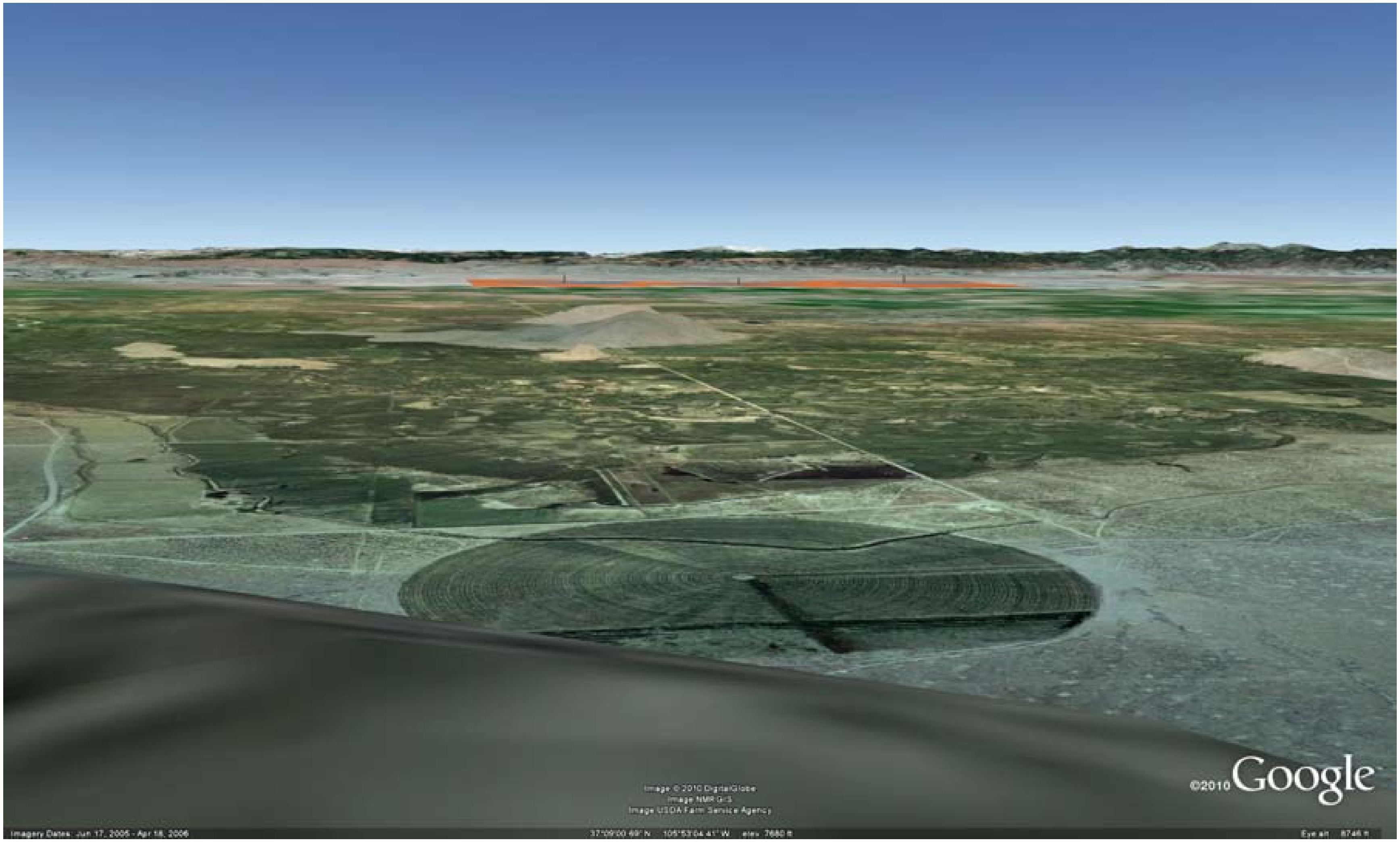

FIGURE 10.4.14.2-4 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from the San Luis Hills WSA

viewpoint is about 870 ft (270 m) higher in elevation than the SEZ.The SEZ area is depicted in orange, the heliostat fields in blue.

The visualization suggests that the viewpoint is sufficiently close to the Los Mogotes SEZ that the SEZ would occupy a moderate portion of the horizontal field of view. Despite the elevated viewpoint, the distance to the SEZ is great enough that the vertical angle of view is low. The collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, making their large areal extent and regular geometry less apparent and causing them to appear in a thin band that would repeat the line of the horizon, tending to lessen visual contrast. Taller solar facility components, such as transmission towers or cooling towers, or plumes (if present) could potentially be visible from this viewpoint.

If operating power towers are located in the SEZ, the receivers would likely appear as points of light atop discernable tower structures, against a backdrop of the valley floor, and would be likely to attract visual attention. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible for long distances, and could be visually conspicuous from this viewpoint because the area west of the SEZ would have few comparable light sources visible. Other lighting associated with solar facilities in the SEZ could potentially be visible as well.

- At lower elevation viewpoints in the WSA, the angle of view is in some cases so low that the expected contrasts from solar facilities within the SEZ would drop to weak levels. In general, the range of visual contrasts observed from the WSA would be dependent on viewer location and project locations within the SEZ and the projects' characteristics. Under the 80% development scenario analyzed in the PEIS, solar energy development within the SEZ would be expected to create weak to moderate visual contrasts as viewed from the WSA. Contrast levels would be highest at high-elevation viewpoints in the western part of the WSA, and lower for low-elevation viewpoints such as in canyons or on bajadas.

  Note that portions of the WSA are also in the viewshed of the proposed Antonito Southeast SEZ, and could be subject to visual impacts from solar facilities in that SEZ as well.

National Scenic Trail

- *Continental Divide*—The Continental Divide National Scenic Trail is a congressionally designated multistate scenic trail that passes within about 20 mi (32 km) of the SEZ at the point of closest approach southwest of the SEZ; however, the portion of the trail within the viewshed of the SEZ is at nearly 25 mi

(40 km) distant from the SEZ. Approximately 0.4 mi (0.6 km) of the trail are within the 650-ft (198.1-m) viewshed of the SEZ.

A very short segment of the Continental Divide National Scenic Trail just north of the South San Juan WA has an open but distant view of the SEZ. The trail in this area is in an open meadow on a high mountain ridge elevated about 4, 500 ft (m) above the SEZ, but is so distant from the SEZ that the SEZ would occupy a very small portion of the field of view.

Solar facilities within the SEZ could potentially be visible just above the top of the closest ridge east of the trail. Despite the elevated viewpoint, the collector reflector arrays of solar facilities within the SEZ would be seen nearly edge on, and might not be noticed by casual viewers, unless they were reflecting sunlight back toward the viewpoint.

Operating power towers within the SEZ might be visible as distant star-like points of light just above the ridge top. At night, if sufficiently tall, the power towers could have red or white flashing hazard navigation lights that could be visible from this section of the trail.

In general, the range of visual contrasts observed from this short section of the Continental Divide National Scenic Trail would depend on project locations within the SEZ and the projects' characteristics. Under the 80% development scenario analyzed in the PEIS, solar energy development within the SEZ would be expected to create minimal to weak contrasts as viewed from this section of the trail.

National Historic Landmarks

- *Pike's Stockade*—Although the original 1807 stockade is no longer standing, this archeological site with a reconstructed stockade is located 13 mi (21 km) northeast of the northeast corner of the Los Mogotes East SEZ. It is contained within the SEZ viewshed.

  Pike Stockade is located within a heavily wooded riparian area along the Rio Grande. It is likely that vegetation would screen the site from views of the SEZ; however, visitors driving to or from Pike's Stockade would be outside the wooded area when going to or from the site and might have open views of the SEZ. Pike's Stockade is approximately 160 ft (48.8 m) lower in elevation than the lowest point in the SEZ, so if solar energy facilities were visible within the SEZ, , the associated collector/reflector arrays would repeat the line of the horizon, which would tend to reduce apparent contrast. Power tower receivers would not project above the distant line of the San Juan Mountains and, at the relatively long distance to the SEZ, would appear as distant points of light. Primarily because of vegetative screening, visual impacts from solar energy development within the SEZ would not be expected at the Pike Stockade site, but if screening were absent in the surrounding area, minimal to weak visual contrast would be expected.

National Wildlife Refuges

- *Alamosa*—The 12,098-acre (48.959-km^2) Alamosa NWR contains the headquarters and visitor center for the San Luis Valley National Wildlife Refuge Complex. It is located 18 mi (29 km) northeast of the SEZ at the closest point of approach and is entirely contained within the viewshed of the SEZ. The refuge is a haven for migratory birds and other wildlife. The Alamosa NWR consists of wet meadows, river oxbows, and riparian corridors primarily within the flood plain of the Rio Grande, and dry uplands vegetated with greasewood and saltbush.

  Because of the very long distance from the NWR to the SEZ, the orientation of views along the long north–south axis of the SEZ, and the lower elevation of the NWR relative to the SEZ (the NWR is about 350 ft [110 m] lower in elevation than the SEZ), solar facilities within the SEZ would be difficult to see from the NWR. From portions of the NWR, the upper portions of power towers within the SEZ might be visible as distant lights on the horizon. Visual impacts on the NWR from solar energy facilities within the SEZ would be minimal.

- *Monte Vista*—The 14,761-acre (59.736-km^2) Monte Vista NWR includes more than 11,000 acres (45 km^2) of wetlands located primarily within the Rio Grande flood plain. The refuge is located 16 mi (26 km) due north of the SEZ and is entirely contained within the viewshed of the SEZ. The NWR's wet meadows, river oxbows, and riparian corridors provide habitat for migratory birds and other wildlife. The NWR can be viewed from county roads and on a 4 mi (6 km) auto tour.

  Because of the very long distance from the NWR to the SEZ and the lower elevation of the NWR relative to the SEZ (the NWR is about 200 to 300 ft [60 to 90 m] lower in elevation than the SEZ), the SEZ and solar facilities within the SEZ would occupy a very small portion of the visual field for viewers in the NWR. From portions of the NWR, power towers within the SEZ might be visible as distant lights on the horizon. Visual impacts on the NWR from solar energy facilities within the SEZ would be minimal.

ACECs Designated for Outstanding Scenic Qualities

- *Cumbres & Toltec Scenic Railroad*—Impacts on the CTSR ACEC are described in Section 10.4.14.2.2.2 (Impacts on Selected Nonfederal Lands and Resources), under the discussion of impacts on the CTSR.

- *San Antonio Gorge*—The San Antonio Gorge ACEC is a very small (373-acre [1.5-km^2]) BLM-designated ACEC that follows San Antonio Creek in New Mexico and is located approximately 11 mi (18 km) due south of the SEZ at the point of closest approach. The ACEC was designated to protect significant wildlife, natural, and scenic values along this stretch of the creek. Because the creek and the ACEC are within a canyon, persons within the ACEC would not see solar development within the SEZ. Potential visual impacts on the ACEC would not be expected.

- *San Luis Hills*—The San Luis Hills ACEC is a 39,421-acre (159.53-km^2) BLM-designated ACEC located approximately 9.4 mi (15.1 km) east of the SEZ at the point of closest approach. The ACEC encompasses the Pinyon Hills and Flattop and nearby hills, and the lower slopes of some of these hills. The ACEC also encompasses the San Luis Hills WSA, and both the ACEC and the WSA were designated in part for their scenic values and opportunities for solitude. The ACEC provides panoramic views of the San Luis Valley and the surrounding mountain ranges. Views toward the SEZ include a large agricultural area east of the SEZ, with center-pivot irrigation circles, other agricultural fields, roads, and other cultural disturbances visible.

  The SEZ viewshed includes the west-facing slopes of the Pinyon Hills and Flattop. Portions of the ACEC within the 650-ft (198.1-m) viewshed include approximately 15,610 acres (63.171 km^2), or 40 % of the total ACEC acreage, and extend from just under 8.8 mi (14.2 km) from the eastern boundary of the SEZ to approximately 14 mi (23 km) from the SEZ. Portions of the ACEC within the 24.6-ft (7.5 m) viewshed include approximately 14,266 acres (57.733 km^2), or 36% of the total ACEC acreage.

  The upper slopes and peaks of the Pinyon Hills and Flattop are sparsely vegetated, have relatively open views of the SEZ, and are sufficiently close to the SEZ that they occupy a significant portion of the field of view, although intervening terrain might screen some views of portions of the SEZ, depending on viewer location. At the highest elevations within the ACEC, the angle of view is great enough that the tops of solar collector arrays might be visible. The angle of view is not so high, however, that the arrays would not repeat the line of the plain in which the SEZ is located, tending to reduce apparent visual contrast.

Figure 10.4.14.2-5 is a Earth visualization of the SEZ (highlighted in orange) as seen from the peak of Flattop, in the eastern portion of the ACEC, approximately 13 mi (21 km) east of the SEZ's eastern boundary. The viewpoint is about 1,400 ft (430 m) higher than the SEZ. . The SEZ area is depicted in orange; the heliostat fields in blue.

The visualization suggests that the SEZ would occupy a moderate portion of the horizontal field of view. Despite the elevated viewpoint, the distance to the SEZ is great enough that the vertical angle of view is low. The collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, making their large areal extent and regular geometry less apparent, and causing them to appear in a thin band that would repeat the line of the horizon, tending to lessen visual contrast. Taller solar facility components, such as transmission towers or cooling towers; or plumes (if present) could potentially be visible from this viewpoint.

If operating power towers were located in the SEZ, the receivers would likely appear as points of light atop discernable tower structures (though the structures might be missed by casual viewers), against a backdrop of the valley floor, and would be likely to attract visual attention. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that would likely be visible from this viewpoint, and could be conspicuous because the area west of the SEZ would have few comparable light sources visible. Other lighting associated with solar facilities in the SEZ could potentially be visible as well.

At lower elevation viewpoints in the ACEC, the angle of view is in some cases so low that the expected contrasts from solar facilities within the SEZ would drop to weak levels. In general, the range of visual contrasts observed from the ACEC would be dependent on viewer location and project locations within the SEZ and the projects' characteristics. Under the 80% development scenario analyzed in this PEIS, solar energy facilities within the SEZ would be expected to attract attention but would not be likely to dominate views from the ACEC, and would be expected to create weak to moderate visual contrasts, depending on viewer location and other visibility factors. Contrast levels would be highest at high-elevation viewpoints in the western part of the ACEC and lower for low-elevation viewpoints such as in canyons or on bajadas.

Note that portions of the ACEC are also in the viewshed of the proposed Antonito Southeast SEZ, and could be subject to visual impacts from solar facilities in that SEZ as well.

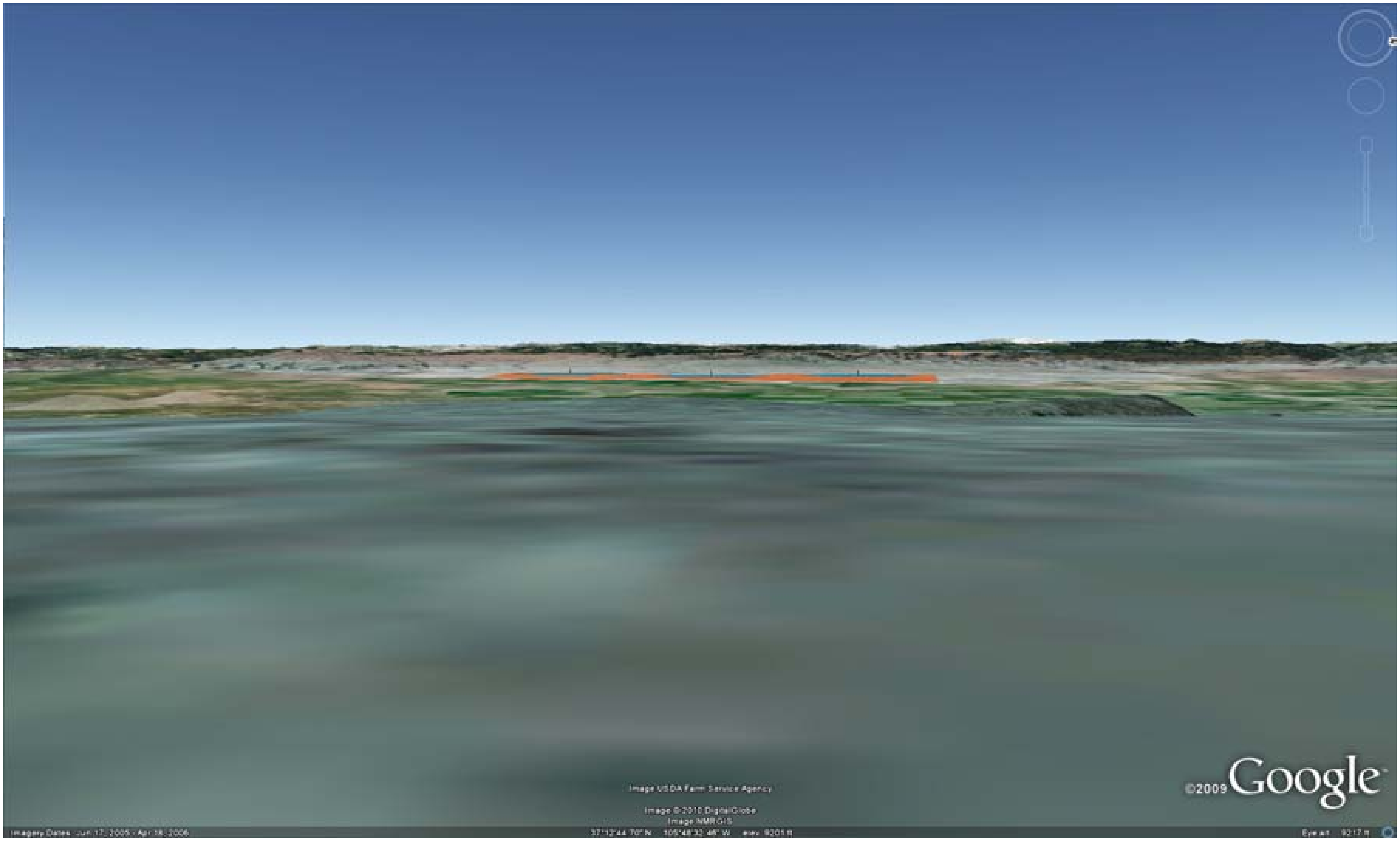

FIGURE 10.4.14.2-5 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Flattop, within the San Luis Hills ACEC

Scenic Highways/Byways

- *Los Caminos Antiguos*—The Los Caminos Antiguos Scenic Byway is a state- and BLM-designated scenic byway that runs through a large section of the San Luis Valley and is located in close proximity to several of the proposed SEZs, including Los Mogotes East. The byway is an important tourist attraction and, in addition to scenic views of the San Luis Valley and surrounding mountain ranges, provides access to numerous historic sites and cultural attractions.

  Approximately 27 mi (44 km) of the byway is within the calculated 650-ft (198.1-m) viewshed of the SEZ; however, undulations in topography; roadside and other vegetation; as well as buildings, such as those in the communities of La Jara, Romeo, and Conejos, screen views of much or all of the SEZ from many locations along the byway. At its point of closest approach to the SEZ, south of the community of Romeo, the byway is approximately 2.6 mi (4.3 km) east–southeast of the southeast corner of the SEZ.

  Elevations along the byway northeast, east, and southeast of the SEZ are slightly lower than in the SEZ itself. Because the SEZ slopes up toward the west, some of the western portions of the SEZ are visible above screening vegetation and structures between the byway and the SEZ.

  Due south of the SEZ, elevations along the byway are about as high as the highest points within the SEZ, but most views of the SEZ from the south would likely be at least partially screened by riparian vegetation along the Conejos River.

  For byway users approaching Conejos from the north, solar facilities visible within the SEZ would appear to the right (west) of the direction of travel. Travelers would likely see any power tower receivers within the SEZ projecting above the trees and landforms of areas close to the SEZ as they looked south down the byway. They would be less likely to see solar dish engines, solar trough arrays, or PV arrays because of screening unless those facilities were located in the western, more elevated portions of the SEZ. Plumes, cooling towers, and other tall structures such as transmission towers might be visible above screening, depending on viewer location and project location and characteristics. The facilities would tend to increase in apparent size as viewers moved toward them and might be subject to sudden disappearance and reappearance because of intermittent screening. Byway users traveling northward from Antonito and beyond would have a similar visual experience, but likely of shorter duration (because of the road configuration and screening of views of the SEZ), and solar facilities visible within the SEZ would appear to the left (west) of the direction of travel.

Because of the 5-mi (8-km) north–south orientation of the SEZ, it would take several minutes to pass the SEZ at highway speeds, and depending on facility height and other visibility factors, solar facilities within the SEZ might be visible to travelers several additional minutes as they approach the SEZ.

Figure 10.4.14.2-6 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from Los Caminos Antiguos Scenic Byway in Romeoapproximately 3.0 mi (4.8 km) east of the SEZ's eastern boundary. The viewpoint is about 130 ft (40 m) lower in elevation than the SEZ. The center power tower in the visualization is about 4.1 mi (6.6 km) from the viewpoint.The SEZ is shown in orange; the heliostat fields in blue. Note that this visualization does not account for potential screening of views of the SEZ. Screening by vegetation and structures that exist in the area might obscure much or all of the view in this location.

The view axis from viewpoint east of the SEZ would be roughly perpendicular to the long north–south axis of the SEZ; because of this and because the SEZ would be so close to the viewpoint, the SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole SEZ..If screening were absent, the visualization suggests that solar energy facilities within the SEZ could potentially dominate the view from the byway and the community of Romero at this location.

The collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on and would repeat the horizontal line of the sloping plain in which the SEZ is situated; this would tend to reduce visual line contrast. Taller ancillary facilities, such as buildings, transmission structures, and cooling towers, and plumes (if present) would likely be visible projecting above the collector/reflector arrays, and their structural details could be discernable, at least for nearby facilities. The ancillary facilities could create form and line contrasts with the strongly horizontal, regular, and repeating forms and lines of the collector/reflector arrays. Color and texture contrasts would also be likely, but their extent would depend on the materials and surface treatments utilized in the facilities. Structural details of some facility components would likely be visible.

If operating power towers were located in the SEZ, the receivers would likely appear as very bright non-point light sources (i.e. they could appear as cylindrical or rectangular light-emitting surfaces) atop clearly discernable tower structures, against the backdrop of the San Juan Mountains to the west, or if sufficiently tall, they might project beyond the tops of the mountain range and be visible against a sky backdrop. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). The operating power towers would strongly attract visual attention. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that

FIGURE 10.4.14.2-6 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Los Caminos Antiguos Scenic Byway, in Romeo, Colorado

> would likely be very conspicuous from this viewpoint because the area to the west of the SEZ would have few comparable light sources visible. Other lighting associated with solar facilities in the SEZ could potentially be visible as well.
>
> The range of impacts experienced by byway travelers would be highly dependent on viewer location, project location and design, and the presence of screening. Under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ could attract the attention of byway users, butthey would not be likely to dominate views except from some locations close to the eastern boundary of the SEZ, assuming screening was absent. At and near the point of closest approach between the byway and the SEZ.
>
> Screening vegetation and buildings might conceal much of any solar facilities within the SEZ. Under the development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create weak to strong visual contrasts as viewed from the byway, depending on viewer location along the byway and other visibility factors.

Additional scenic resources exist at the national, state, and local levels, and impacts may occur on both federal and nonfederal lands, including sensitive traditional cultural properties important to Tribes. In addition to the resource types and specific resources analyzed in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation areas, other sensitive visual resources, and communities close enough to the proposed project to be affected by visual impacts. Selected other lands and resources are included in the discussion below.

In addition to impacts associated with the solar energy facilities themselves, 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 short transmission line that reaches the eastern boundary of 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. If an existing 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-Note that depending on project- and site-specific conditions, visual impacts associated with access roads and, to an even greater extent, transmission lines could be large. For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that the existing 69-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. Detailed information on visual impacts associated with transmission lines is presented in Section 5.12.1 of this PEIS. A detailed site-specific impact 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 Selected Other Lands and Resources

Communities of Romeo, La Jara, Antonito, Conejos, Sanford, and Manassa. The viewshed analyses indicate visibility of the proposed SEZ from the communities of La Jara (approximately 5.3 mi [8.6 km] northeast of the proposed SEZ), Antonito (approximately 5.2 mi [8.4 km] south–southeast of the proposed SEZ), Romeo (approximately 3.0 mi [4.8 km] east of the proposed SEZ), and the unincorporated community of Conejos (approximately 4.3 mi [7.0 km] south–southeast of the proposed SEZ). However, a site visit in July 2009 indicated at least partial screening of ground-level views of the proposed SEZ from these communities because of slight variations in topography, vegetation, or both. A detailed future site-specific NEPA analysis is required to determine visibility precisely; however, note that even with the existing screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other tall structures associated with the facilities could potentially be tall enough to exceed the height of the screening and could in some cases cause visual impacts on these communities.

Where screening is absent, strong visual contrast could be observed, particularly in or near Romeo, because of the proximity of the SEZ and the orientation of view perpendicular to the long north–south axis of the SEZ (see Figure 10.4.14.2-6 for a view of the SEZ from Romeo). At night, hazard warning lights on power towers of sufficient height (200 ft [61 m] or greater) would likely be very conspicuous light sources as seen from Romeo.

La Jara is farther from the SEZ than Romeo, and the orientation of the views is more oblique to the long axis of the SEZ; thus the SEZ and solar energy facilities would occupy a much smaller portion of the field of view than at Romeo, and moderate levels of visual contrast would be expected. Antonito and Conejos are also farther from the SEZ than Romeo and have a more oblique viewing angle. In addition, many views from these locations would likely be screened by riparian vegetation along the Conejos River. Weak visual contrast levels would be expected where there were unobstructed views of the SEZ. At night, hazard warning lights on power towers of sufficient height (200 ft [61 m] or greater) would be conspicuous light sources as seen from these communities, where there were unobstructed views to the SEZ.

Manassa is approximately 5.5 mi (8.5 km) east of the SEZ, and like Romeo, the orientation of view is perpendicular to the long north–south axis of the SEZ. While trees and structures would screen views of the SEZ for much of Manassa, where screening was absent, the SEZ and associated solar facilities could potentially stretch across much of the field of view. The viewing angle would be low, but under the 80% development scenario analyzed in the PEIS, solar facilities in the SEZ would stretch across much of the western horizon, and expected contrast levels would be strong where there were unobstructed views to the SEZ.

Sanford is approximately 7.7 mi (12.4 km) east northeast of the SEZ. Potential visual impacts from solar energy facilities within the SEZ as experienced in Sanford would be generally similar to those experienced in Manassa, but somewhat lower in magnitude, because of the greater distance and slightly more oblique viewing angle. Moderate to strong visual contrasts would be expected where there were unobstructed views to the SEZ.

Regardless of visibility from these communities, 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, including U.S. 285, portions of which are included in the Los Caminos Antiguos Scenic Byway (see above).

Cumbres & Toltec Scenic Railroad. The CTSR is a narrow-gauge railroad running between Chama, New Mexico, and Antonito, Colorado, with an historic depot in Antonito. The railroad is an historic and cultural property owned by the states of Colorado and New Mexico and is operated for the states by the CTSR Commission, an interstate agency authorized by an act of Congress in 1974. The railroad is an important local tourist attraction, offering day-long rides through high-quality scenery, primarily in the San Juan Mountains. The railroad depot is on the southern edge of Antonito, and the rail line extends southwest of Antonio, climbing into the foothills of the San Juan Mountains and running southwest along the valley's western edge before turning west into the mountains after entering New Mexico.

The BLM has designated 3,868 acres (15.65 km^2) of land along the railroad route as the CTSR Corridor ACEC (see Figure 10.4.14.2-2), and the San Luis RMP (BLM 1991) states that the area will be subject to special management for "strict conformance to existing VRM class objectives" in order to protect historical and scenic values. The ACEC designation covers "the minimum necessary foreground viewshed" to "provide protection for the unique scenic resources viewed from the train." At the point of closest approach, the ACEC is approximately 7.1 mi (11.4 km) south of the SEZ.

The viewshed analyses indicate visibility of the SEZ from the railroad depot in Antonito (approximately 5.9 mi [9.5 km] south–southeast of the SEZ), though the view may be at least partially screened by landform and vegetation. The viewshed analyses indicate visibility of the SEZ from the rail line southwest of Antonito up to approximately 2.9 mi (4.7 km) from the railroad depot in Antonito, with potential visibility reduced slightly for the lower height solar technologies, as shown in Figure 10.4.14.2-1. The SEZ is also visible from some locations in the San Juan Mountains, including small portions of the CTSR Corridor ACEC, as shown in Figure 10.4.14.2-2. Portions of the ACEC within the 650-ft (198.1-m) viewshed include approximately 1,570 acres (6.354 km^2), or 41% of the total ACEC acreage. Portions of the ACEC within the 24.6-ft (7.5-m) viewshed include approximately 1,002 acres (4.055 km^2), or 26% of the total ACEC acreage. Approximately 13 mi (21 km) of the railroad line is within the SEZ viewshed.

The nature of the visual impacts experienced by train passengers and other visitors to the ACEC and surrounding lands would depend largely on viewer location, the size of the solar facility, the solar technology employed, the precise location of the facility within the SEZ, and other visibility factors discussed in Section 5.12. A detailed future site-specific NEPA analysis would be required to determine visibility and potential impacts precisely.

A site visit in July 2009 indicated at least partial screening of ground-level views of the SEZ from the CTSR depot in Antonito and the first 2.3 mi (3.7 km) of the railroad southwest of Antonito, because of slight variations in topography, vegetation, or both. However, some components of solar facilities sufficiently close to the southern boundary of the proposed SEZ (particularly power tower receivers) might be visible over the tops of screening vegetation or buildings and, if so, might create weak contrasts, primarily in line (due to vertical towers in a strongly horizontal landscape), especially if viewed against a sky backdrop. Depending on location, tower height, and project design, the intense light emitted by a power tower receiver could potentially be visible from the depot and rail line above the screening objects and could be noticeable, tending to draw viewers' attention. Where screening did not exist, more components of the solar facility could be visible, adding additional contrasts in form, line, color, and texture.

Trees and other vegetation along the rail line may screen some views of the SEZ from the rail line and from the scenic ACEC, but the viewpoint becomes increasingly elevated as the rail line approaches the San Juan Mountains, affording more open views of the proposed SEZ. Views within the mountains and some parts of the ACEC are also subject to screening from vegetation. However, some open views exist, and the viewpoints are further elevated, again affording unobstructed views of the SEZ. Even with any existing screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other tall structures associated with the solar energy facilities could potentially be tall enough to exceed the height of the screening and could in some cases cause visual impacts on the rail line and the CTSR Corridor ACEC. Because of the north-to-south orientation of the SEZ, views from the rail line, which is south of the SEZ, would be along the north–south axis of the SEZ and would therefore be perpendicular to the relatively narrow (1.7 mi [2.8 km]) southern boundary of the SEZ. Thus the SEZ would occupy a very small portion of the field of view, tending to reduce visual contrasts. Under the development scenario analyzed in this PEIS, visual contrast from solar energy development in the SEZ would be expected to range from minimal to weak.

Figures 10.4.14.2-7 and 10.4.14.2-8 are Google Earth visualizations depicting views of the SEZ (highlighted in orange) as seen from points on the CTSR. The SEZ area is depicted in orange; the heliostat fields in blue. Note that these visualizations do not account for potential screening of views of the SEZ. Screening by vegetation and structures that exist in the area might obscure much or all of the view in these locations.

Figure 10.4.14.2-7 depicts a view of the SEZ as it would be seen from the CTSR line approximately 2.0 mi (3.2 km) southwest of the depot at Antonito, and 6.8 mi (11.0 km) from the closest point in the SEZ. The nearest power tower is located approximately 7.7 mi (12.5 km) from the viewpoint, and the farthest power tower is located approximately 11 mi (18 km) from the viewpoint. The viewpoint elevation is approximately 30 ft (9 m) higher than the base of the closest (left-most) power tower shown in the visualization. The visualization suggests that lower height solar facilities within the SEZ would not be visible from this location on the railroad, but, depending on tower location and height, power tower receivers and other sufficiently tall project

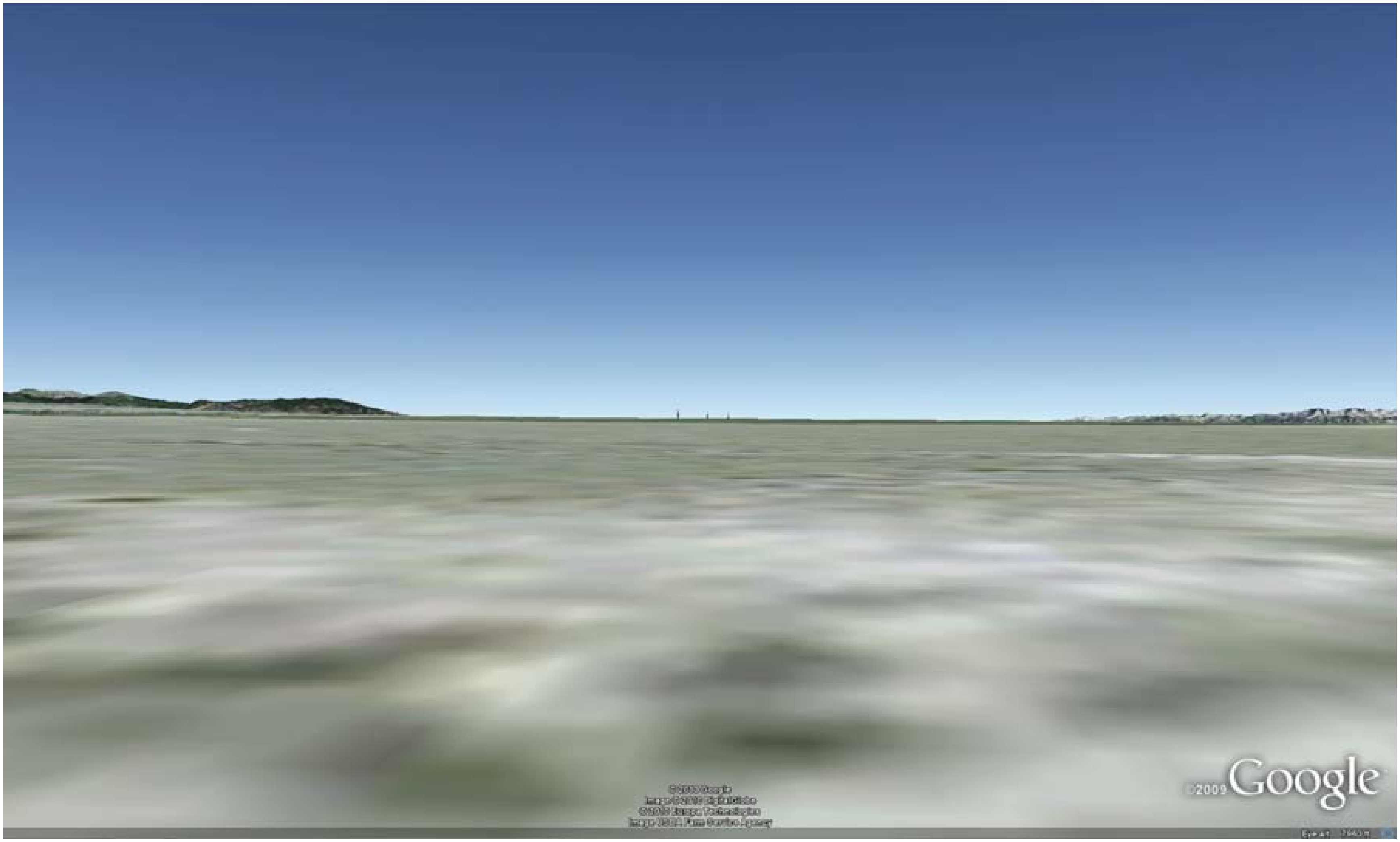

FIGURE 10.4.14.2-7 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the Cumbres & Toltec Scenic Railroad Approximately 2.0 mi (3.2 km) Southwest of the Depot at Antonito

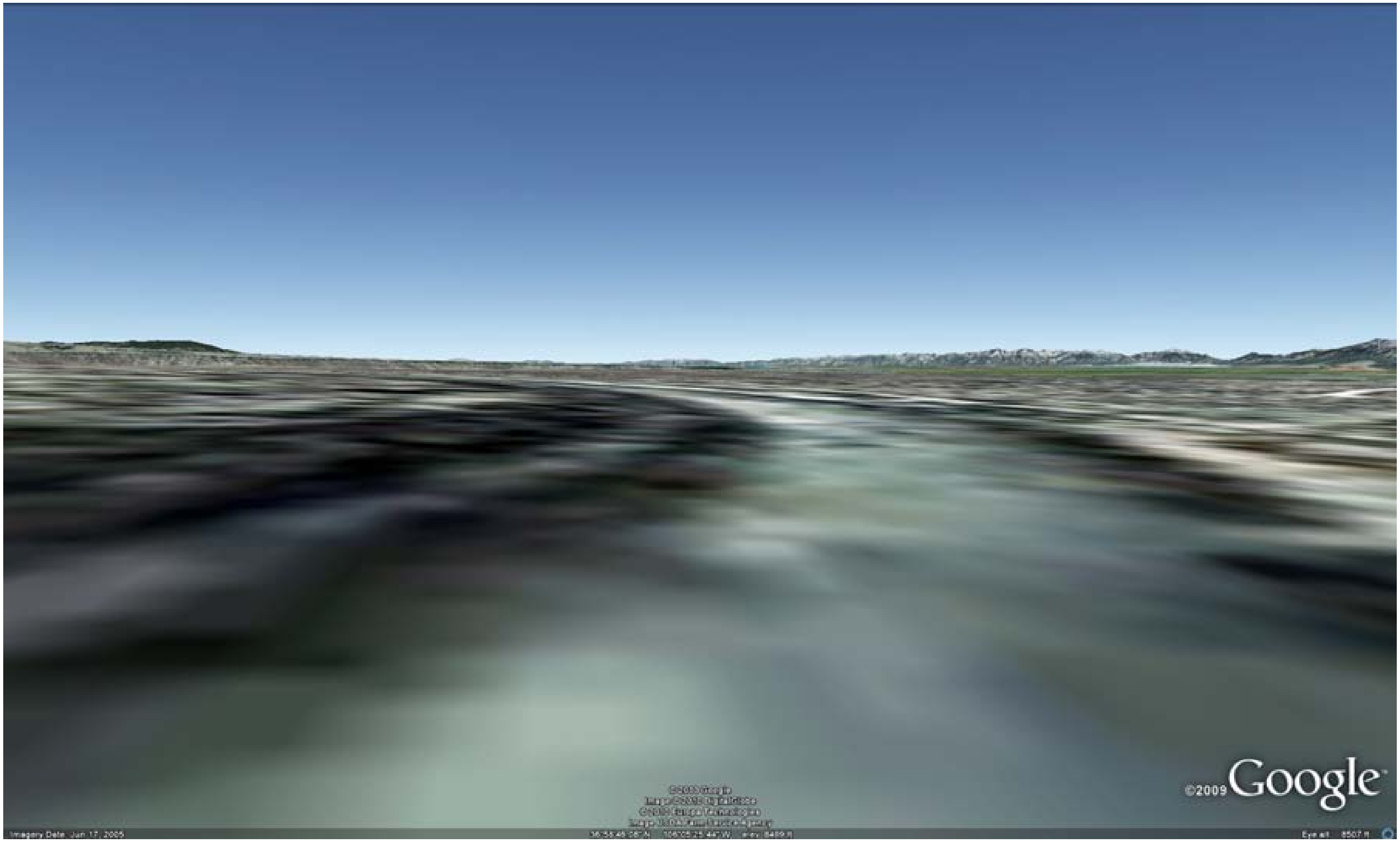

FIGURE 10.4.14.2-8 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the Cumbres & Toltec Scenic Railroad Approximately 7.4 mi (11.9 km) Southwest of the Depot at Antonito

components (e.g., condensers, transmission towers, plumes) could potentially be visible above intervening terrain (possibly with additional screening from vegetation) located between the viewpoint and the SEZ.

Figure 10.4.14.2-8 depicts a view of the SEZ as it would be seen from the CTSR line approximately 7.4 mi (11.9 km) southwest of the depot at Antonito. The nearest power tower is located approximately 13 mi (21 km) from the viewpoint, and the farthest power tower is located approximately 16 mi (26 km) from the viewpoint. The viewpoint elevation is approximately 570 ft (170 m) higher than the base of the closest (left-most) power tower shown in the visualization. The visualization suggests that low-height solar project components within the SEZ might not be visible from this location, but the upper portions of power tower receivers might be viewed against the backdrop of the mountains north of the SEZ. Because of the distance and elevated viewpoint, even tall power tower receivers would be unlikely to be visible above the peaks of the mountain range from this location. The elevated viewpoint could allow for slightly greater visibility of lower height facility components.

In general, because views from the CTSR line are along the SEZ's narrow north–south axis, the SEZ would occupy a very small portion of the horizontal field of view. In addition, the angle of view from the rail line to the SEZ is low, and many views toward the SEZ from the rail line are partially screened by topography, vegetation, or both. Consequently, solar facilities within the SEZ would be expected to cause weak levels of visual contrast for travelers on the railroad.

West Fork of the North Branch of the Old Spanish Trail. The West Fork of the North Branch of the Old Spanish Trail roughly parallels the eastern boundary of the proposed SEZ, passing to within approximately 1.0 mi (1.6 km) of the proposed SEZ at closest approach. The West Fork is visible as a blue dashed line near the eastern boundary of the SEZ in Figure 10.4.14.2-9. The viewshed analyses depicted in these figures indicate that the SEZ would be visible from many points along the trail, starting approximately 21 mi (24 km) south of the SEZ to farther than 25 mi (40 km) north of the SEZ. Approximately 54 mi (87 km) of the trail is within the 650-ft (198.1-m) SEZ viewshed within 25 mi (40 km) of the SEZ.

The community of Romeo is 1.6 mi (2.6 km) east of the West Fork trail and the SEZ, and a variety of other cultural modifications typical of a rural setting are also visible in the area.

Trail users would have extended views of the Los Mogotes East SEZ as they approached and passed it. However, some views of the SEZ (particularly the eastern portion) would likely be partially screened by vegetation and structures located between the trail and the SEZ. Where views are open, trail users distant from the SEZ would generally see solar facilities located near the western boundary of the SEZ, close to the center of their field of view as they looked down the trail, causing weak visual contrasts with the surrounding landscape. As viewers approached the SEZ, the facilities would appear farther away from the center of the field of view looking down the trail. The facilities would appear larger and more detailed and would have greater

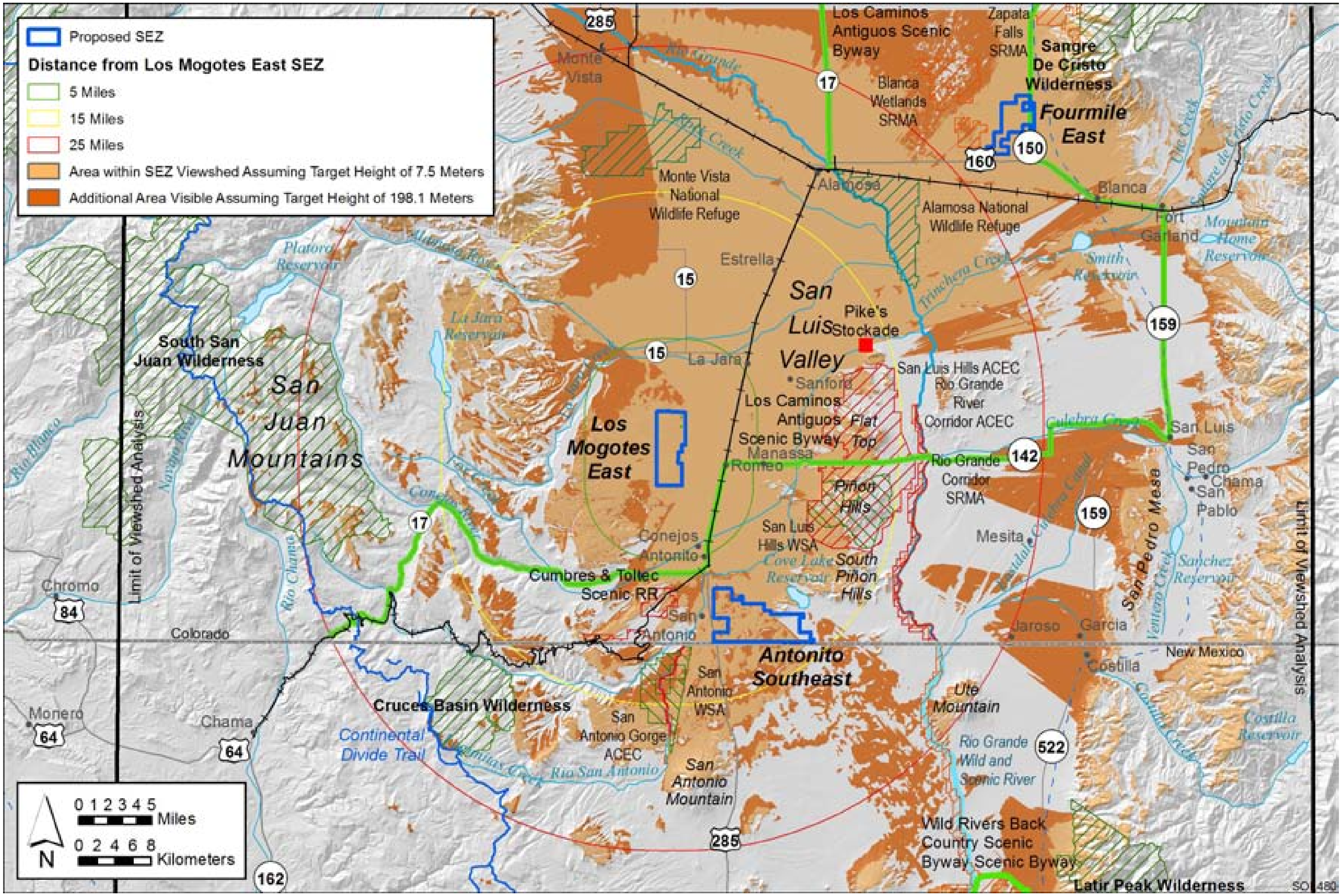

FIGURE 10.4.14.2-9 West Fork of the North Branch of the Old Spanish Trail in the Vicinity of the Proposed Los Mogotes East SEZ

contrast with their surroundings. Where screening was absent or insufficiently tall to block views of solar facilities within the SEZ, because of the close approach of the West Fork trail to the SEZ (approximately 1.0 mi [1.6 km]), energy facilities located within the SEZ might be viewed in the foreground for trail users and could potentially create strong visual contrasts with the surrounding landscape.

The Antonito Southeast SEZ is relatively close to the Los Mogotes East SEZ (approximately 7 mi [11.3 km]). The West Fork of the North Branch of the Old Spanish Trail is located between the two SEZs, paralleling the western boundary of the Antonito Southeast SEZ and the eastern boundary of the Los Mogotes East SEZ. As a result, from some locations on the West Fork, both SEZs are within the field of view, or could be seen in succession as a viewer turned his or her head to scan the field of view. It is therefore possible that solar energy facilities in both SEZs could be visible simultaneously or in succession. However, the topography and viewing geometry are such that solar facilities in one of the two SEZs would be expected to cause much lower levels of visual impact than facilities in the other SEZ, as viewed from most locations, due to its relative distance. Screening in some locations might also limit simultaneous viewing of both SEZs.

Figures 10.4.14.2-10 and 10.4.14.2-11 are Google Earth visualizations depicting views of the SEZ as seen from points on the West Fork of the North Branch of the Old Spanish Trail. The SEZ area is depicted in orange; the heliostat fields in blue. Note that these visualization do not account for potential screening of views of the SEZ and solar energy facilities that might be built within the SEZ. Screening by vegetation and structures that exist in the area might obscure much or all of the view in these locations.

Figure 10.4.14.2-10 depicts a view of the SEZ as it would be seen from the West Fork trail approximately 3.6 mi (5.8 km) southeast of the southeast corner of the SEZ. The nearest power tower is located approximately 4.9 mi (7.8 km) from the viewpoint, and the farthest power tower is located approximately 7.9 mi (12.7 km) from the viewpoint. The viewpoint is elevated approximately 46 ft (14.0 m) above the southeastern corner of the SEZ. The visualization suggests that from this location, solar projects within the SEZ would generally be viewed against the backdrop of the San Juan Mountains west of the SEZ or against the sky, depending on viewer and project location.

Operating power towers within the nearest portions of the SEZ would likely appear as very bright non-point (i.e., with a visible cylindrical or rectangular shape) light sources atop discernable tower structures. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). When operating, the power towers would likely strongly attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be conspicuous from this viewpoint. Other light associated with solar facilities in the SEZ would likely be visible as well.

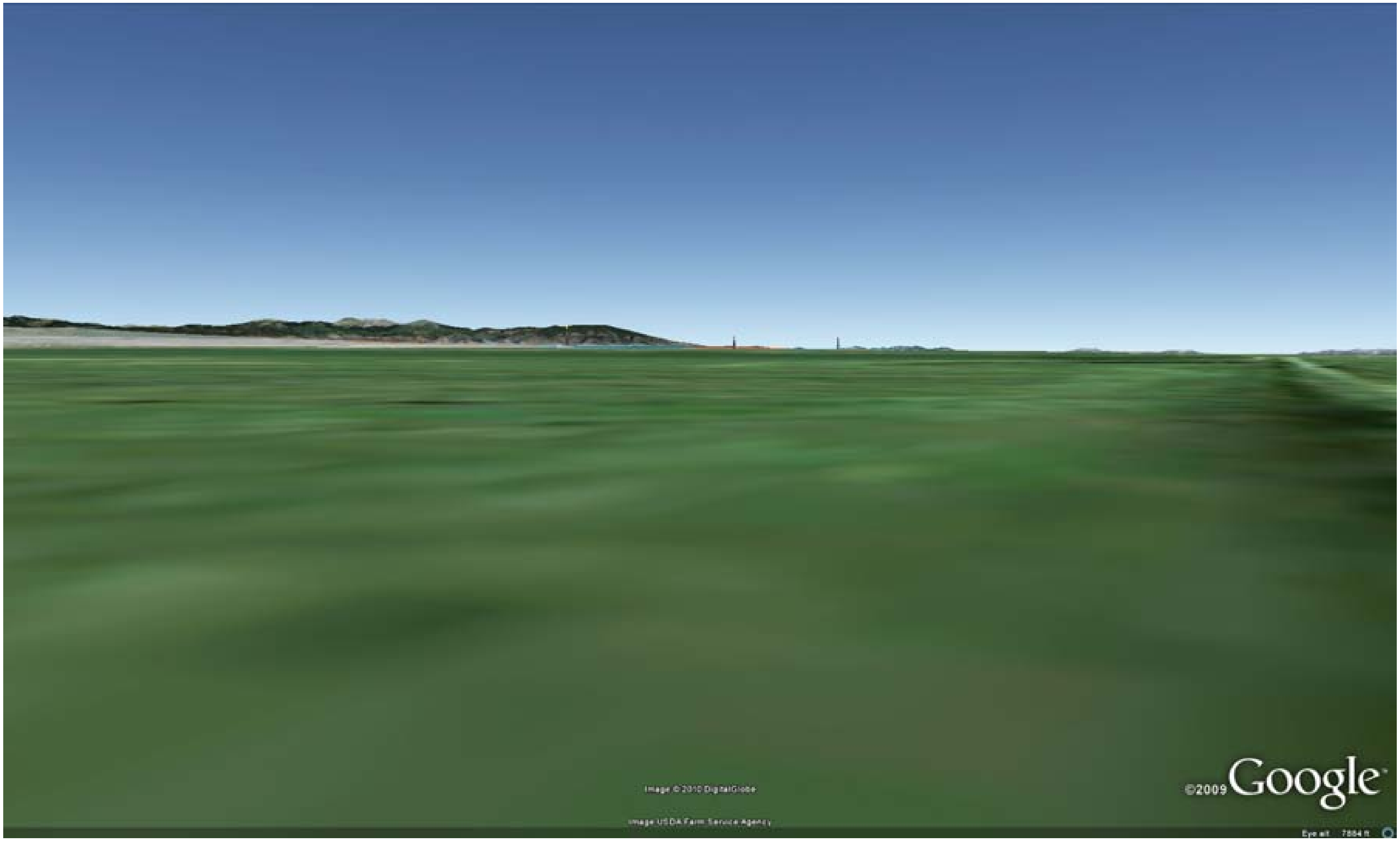

FIGURE 10.4.14.2-10 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the West Fork of the North Branch of the Old Spanish Trail Approximately 3.6 mi (5.8 km) Southeast of the Southeast Corner of the SEZ

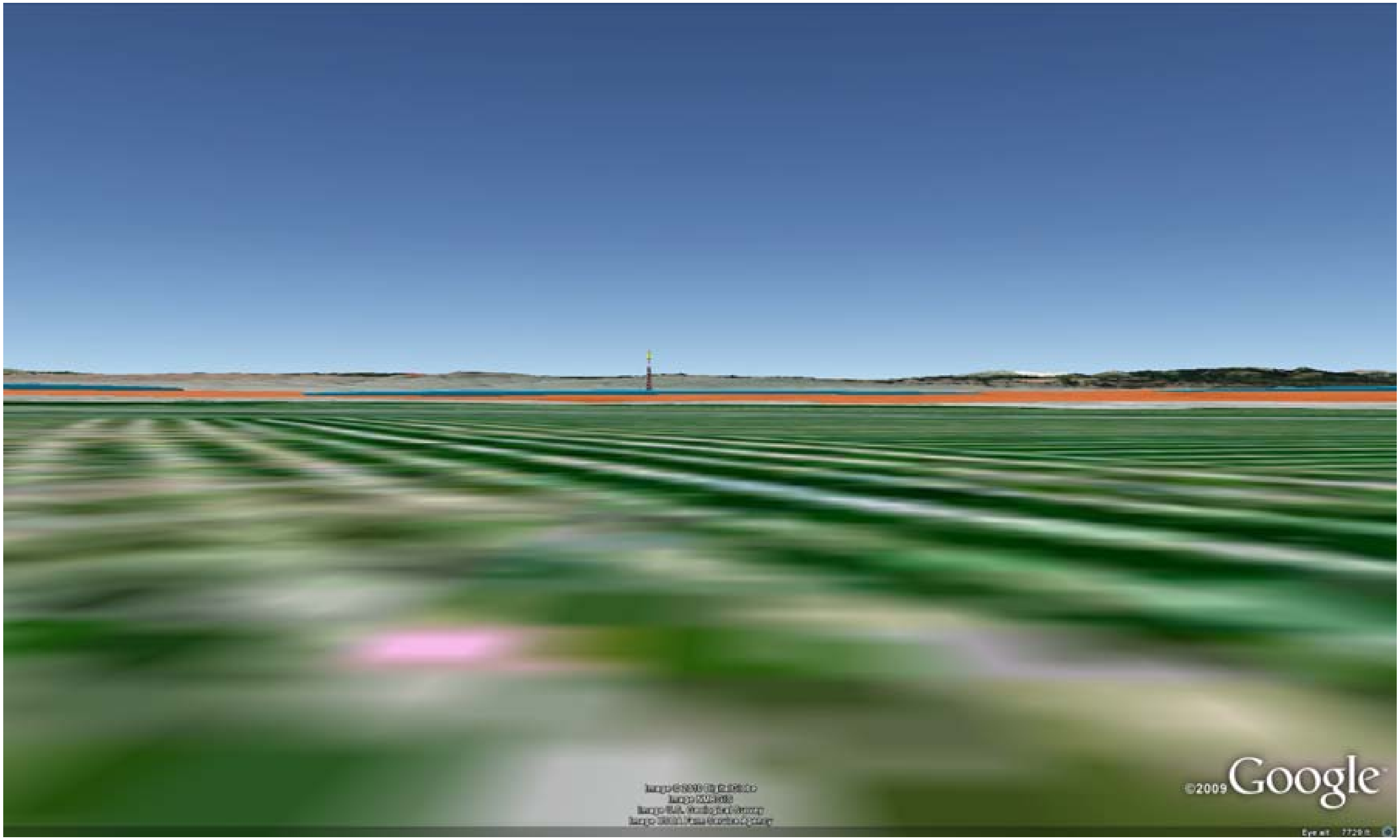

FIGURE 10.4.14.2-11 Google Earth Visualization of the Proposed Los Mogotes East SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on the West Fork of the North Branch of the Old Spanish Trail Approximately 1.2 mi (1.9 km) from the Closest Point in the SEZ

Figure 10.4.14.2-11 depicts a view of the SEZ as it would be seen from the West Fork trail from a location directly east of the SEZ and approximately 1.2 mi (1.9 km) from the closest point in the SEZ, looking west. The single power tower in this view is located approximately 2.4 mi (3.9 km) from the viewpoint. The viewpoint is elevated approximately 14 ft (4.3 m) above the western edge of the SEZ.

The visualization suggests that because the SEZ is so close to the viewpoint, the SEZ is too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole SEZ. Under the 80% development scenario analyzed in this PEIS, solar facilities within the SEZ would likely dominate the view toward the San Juan Mountains from this location.

Because the viewpoint is only slightly higher in elevation than the SEZ, the vertical angle of view would be very low, so that collector/reflector arrays of solar facilities within the SEZ would be seen edge-on. This would make the large areal extent and regular geometry of the arrays less apparent, and they would appear as thin lines on the horizon, though if very close to the viewpoint, their forms and structural details could be evident, thereby increasing contrasts. Taller ancillary facilities, such as transmission components, cooling towers, and the like would likely be visible projecting above the arrays, and could contrast noticeably in form, line, and possibly color with the very regular and strongly horizontal collector/reflector arrays.

Operating power towers within the nearest portions of the SEZ would likely appear as brilliant white non-point (i.e., with a visible cylindrical or rectangular shape) light sources atop clearly discernable tower structures. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower(s). Depending on tower location and height, power tower receivers could potentially be visible above the peaks of the San Juan Mountains. When operating, the power towers would likely strongly attract visual attention, as seen from this viewpoint.

At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be very conspicuous from this viewpoint. Other light associated with solar facilities in the SEZ would likely be visible as well.

The range of visual impacts on the West Fork would be highly dependent on viewer location along the trail, project location within the SEZ, project characteristics, and the presence or absence of topographic and vegetation screening. These issues would be addressed in a site- and project-specific impact assessment. Depending primarily on viewer location on the trail, where screening did not conceal the facilities from view, solar facilities within the SEZ could dominate the view from nearby portions of the trail. Under the development scenario analyzed in this PEIS, visual contrast from solar energy facilities in the SEZ would be expected to range from minimal to strong.

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, from some locations, strong visual contrasts from solar development within the SEZ could potentially be observed.

10.4.14.2.3 Summary of Visual Resource Impacts for the Proposed Los Mogotes East SEZ

Under the 80% development scenario analyzed in this PEIS, there could be multiple solar facilities within the Los Mogotes East SEZ, a variety of technologies employed, and a range of supporting facilities that would contribute to visual impacts, such as transmission towers and lines, substations, power block components, and roads. The resulting visually complex landscape would be essentially industrial in appearance and would contrast strongly with the surrounding, mostly natural-appearing landscape. Large visual impacts on the SEZ and surrounding lands within the SEZ viewshed would be associated with solar energy development within the SEZ because of major modification of the character of the existing landscape. Additional impacts could occur from construction and operation of transmission lines and access roads within and/or outside the SEZ.

The SEZ is in an area of low scenic quality. Visitors to the area, workers, and residents of nearby areas may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads.

Utility-scale solar energy development within the proposed Los Mogotes East is likely to result in weak to moderate visual contrasts for some viewpoints in the San Luis Hills WSA, which is approximately 8.8 mi (14.2 km) east–southeast of the SEZ.

Weak to moderate visual contrast levels would be expected for high-elevation viewpoints in the San Luis Hills ACEC, which is approximately 9.4 mi (15.1 km) east of the SEZ.

Almost 33 mi (53 km) of Los Caminos Antiguos Scenic Byway is within the Los Mogotes East SEZ viewshed. Travelers on the byway would be likely to observe weak to strong visual contrasts from solar energy development within the SEZ at some locations on the byway.

Portions of the CTSR Corridor and the CTSR Corridor ACEC are within the SEZ viewshed. Railroad passengers would be likely to observe moderate visual contrasts from solar energy development within the SEZ at some points on the railroad.

The West Fork of the North Branch of the Old Spanish Trail roughly parallels the eastern boundary of the proposed SEZ, passing to within approximately 1.0 mi (1.6 km) of the proposed SEZ. Trail users would be expected to observe strong visual contrasts from solar energy development within the SEZ at some points on the trail.

Where clear views to the SEZ existed, residents and visitors to the communities of Romeo (approximately 3.0 mi [4.8 km] east of the proposed SEZ) and Manassa (approximately 5.5 mi (8.5 km) east of the SEZ) could observe strong visual contrasts from solar facilities within the SEZ. Where clear views to the SEZ existed, residents and visitors to the community of Sanford (approximately 7.7 mi (12.4 km) east–northeast of the SEZ) could observe moderate to strong visual contrasts from solar facilities within the SEZ. Residents of and visitors to La Jara (approximately 5.3 mi [8.6 km] northeast of the proposed SEZ) could observe moderate levels of contrasts.

Minimal to weak visual contrasts would be expected for some viewpoints within other sensitive visual resource areas within the SEZ 25-mi (40 km) viewshed.

10.4.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

The presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into nonindustrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be mitigated substantially. However, the implementation of required programmatic design features presented in Appendix A, Section A.2.2, would reduce the magnitude of visual impacts experienced. While the applicability and appropriateness of some design features would depend on site- and project-specific information that would be available only after a specific solar energy project had been proposed, the following SEZ-specific design feature can be identified for the Los Mogotes East SEZ at this time:

- The development of power tower facilities should be prohibited within the SEZ.

The height of solar power tower receiver structures, combined with the intense light generated by the receiver atop the tower, would be expected to create strong visual contrasts that could not be effectively screened from view for most areas surrounding the SEZ, given the broad, flat, and generally treeless expanse of the 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 West Fork of the North Branch of the Old Spanish Trail; the Los Caminos Antiguos Scenic Byway; the other sensitive visual resource areas identified above; the communities of Antonito, Conejos, Romeo, Sanford, Manassa, and La Jara; and other residents and visitors to the San Luis Valley, a regionally important tourist destination.

Implementation of design features intended to reduce visual impacts (described in Appendix A, Section A.2.2, of this PEIS) would be expected to reduce visual impacts associated with utility-scale solar energy development within the SEZ; however, the degree of effectiveness of these design features could be assessed only at the site- and project-specificlevel. Given the large scale, reflective surfaces, strong regular geometry of utility-scale solar energy facilities, and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive visual resource areas and other sensitive viewing areas is the primary means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would generally be limited.

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10.4.15 Acoustic Environment

10.4.15.1 Affected Environment

The proposed Los Mogotes East SEZ is located near the central portion of the Conejos County in south-central Colorado, which has no quantitative noise level regulations, but Colorado has established the 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 is located as close as about 2.6 mi (4 km) east of the Los Mogotes East SEZ. Several county roads criss-cross the agricultural lands to the east, three of which provide access roads from U.S. 285 to the SEZ. The nearest railroad runs to the east along U.S. 285. The nearest airport is San Luis Valley Regional Airport, about 17 mi (27 km) north–northeast of the SEZ. Other nearby airports include Monte Vista Municipal Airport and Blanca Airport, which are located about 21 mi (34 km) north and 29 mi (47 km) east–northeast of the SEZ, respectively. Immediately to the east and the north are developed, large-scale irrigated agricultural activities for alfalfa and grains, while cattle grazing occurs on-site. No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist around the Los Mogotes East SEZ. The nearby residences from the SEZ boundary are farms to the east and the north, located as close as about 0.4 mi (0.6 km) from the southeast corner. Several population centers with schools or town infrastructure are within a 5-mi (8-km) distaqnce. Antonito to the east–southeast, Manassa to the east, and La Jara to the northeast. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, aircraft flyover, agricultural activities, animal noise, and community activities and events. The proposed Los Mogotes East 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 Los Mogotes East SEZ. On the basis of population density, the day-night sound level (L_{dn} or DNL) is estimated to be 30 dBA for Conejos County, lower than the 33 to 47 dBA L_{dn} typical of a rural area[10] (Eldred 1982; Miller 2002).

10.4.15.2 Impacts

Potential noise impacts associated with solar projects built in the Los Mogotes East SEZ would occur during all phases of the projects. During the construction phase, potential noise impacts on the nearest residence (within 0.4 mi [0.6 km] of the SEZ boundary) associated with operation of heavy equipment and vehicular traffic 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 detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the Los Mogotes East SEZ are presented in this section. Any such impacts would be minimized through the implementation of required programmatic design

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 the daytime level, and it can be interpreted as 33 to 47 dBA (mean 40 dBA) during daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

features described in Appendix A, Section A.2.2, and through the application of any additional SEZ-specific design features (see Section 10.4.15.3, 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.

10.4.15.2.1 Construction

The proposed Los Mogotes East 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; installing equipment, piping, and electrical). Solar array construction would also generate noise, but spread over a wide area.

For the parabolic trough and power tower technologies, the highest construction noise levels would occur at the power block area, where key components (e.g., steam turbine/generator) needed to generate electricity are located; a maximum of 95 dBA at a distance of 50 ft (15 m) is assumed, if impact equipment, such as pile drivers or rock drills, is not used. 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. With geometric spreading and ground effects, 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 level. In addition, mid- and high-frequency noise from construction activities is significantly attenuated by atmospheric absorption under the low humidity conditions typical of an arid desert environment, and by temperature lapse conditions typical of daytime hours; thus noise attenuation to a 40-dBA level would occur at somewhat shorter distances than the aforementioned distances. If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur at about 1,200 ft (370 m) from the power block area, which would be well within the facility boundary. For construction activities occurring near the residence closest to the southeastern SEZ boundary, estimated noise levels at the nearest residence would be about 52 dBA, which is higher than a typical daytime mean rural background level of 40 dBA. In addition, an estimated 49 dBA L_{dn} at this residence[11] falls below the EPA guideline of 55 dBA for residential areas.

In addition, noise levels were estimated at the specially designated areas within a 5-mi (8-km) distance from the Los Mogotes East SEZ, which is the farthest distance that noise (except extremely loud noise) would be discernable. The Los Mogotes ACEC and North Branch of the Old Spanish Trail, which lie as close as 1.0 mi (1.6) west and east of the SEZ boundary, respectively, are within this distance. For construction activities occurring near the western or eastern SEZ boundary, estimated noise levels at the Los Mogotes ACEC or North Branch of Old Spanish Trail would be about 42 dBA, slightly higher than the typical daytime mean rural background level of 40 dBA. Construction noise from the SEZ is not likely to adversely affect

[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.

wildlife at the Los Mogotes ACEC (Manci et al. 1988), as discussed in Section 5.10.2. However, construction occurrning near the eastern SEZ boundary could result in minor noise impacts on the North Branch of Old Spanish Trail. These impacts would be temporary.

Depending on the soil conditions, pile driving might be required for installation of solar dish engines. However, the pile drivers used would be relatively small and quiet, such as vibratory or sonic drivers, in contrast to impulsive impact pile drivers frequently seen at large-scale construction sites. Potential impacts on neighboring residences would be anticipated to be minor, considering the distance to the nearest residence (more than 0.4 mi [0.6 km] from the SEZ boundary).

It is assumed that most construction activities would occur during the day, when noise is tolerated better than at night because of the masking effects of background noise. In addition, construction activities for a utility-scale facility are temporary (typically a few years). Construction would cause some unavoidable but localized short-term impacts on neighboring communities, particularly for activities occurring near the eastern proposed SEZ boundary, close to the nearby residences.

Construction activities could result in various degrees of ground vibration, depending on the equipment used and construction methods employed. All construction equipment causes ground vibration to some degree, but activities that typically generate the most severe vibrations are high-explosive detonations and impact pile driving. As is the case for noise, vibration would diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of perception for humans, which is about 65 VdB (Hanson et al. 2006). During the construction phase, no major construction equipment that can cause ground vibration would be used, and no residences or sensitive structures are close. Therefore, no adverse vibration impacts from construction activities are anticipated, 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 the existing regional 69-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 noise impacts on nearby residences would be a minor component of construction impacts in comparison to solar facility construction and would be temporary.

10.4.15.2.2 Operations

Noise sources common to all or most types of solar technologies are equipment motion from solar tracking; maintenance and repair activities (e.g., washing of mirrors or replacement of broken mirrors) at the solar array area; and commuter/visitor/support/delivery traffic within and around the solar facility and around 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 arrays area would be minimal, related mainly to solar tracking, if used. On the other hand, dish engine technology, which employs collector and converter devices in a single unit, would be the strongest noise source.

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 southeastern corner of the SEZ, the predicted noise level from the power block would be about 45 dBA at the nearest residence, located about 0.4 mi (0.6 km) from the site boundary, which is higher than the typical daytime mean rural background level of 40 dBA. If TES was not used (i.e., if the operation was limited to daytime, 12 hours only[12]), the EPA guideline level of 55 dBA as L_{dn} for residential areas would occur at about 1,370 ft (420 m) from the power block area and thus would not be exceeded outside of the proposed SEZ boundary. At the nearest residence, about 44 dBA L_{dn} would be estimated, which is well below the EPA guideline level of 55 dBA L_{dn} for residential areas. However, day-night average noise levels higher than those estimated above by using the simple noise modeling would be anticipated if TES was used during nighttime hours, as explained below and in Section 4.13.1.

On a calm, clear night typical of the proposed Los Mogotes East SEZ setting, 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[13] within 1 or 2 mi (1.6 to 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 after 12-hour daytime generation with TES is assumed. For nighttime hours under temperature inversion, 10 dB is added to noise levels estimated from the uniform atmosphere (see Section 4.13.1). Based on these assumptions, the estimated nighttime noise level at the nearest residence (about 0.9 mi [1.4 km] from the power block area for a solar facility located near the southeastern SEZ boundary) would be about 55 dBA, which is quite higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 57 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

[12] Maximally possible operating hours around summer solstice but limited to 7 to 8 hours around winter solstice.

[13] A shadow zone is defined as the region where direct sound does not penetrate because of upwards diffraction.

57 dBA L_{dn} at the nearest residence, even if TES is used at a solar facility. Consequently, operating parabolic trough or power tower facilities with TES and located near the southeastern 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 western or eastern boundary of the SEZ, estimated daytime and nighttime noise levels at the Los Mogotes ACEC or North Branch of Old Spanish Trail would be about 41 and 51 dBA, respectively, which are comparable to and higher than typical daytime and nighttime mean rural background levels of 40 and 30 dBA. Operation noise from the SEZ is not likely to adversely affect wildlife at the Los Mogotes ACEC (Manci et al. 1988). However, a solar facility located near the eastern SEZ boundary could result in noise impacts on the North Branch of Old Spanish 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, but a solar facility might employ thousands of dish engines, which would cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar Two, LLC 2008). At the Los Mogotes East SEZ, assuming a dish engine facility of up to 526-MW capacitly (covering 80% of the total area, or 4,734 acres [19.2 km^2]), up to 21,040 25-kW dish engines could be employed. Also, for a large dish engine facility, several hundred step-up transformers would be embedded in the dish engine solar field, along with a substation; however, the noise from these sources would be masked by dish engine noise.

The composite noise level of a single dish engine would be about 88 dBA at a distance of 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA (typical of the rural daytime environment) within 320 ft (100 m). However, the combined noise level from tens of thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility, e.g., about 48 dBA at 1 mi (1.6 km) and 44 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field; both values are higher than the typical daytime mean rual background level of 40 dBA. However, these levels would occur at somewhat shorter distances than the aforementioned distances, considering noise attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate noise levels at the nearest residence, it was assumed that dish engines were placed all over the Los Mogotes East SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest residence, about 0.4 mi (0.6 km) from the SEZ boundary would be about 49 dBA, which is higher than the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 47 dBA L_{dn} at this residence is below the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other attenuation mechanisms, noise levels at the nearest residences would be lower than the values estimated above. Noise from dish engines could cause adverse impacts on the nearest residence, depending on background noise levels and meteorological conditions.

For dish engines placed all over the SEZ, estimated noise levels would be about 47 to 48 dBA at the Los Mogotes ACEC and North Branch of Old Spanish Trail, which are higher than the typical daytime mean rural background level of 40 dBA. Dish engine noise from the SEZ is not likely to adversely affect wildlife at the Los Mogotes ACEC (Manci et al. 1988) but could result in noise impacts on the North Branch of Old Spanish 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 be considered.

During operations, no major ground-vibrating equipment would be used. In addition, no sensitive structures are located close enough to the Los Mogotes East 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, which is typically near the center of a solar facility. Noise from these sources would generally be limited to within the facility boundary and rarely be heard at nearby residences, assuming a 0.9-mi (1.4-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and another 0.4 mi [0.6 km] to the nearby residences). Accordingly, potential impacts of these noise sources on nearby residences would be minimal.

For noise impacts from transmission line corona discharge (Section 5.13.1.5), during rainfall events, the noise levels at 50 ft (15 m) and 300 ft (91 m) from the center of a 230-kV transmission line towers would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of daytime and nighttime mean background levels in rural environments. Corona noise 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 Los Mogotes East SEZ is located in an arid desert environment, and incidents of corona discharge are infrequent. Therefore, potential impacts associated with transmission lines on nearby residents along the transmission lines ROW would be negligible.

10.4.15.2.3 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. The same design features 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.

10.4.15.3 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 project details are being considered, some measures can be identified at this time, as follows:

- Noise levels from cooling systems equipped with TES should be managed so that levels at nearby residences to the north and east of the SEZ are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.

- Dish engine facilities within the Los Mogotes East SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from nearby residences around the SEZ (i.e., the facilities should be located in the 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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10.4.16 Paleontological Resources

The paleontological conditions of the San Luis Valley, which encompasses the proposed Los Mogotes East SEZ, are described in Section 10.1.16.

10.4.16.1 Affected Environment

The proposed Los Mogotes East SEZ is covered predominantly by Tertiary basalt flows and associated tuff, breccia, and conglomerate (classified as Tbb on geological maps). Of the entire 5,909-acre (24-km^2) area of SEZ land, 5,192 acres (21 km^2), or 88%, is composed of this volcanic deposit. The PFYC for Tbb is Class 1, which indicates that the occurrence of significant fossil materials is non-existent or extremely rare. (Section 4.8 discusses the PFYC system.) No paleontological resources from this surface geology type are known in the San Luis Valley Resource Area. About 12% of the SEZ (718 acres or 2.9 km^2) is composed of unclassified Quaternary surface deposits (classified on geologic maps as QTsa) overlying the Alamosa Formation. This area is on the eastern edge of the SEZ. The PFYC for QTsa is Class 4/5 (on the basis of the PFYC map from the Colorado State Office; see Murphey and Daitch 2007), although no known paleontological resources from these deposits in the San Luis Valley have been recorded (Lindsey 1983). The nearest identified exposures of the Alamosa Formation are located in the San Luis Hills to the east of the Los Mogotes East SEZ and at Hansen's Bluff southeast of Alamosa, Colorado (northeast of the SEZ). Most areas immediately adjacent to the proposed Los Mogotes East SEZ are also Tbb deposits and are unlikely to contain significant fossils. However areas immediately east of the SEZ are composed of QTsa deposits and are PFYC Class 4/5.

10.4.16.2 Impacts

Few, if any, impacts on significant paleontological resources are likely to occur in the portion of the proposed Los Mogotes East SEZ that have been identified as PFYC Class 1. However, a more detailed look at the local geological deposits of the SEZ is needed to verify that a PFYC of Class 1 is accurate and appropriate and that no exposures of the Alamosa Formation are present. On the basis of the PFYC classification of Class 4/5 for the eastern 12% of the SEZ, there could be impacts on significant paleontological resources in this area, although the presence of such resources is currently unknown. A more detailed look at the geological deposits in the eastern portion of the SEZ and the depth to the Alamosa Formation is needed, as well as a paleontological survey prior to development, as per BLM IM2008-009 and IM2009-011 (BLM 2007, 2008a). If significant paleontological resources are found to be present within the eastern 12% of the proposed Los Mogotes East SEZ during a paleontological survey, Section 5.14 discusses the types of impacts that could occur. Because it is also 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. Programmatic design features (as described in Section A.2.2) assume that the necessary surveys will occur.

Indirect impacts, such as through looting or vandalism, on paleontological resources outside of the SEZ, in areas to the east that are also classified as PFYC 4/5, are unknown but unlikely; any such resources would be below the surface and not readily accessed, although the presence of exposures of the Alamosa Formation is currently unknown. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

Approximately 3 mi (5 km) of access road is anticipated to connect the SEZ to U.S. 285 to the east. Areas of PFYC Class 4/5 could be affected. The depth to the Alamosa Formation should be determined to identify whether the application of mitigation measures might be necessary in that area to avoid the potential for adverse effects (both direct and indirect) related to construction of the ROW.

10.4.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. An SEZ-specific design feature is as follows:

- Avoidance of PFYC Class 4/5 areas is recommended for development within the proposed Los Mogotes East SEZ and for access road placement. Where avoidance of Class 4/5 deposits is not possible, a paleontological survey may be required.

10.4.17 Cultural Resources

The general culture history of the San Luis Valley, which encompasses the proposed Los Mogotes East SEZ, is described in Section 10.1.17.

10.4.17.1 Affected Environment

No archaeological sites have been recorded in the proposed Los Mogotes East SEZ. Two segments of the Little Mogotes Allotment Water Development Project that minimally extend into the Los Mogotes East SEZ were surveyed for cultural resources (0.02% of the SEZ). No sites were encountered in these small survey areas. A total of 144 sites and isolated finds have been recorded within 5 mi (8 km) of the SEZ. In 1980, a 5-mi^2 (13-km^2) area directly south of the SEZ, called the Mogote Survey Area, was surface surveyed as part of the first phase of the San Luis Valley Archaeological Project. Thirty-nine sites were recorded, including several stone circles, stone enclosures, and rock piles, as well as prehistoric activity and occupation areas and historic sites and trash scatters; at least one of the sites appeared to have buried deposits in association with a hearth (Haas 1980). Just west of the SEZ, a large number of archaeological sites (50 sites within 5 mi [8 km] of the SEZ) were recorded in 1982 as part of a project called "San Luis Valley: A Model for Management." Many of these sites are rock alignments, cairns, and wind breaks (Colorado SHPO 2009). During the site visit, a cairn overlooking the SEZ was visited; it contained an historic rock art depiction of a cross etched into the desert varnish. It was likely one of the sites initially recorded in 1982. Approximately 135 additional sites located slightly more than 5 mi (8 km) west of the north end of the SEZ were recorded and evaluated during a survey of the La Jara Reservoir area for the Baca Land Exchange; 51 of those sites are eligible for listing in the NRHP and 29 sites, although not individually eligible, contribute to the La Jara Archaeological Area (Wells 2008). Consistent with findings in the local area, many of the prehistoric sites found during the survey include lithic scatters, open camps, open architectural sites, and rock art sites, and historic sites include culturally peeled trees, trash scatters, structures, and an ethnobotanical gathering site.

No properties currently listed in the NRHP for Conejos County are located within the SEZ; however, five properties are located nearby in Antonito, just over 5 mi (8 km) to the south of the SEZ. The Denver & Rio Grande Railroad San Juan Extension (also known as the CTSR) is one of the properties listed in the NRHP that is located relatively close to the SEZ; it is currently nominated for National Landmark status.

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 10.4.18). Traditional cultural properties of interest to the Hispanic community are possible in this area.

This SEZ has the potential to contain significant cultural resources. The large number of sites encountered to the west indicates people were present in this location in both prehistoric and historic times. The potential for finding significant Paleoindian sites exists throughout the entire valley. Sites related to the historic period settlement of the valley are also possible. A large trash scatter of seemingly recent origin is located on the eastern side of the SEZ, outside the boundary, although older deposits of historic debris are possible in the vicinity. An acequia is also located just east of the proposed SEZ, connecting to the Conejos River.

The West Fork of the North Branch of the Old Spanish Trail proceeds close to the eastern boundary of the SEZ.[14] A survey of the West Fork is needed to verify the location of the trail and identify associated sites and features. Identification of evidence for use of the West Fork during the period of 1829 to 1848 would support local recommendations by the Old Spanish Trail Association to include the West Fork as part of the congressionally designated Old Spanish National Historic Trail. Until additional research has been completed, the West Fork is being managed as a significant cultural resource in order to maintain the historic and visual integrity of the corridor (Haas 2010).

10.4.17.2 Impacts

Direct impacts on significant cultural resources during site preparation and construction activities could occur in the proposed Los Mogotes East SEZ; however, further investigation is needed. A cultural resource survey of the entire area of potential effect would first need to be conducted required to identify archaeological sites, historic structures or features, and traditional cultural properties, and an evaluation would need to follow to determine whether any recorded sites meet the criteria for eligibility for listing in the NRHP. 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 to the extent possible 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 would occur.

Indirect impacts on cultural resources resulting from erosion outside of the SEZ boundary (including along ROWs) are unlikely assuming programmatic design features to reduce water runoff and sedimentation are implemented (as described in Section A.2.2). Approximately 3 mi (5 km) of access road is anticipated to connect to U.S. 285 to the east. Indirect impacts on cultural resources, such as vandalism or theft, could occur if significant sites are close to the ROW east of the SEZ. No new transmission lines have been assessed for the proposed SEZ, assuming existing corridors would be used and no new areas of potential cultural significance would be opened to increased access; impacts on cultural resources related to the creation of new corridors would be evaluated at the project-specific level if new road construction or line upgrades are to occur.

Although the West Fork of the North Branch of the Old Spanish Trail has not received National Historic Trail status, the potential effect of solar energy development on the visual setting of the nearby trail should be further evaluated. On the basis of the preliminary visual analysis presented in Section 10.4.14.2, the CTSR Corridor ACEC located south of the zone would not be adversely affected by solar energy development in the Los Mogotes East SEZ, with

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[14] The West Fork is located within 1.0 mi (1.6 km) of the SEZ at its closest point on the basis of preliminary maps; the mapped location of the trail is considered approximate.

the possible exception of visual impacts resulting from the installation of a power tower or other similarly tall structures (see Figure 10.4.14.2-1). However, the ACEC is located farther away than other portions of the railroad system, and the impact of solar energy development on the visual setting of the entire historic property should be further evaluated.

10.4.17.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

Ongoing consultation with the Colorado SHPO and the appropriate Native American governments would be conducted during the development of the proposed Los Mogotes East SEZ. It is likely that adverse effects on significant resources in the valley could be mitigated to some degree through such efforts, although not enough to eliminate the effects unless a significant resource is avoided entirely. SEZ-specific design features could include:

- Development of a PA may be needed 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) also should be included in the development of that PA.

- Additional coordination with the CTSR Commission is recommended to address possible mitigation measures for reducing visual impacts on the Cumbres and Toltec Scenic Railroad.[15]

[15] Additional parties, such as the NPS and the ACHP, may need to be consulted if the railroad achieves National Historic Landmark status.

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10.4.18 Native American Concerns

10.4.18.1 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 Los Mogotes East SEZ, Section 10.4.17 discusses archaeological sites, structures, landscapes, trails, and traditional cultural properties, and Section 10.1.17 describes the general cultural history of the San Luis Valley; Section 10.4.9.1.3 discusses water rights and water use; Section 10.4.10 discusses plant species; 10.4.11 discusses wildlife species, including wildlife migration patterns; Sections 10.4.19 and 10.4.20 discuss socioeconomics and environmental justice, respectively; and issues of human health and safety are discussed in Section 5.21.

The valley was predominantly used by Tribes historically for hunting and trading rather than long-term settlement. The nearest Tribal land claim (judicially established as traditional tribal territory) to the proposed Los Mogotes East SEZ is for the Jicarilla Apache. Their land claim is located east and southeast of the SEZ, mostly in New Mexico but also up into southeastern Colorado. The Taos Pueblo has a judicially established land claim to the south of the SEZ in New Mexico.

Consultation for the Colorado SEZs has been initiated by the BLM with the Tribes[16] shown in Table 10.4.18.1-1. 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.

10.4.18.2 Impacts

To date, no comments have been received from the Tribes referencing the proposed Los Mogotes East SEZ specifically. The Navajo Nation has responded that “the proposed undertaking/project area will not impact any Navajo traditional cultural properties,” with the caveat that the Nation be notified of any inadvertent discoveries that might take place related to the undertaking (Joe 2008; Joe 2009). No direct impacts from disturbance during project development would occur to judicially established Tribal land claims or to areas in the San Luis Valley 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 in the SEZ on these areas 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 important animals will be lost.

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[16] 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 10.4.18.1-1 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

Given that similar plants and habitat would remain in the valley, project-level consultation with Tribes will be necessary to determine the importance of the traditional resources.

Groundwater withdrawals in the valley are tightly regulated and the use of programmatic design features described in Appendix A, Section A.2.2, would ensure that minimal impacts to surface waters and springs would occur.

10.4.18.3 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. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

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 10.4.18.1-1.

10.4.19 Socioeconomics

10.4.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the ROI surrounding the proposed Los Mogotes East SEZ. The ROI is a six-county area comprising Alamosa, Conejos, Costilla, and Rio Grande Counties in Colorado and Rio Arriba and Taos Counties in New Mexico. It encompasses the area in which workers are expected to spend most of their salaries and in which a portion of site purchases and nonpayroll expenditures from the construction, operation, and decommissioning phases of the proposed SEZ facility are expected to take place.

10.4.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 55,187 (Table 10.4.19.1-1). Over the period 1999 to 2008, annual average employment growth rates were higher in Taos County (3.7%) and Rio Grande County (2.4%) than elsewhere in the ROI. Employment declined over this period in Conejos County. At 1.5%, the growth rate in the ROI as a whole was similar to the average state rates for Colorado (1.5%) and New Mexico (1.5%).

TABLE 10.4.19.1-1 ROI Employment for the Proposed Los Mogotes East SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Alamosa County, Colorado	7,885	7,935	0.1
Conejos County, Colorado	3,498	3,402	–0.3
Costilla County, Colorado	1,234	1,268	0.3
Rio Grande County, Colorado	4,784	6,040	2.4
Rio Arriba County, New Mexico	18,426	19,886	0.8
Taos County, New Mexico	11,612	16,656	3.7
ROI	47,439	55,187	1.5
Colorado	2,269,668	2,596,309	1.5
New Mexico	793,052	919,466	1.5

Sources: U.S. Department of Labor (2009a,b).

In 2006, the service sector provided the highest percentage of employment in the ROI at 47.7%, followed by agriculture (18.6%) and wholesale and retail trade (18.0%) (Table 10.4.19.1-2). Smaller employment shares were held by construction (7.0%) and finance, insurance, and real estate (4.7%). Within the ROI, the distribution of employment across sectors is similar to that of the ROI as a whole, with a lower percentage of employment in agriculture in Rio Arriba County (14.1%) and in Taos County (3.6%) than in the ROI as a whole. In the four Colorado counties, employment in agriculture is more significant than in the ROI as a whole, with more than 75% of total employment in this sector in Costilla County, and more than 40% in Rio Grande and Conejos Counties. Employment in services is much less significant than in the ROI as a whole.

10.4.19.1.2 ROI Unemployment

Unemployment rates have varied across the six counties in the ROI. Over the period 1999 to 2008, the average rate in Costilla County was 9.2%, with a relatively high rate of 6.9% in Taos and Conejos Counties, with rates exceeding 5% in all counties except Alamosa over this period (Table 10.4.19.1-3). Rates have fallen over the period; in 1999, Taos and Conejos Counties experienced rates higher than 11%. The average rate in the ROI over this period was 6.1%, higher than the average rate for Colorado (4.5%) and New Mexico (5.0%). Unemployment rates for the first 5 months of 2009 contrast with rates for 2008 as a whole; in Costilla County, the unemployment rate increased to 11.1%, while rates reached 9.9% and 8.4% in Conejos County and Rio Grande County, respectively. The average rates for the ROI (7.0%), for Colorado (7.5%), and for New Mexico (5.6%) were also higher during this period than the corresponding average rates for 2008.

10.4.19.1.3 ROI Urban Population

The population of the ROI in 2008 was 29% urban; the largest city, Alamosa, had an estimated population of 8,746; other cities in the ROI include Espanola (7,076), Taos (5,546) and Monte Vista (4,015) (Table 10.4.19.1-4). In addition, there are ten smaller cities in the ROI with a 2008 population of less than 1,500.

Population growth rates in the ROI have varied over the period 2000 to 2008 (Table 10.4.19.1-4). Taos grew at an annual rate of 2.1% during this period, with higher-than average-growth also experienced in Chama (1.4%) and Alamosa (1.2%). The remaining cities experienced lower growth rates from 2000 to 2008, with the majority of these cities experiencing negative growth rates during this period.

10.4.19.1.4 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 Taos Ski Village ($87,175) had a median income that

TABLE 10.4.19.1-2 ROI Employment for the Proposed Los Mogotes East SEZ by Sector, 2006[a]

Industry	Alamosa County, Colorado		Conejos County, Colorado		Costilla County, Colorado		Rio Grande County, Colorado	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,470	22.4	488	42.8	484	77.0	1,763	41.9
Mining	10	0.2	10	0.9	0	0.0	0	0.0
Construction	324	4.9	39	3.4	14	2.2	179	4.3
Manufacturing	93	1.4	60	5.3	10	1.6	79	1.9
Transportation and public utilities	201	3.1	100	8.8	10	1.6	70	1.7
Wholesale and retail trade	1,300	19.8	159	14.0	90	14.3	769	18.3
Finance, insurance, and real estate	434	6.6	41	3.6	10	1.6	197	4.7
Services	2,752	41.9	299	26.3	114	18.4	1,172	27.9
Other	9	0.1	0	0.0	10	1.6	10	0.2
Total	6,575		1,139		631		4,207	

Industry	Rio Arriba County, New Mexico		Taos County, New Mexico		ROI	
	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	1,281	14.1	353	3.6	5,841	18.6
Mining	107	1.2	758	0.8	205	0.7
Construction	621	6.8	1,038	10.6	2,215	7.0
Manufacturing	176	1.9	133	1.4	551	1.8
Transportation and public utilities	225	2.5	199	2.0	805	2.6
Wholesale and retail trade	1,724	18.9	1,637	16.7	5,679	18.0
Finance, insurance, and real estate	290	3.2	495	5.0	1,467	4.7
Services	4,803	52.8	5,874	59.8	15,014	47.7
Other	10	0.1	10	0.1	49	0.2
Total	9,100		9,825		31,477	

[a] Agricultural employment includes 2007 data for hired farm workers.

Sources: U.S. Bureau of the Census (2009a); U.S. Department of Agriculture (2009a,b).

TABLE 10.4.19.1-3 ROI Unemployment Rates (%) for the Proposed Los Mogotes East SEZ

Location	1999–2008	2008	2009[a]
Alamosa County, Colorado	5.0	5.3	7.6
Conejos County, Colorado	6.9	7.5	9.9
Costilla County, Colorado	9.2	7.6	11.1
Rio Grande County, Colorado	5.6	5.8	8.4
Rio Arriba County, New Mexico	5.9	5.1	6.1
Taos County, New Mexico	6.9	5.2	6.5
ROI	6.1	5.5	7.0
Colorado	4.5	4.2	7.5
New Mexico	5.0	4.9	5.6

[a] Rates for 2009 are the average for January through May.

Sources: U.S. Department of Labor (2009a–c).

TABLE 10.4.19.1-4 ROI Urban Population and Income for the Proposed Los Mogotes East SEZ

	Population			Median Household Income ($ 2008)		
City	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 (%)[a]
Alamosa, Colorado	7,960	8,746	1.2	32,771	NA	NA
Espanola, New Mexico	7,105	7,076	–0.1	34,948	NA	NA
Taos, New Mexico	4,700	5,546	2.1	32,208	NA	NA
Monte Vista, Colorado	4,529	4,015	–1.5	36,556	NA	NA
Chama, New Mexico	1,199	1,344	1.4	39,286	NA	NA
Manassa, Colorado	1,042	936	–1.3	29,731	NA	NA
La Jara, Colorado	877	784	–1.4	31,115	NA	NA
Antonito, Colorado	873	776	–1.5	24,727	NA	NA
Sanford, Colorado	817	733	–1.3	32,993	NA	NA
San Luis, Colorado	739	641	–1.8	18,299	NA	NA
Blanca, Colorado	391	343	–1.6	29,452	NA	NA
Romeo, Colorado	375	340	–1.2	24,857	NA	NA
Hooper, Colorado	123	125	0.2	41,154	NA	NA
Taos Ski Village, New Mexico	56	58	0.4	87,175	NA	NA

[a] Data are averages for the period 2006 to 2008.

Source: U.S. Bureau of the Census (2009b-d).

was higher than the average for Colorado ($56,574) and New Mexico ($43,202) (Table 10.4.19.1-4).

10.4.19.1.5 ROI Population

Table 10.4.19.1-5 presents recent and projected populations in the ROI and states as a whole. Population in the ROI stood at 116,511 in 2008, having grown at an average annual rate of 0.7% since 2000. Growth rates for the ROI were lower than those for New Mexico (1.7%) and Colorado (1.9%) over the same period.

Three of the six counties in the ROI have experienced minor growth in population since 2000; the remainder have experienced loss of population. Population in Taos County grew at an annual rate of 1.2% from 2000 to 2008, while Alamosa County and Rio Arriba County populations grew by 0.7% over the same period. The remaining counties saw declines in population of less than 1.0%. The ROI population is expected to increase to 132,554 by 2021 and to 134,655 by 2023 (State Demography Office 2009; University of New Mexico 2009).

10.4.19.1.6 ROI Income

Personal income in the ROI stood at $3.0 billion in 2007 and grew at an annual average rate of 2.2% over the period 1998 to 2007 (Table 10.4.19.1-6). ROI personal income per

TABLE 10.4.19.1-5 ROI Population for the Proposed Los Mogotes East SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Alamosa County, Colorado	14,966	15,783	0.7	20,210	20,943
Conejos County, Colorado	8,400	8,232	–0.3	9,322	9,453
Costilla County, Colorado	3,663	3,465	–0.7	3,898	3,945
Rio Grande County, Colorado	12,413	12,279	–0.1	14,465	14,776
Rio Arriba County, New Mexico	41,190	43,653	0.7	46,300	46,487
Taos County, New Mexico	29,979	33,100	1.2	38,359	39,051
ROI	110,611	116,511	0.7	132,554	134,655
Colorado	4,301,261	5,010,395	1.9	6,398,532	6,613,747
New Mexico	1,819,046	2,085,115	1.7	2,573,667	2,640,712

Sources: U.S. Bureau of the Census (2009e,f); State Demography Office (2009); University of New Mexico (2009).

TABLE 10.4.19.1-6 ROI Personal Income for the Proposed Los Mogotes East SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Alamosa County, Colorado			
Total income[a]	0.4	0.4	1.1
Per capita income	26,089	27,238	0.4
Conejos County, Colorado			
Total income[a]	0.2	0.2	0.9
Per capita income	18,795	20,161	0.7
Costilla County, Colorado			
Total income[a]	0.1	0.1	0.9
Per capita income	20,755	23,273	1.2
Rio Grande County, Colorado			
Total income[a]	0.3	0.4	0.5
Per capita income	27,435	27,814	0.1
Rio Arriba County, New Mexico			
Total income[a]	0.8	1.0	2.4
Per capita income	19,865	23,321	1.6
Taos County, New Mexico			
Total income[a]	0.7	0.9	3.6
Per capita income	23,005	28,763	2.3
ROI			
Total income[a]	2.4	3.0	2.2
Per capita income	22,360	25,637	1.4
Colorado			
Total income[a]	118.5	199.5	2.8
Per capita income	37,878	41,955	1.0
New Mexico			
Total income[a]	48.8	62.4	2.5
Per capita income	27,182	30,497	1.2

[a] Unless indicated otherwise, values are reported in $ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

capita also rose over the same period at a rate of 1.4%, increasing from $22,360 to $25,637. Per-capita incomes in Taos ($28,763), Rio Grande ($27,814), and Alamosa ($27,238) Counties in 2007 were higher than elsewhere in the ROI. Personal income and per-capita income growth rates were higher in Rio Arriba and Taos Counties than in New Mexico as a whole; personal income per capita, however, was higher in New Mexico ($30,497) in 2007 than in both New Mexico counties. In the Colorado counties, the per-capita income growth rate in Costilla County was higher than the state rate, but per-capita incomes were significantly lower in these counties than for Colorado as a whole ($41,955).

Median household income over the period 2006 to 2008 varied between $25,146 in Costilla County and $41,387 in Rio Arriba County (U.S. Bureau of the Census 2009d).

10.4.19.1.7 ROI Housing

In 2007, more than 57,300 housing units were located in the six ROI counties, with more than 6% of these in Rio Arriba and Taos Counties (Table 10.4.19.1-7). Owner-occupied units compose approximately 75% of the occupied units in the six counties, with rental housing making up 25% of the total. Vacancy rates in 2007 were significantly higher in Taos County (32.4%) and Costilla County (31.7%) than elsewhere in the ROI, although a significant portion of vacant housing in Taos County were units used for seasonal or recreational purposes. With an overall vacancy rate of 25.6% in the ROI, there were 14,691 vacant housing units in the ROI in 2007, of which 2,844 are estimated to be rental units that would be available to construction workers. There were 5,837 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

Housing stock in the ROI as a whole grew at an annual rate of 1.0% over the period 2000 to 2007, with 3,729 new units added to the existing housing stock in the ROI (Table 10.4.19.1-6).

The median value of owner-occupied housing in 2006 to 2008 varied between $58,980 in Costilla County and $233,000 in Taos County (U.S. Bureau of the Census 2009g).

10.4.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 10.4.19.1-8. There are five Tribal governments located in the ROI, and there are members of other Tribal groups located in the ROI but whose Tribal governments are located in adjacent counties or states.

TABLE 10.4.19.1-7 ROI Housing Characteristics for the Proposed Los Mogotes East SEZ

Parameter	2000	2007[a]
Alamosa County, Colorado		
Owner-occupied	3,498	3,713
Rental	1,969	2,090
Vacant units	621	659
Seasonal and recreational use	75	NA[b]
Total units	6,088	6,463
Conejos Count, Colorado		
Owner-occupied	2,347	2,590
Rental	633	699
Vacant units	906	1,000
Seasonal and recreational use	544	NA
Total units	3,886	4,289
Costilla County, Colorado		
Owner-occupied	1,175	1,230
Rental	328	343
Vacant units	699	732
Seasonal and recreational use	447	NA
Total units	2,202	2,305
Rio Grande County, Colorado		
Owner-occupied	3,323	3,676
Rental	1,378	1,524
Vacant units	1,302	1,440
Seasonal and recreational use	761	NA
Total units	6,003	1,641
Rio Arriba County, New Mexico		
Owner-occupied	12,281	11,164
Rental	2,763	2,831
Vacant units	2,972	4,731
Seasonal and recreational use	1,042	NA
Total units	18,016	18,726
Taos County, New Mexico		
Owner occupied	9,570	9,166
Rental	3,105	3,609
Vacant units	4,729	6,129
Seasonal and recreational use	2,968	NA
Total units	17,404	18,904

TABLE 10.4.19.1-7 (Cont.)

Parameter	2000	2007[a]
ROI total		
Owner-occupied	32,194	31,540
Rental	10,176	11,097
Vacant units	11,229	14,691
Seasonal and recreational use	5,837	NA
Total units	53,599	57,328

[a] 2007 data for number of owner-occupied, rental, and vacant units for Colorado counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

[b] NA = data not available.

Sources: U.S. Bureau of the Census (2009h–j).

TABLE 10.4.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Los Mogotes East SEZ

Governments	
City	
Alamosa, Colorado	Manassa, Colorado
Antonito, Colorado	Monte Vista, Colorado
Blanca, Colorado	Romeo, Colorado
Chama, New Mexico	San Luis, Colorado
Espanola, New Mexico	Sanford, Colorado
Hooper, Colorado	Taos, New Mexico
La Jara, Colorado	Taos Ski Village. New Mexico
County	
Alamosa County, Colorado	Rio Grande County, Colorado
Conejos County, Colorado	Rio Arriba County, New Mexico
Costilla County, Colorado	Taos County, New Mexico
Tribal	
Jicarilla Apache Nation, New Mexico	Pueblo of Santa Clara, New Mexico
Pueblo of Picuris, New Mexico	Pueblo of Taos, New Mexico
Pueblo of San Juan, New Mexico	

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

10.4.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

Schools

In 2007, the six-county ROI had a total of 92 public and private elementary, middle, and high schools (NCES 2009). Table 10.4.19.1-9 provides summary statistics for enrollment and educational staffing and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Costilla County schools (11.1) is slightly lower than for schools in the remaining five counties, while the level of service is slightly higher in Conejos County (15.4); in Taos County, there are fewer teachers per 1,000 population (8.8).

Health Care

While Taos County has a much larger number of physicians (98), the number of doctors per 1,000 population is also higher than in the majority of the remaining counties in the ROI, and significantly higher than in Costilla County (0.8) (Table 10.4.19.1-10). The smaller number of health care professionals in Conejos and Costilla Counties may mean that residents of these counties have poorer access to health care; a substantial number of county residents might also travel to other counties in the ROI for their medical care.

TABLE 10.4.19.1-9 ROI School District Data for the Proposed Los Mogotes East SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Alamosa County, Colorado	2,483	166	14.9	10.5
Conejos County, Colorado	1,830	129	14.2	15.4
Costilla County, Colorado	535	48	11.1	13.6
Rio Grande County, Colorado	2,272	170	13.4	13.5
Rio Arriba County, New Mexico	6,550	447	14.7	10.3
Taos County, New Mexico	4,315	287	15.1	8.8
ROI	17,985	1,246	14.4	10.7

[a] Number of teachers per 1,000 population.

Source: NCES (2009).

TABLE 10.4.19.1-10 Physicians in the Proposed Los Mogotes East SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Alamosa County, Colorado	41	2.6
Conejos County, Colorado	8	1.0
Costilla County, Colorado	3	0.8
Rio Grande County, Colorado	13	1.0
Rio Arriba County, New Mexico	47	1.1
Taos County, New Mexico	98	3.0
ROI	210	1.8

[a] Number of physicians per 1,000 population.

Source: AMA (2009).

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI (Table 10.4.19.1-11). Conejos County has 7 officers and would provide law enforcement services to the SEZ; there are 69 officers in the remainder of the ROI counties. Currently, there is only 1 professional firefighter in the ROI, with the majority of firefighting services provided by volunteers (Table 10.4.19.1-11). Levels of service of police protection in Costilla County (1.4) and Alamosa County (1.3) are higher than those for the counties in the remainder of the ROI, and lower than those in Rio Arriba County (0.4).

10.4.19.1.10 ROI Social Structures and Social Change

Community social structures and other forms of social organization within the ROI are related to various factors, including historical development, major economic activities and sources of employment, income levels, race and ethnicity, and forms of local political organization. Although an analysis of the character of community social structures is beyond the scope of the current programmatic analysis, project-level NEPA analyses would include a description of ROI social structures, contributing factors, their uniqueness, and, consequently, the susceptibility of local communities to various forms of social disruption and social change.

Various energy development studies have suggested that once the annual growth in population is between 5 and 15% in smaller rural communities, there would be increases in alcoholism, depression, suicide, social conflict, divorce, and delinquency and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996). Tables 10.4.19.1-12 and 10.4.19.1-13 present data for a number of indicators of social change, including violent and property crime

TABLE 10.4.19.1-11 Public Safety Employment in the Proposed Los Mogotes East SEZ ROI

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service
Alamosa County	21	1.3	0	0.0
Conejos County	7	0.8	0	0.0
Costilla County	5	1.4	0	0.0
Rio Grande County	8	0.6	0	0.0
Rio Arriba County	18	0.4	1	0.0
Taos County	17	0.5	0	0.0
ROI	76	0.7	1	0.0

[a] 2007 data.

[b] Number per 1,000 population.

[c] 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2008); Fire Departments Network (2009).

TABLE 10.4.19.1-12 County and ROI Crime Rates for the Proposed Los Mogotes East SEZ[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
Location	Offenses	Rate	Offenses	Rate	Offenses	Rate
Alamosa County, Colorado	65	4.1	477	30.2	542	34.3
Conejos County, Colorado	NA[d]	NA	NA	NA	NA	NA
Costilla County, Colorado	NA	NA	NA	NA	NA	NA
Rio Grande County, Colorado	26	2.1	139	11.3	165	13.4
Rio Arriba County, New Mexico	224	5.1	669	15.3	893	20.5
Taos County, New Mexico	58	1.8	448	13.5	506	15.3
ROI	368	3.2	1,696	14.6	2,064	17.7

[a] Rates are the number of crimes per 1,000 population.

[b] Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

[c] Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

[d] NA = not available.

Sources: U.S. Department of Justice (2009a,b).

TABLE 10.4.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Los Mogotes East SEZ ROI

Geographic Area	Alcoholism[a]	Illicit Drug Use[a]	Mental Health[b]	Divorce[c]
Colorado Region 4 (includes Alamosa, Conejos, Costilla, and Rio Grande Counties)	9.7	3.1	10.2	–[d]
New Mexico Region 2 (includes Rio Arriba and Taos Counties	9.3	2.6	9.8	–
Colorado				4.4
New Mexico				4.3

[a] Data for alcoholism and drug use represent percentage of the population over 12 years of age with dependence or abuse of alcohol or illicit drugs. Data are averages for 2004 to 2006.

[b] Data for mental health represent percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

[c] Divorce rates are the number of divorces per 1,000 population. Data are for 2004.

[d] A dash indicates not applicable.

Sources: SAMHSA (2009); CDC (2009).

rates, alcoholism and illicit drug use, metal health and divorce, that might be used to indicate social change.

There is some variation in the level of crime across the ROI, with slightly higher rates of violent crime in Rio Arriba County (5.1 per 1000 population) and Alamosa County (4.1) and lower rates elsewhere in the ROI (Table 10.4.19.1-12). Property-related crime rates were much higher in Alamosa County (30.2) than in the remainder of the ROI, meaning that overall crime rates in Alamosa County were almost double the rate for the ROI as a whole. No crime rates for Conejos County and Costilla County were reported.

Other measures of social change–alcoholism, illicit drug use, and mental health—are not available at the county level and so are presented for the region in which the ROI is located. There is some variation across the ROI, with slightly higher rates in the Colorado portion of the ROI than in the New Mexico counties (Table 10.4.19.1-13). Divorce rates are also slightly higher in Colorado as a whole than in New Mexico.

10.4.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for a range of activities, including hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These activities are discussed in Section 10.4.5.

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; some activity occurrs on private land (e.g., dude ranches, golf courses, bowling alleys, and movie theaters). Expenditures associated with recreational activities form an important part of the economy of the ROI. In 2007, 5,577 people were employed in the ROI in the various sectors identified as recreation, constituting 10.0% of total ROI employment (Table 10.4.19.1-14). Recreation spending also produced almost $104.3 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

10.4.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including those on recreation, social change, and livestock grazing. These impacts would occur regardless of the solar technology developed in the SEZ. The impacts of projects employing various solar energy technologies are analyzed in detail in subsequent sections.

TABLE 10.4.19.1-14 Recreation Sector Activity in the Proposed Los Mogotes East SEZ ROI, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	336	8.1
Automotive rental	18	0.6
Eating and drinking places	3,479	55.7
Hotels and lodging places	882	19.4
Museums and historic sites	55	4.9
Recreational vehicle parks and campsites	187	3.7
Scenic tours	154	5.7
Sporting goods retailers	486	6.2
Total ROI	5,577	104.3

Source: MIG, Inc. (2010).

10.4.19.2.1 Common Impacts

Construction and operation of solar energy facilities at the proposed SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of expenditures on wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as project wages and salaries, procurement expenditures, and tax revenues subsequently circulated through the economy of each state, thereby creating additional employment, income, and tax revenues. Facility construction and operation would also require in-migration of workers and their families into the ROI surrounding the site, which would affect population, rental housing, health service employment, and public safety employment. Socioeconomic impacts common to all utility-scale solar energy projects are discussed in detail in Section 5.17. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits). 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 development in small rural communities are still unclear (see Section 5.17). While some degree of social disruption is likely to accompany large-scale in-migration during the boom phase, there is insufficient evidence to predict the extent to which specific communities are likely to be affected, which population groups within each community are likely to be most affected, and the extent to which social disruption is likely to persist beyond the end of the boom period (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it has been suggested that social disruption is likely to occur once an arbitrary population growth rate associated with solar energy development projects has been reached, and an annual rate of 5 to 10% growth in population is assumed to result in a breakdown in social structures, with a consequent increase in alcoholism, depression, suicide, social conflict, divorce, delinquency, and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

In overall terms, the in-migration of workers and their families into the ROI would represent an increase of 1.4 % in ROI population during construction of the trough technology and smaller increases for the power tower, dish engine and photovoltaic technologies and during the operation of each technology. While it is possible that some construction and operations workers will choose to locate in communities closer to the SEZ, the lack of available housing in smaller rural communities in the ROI to accommodate all in-migrating workers and families, and an insufficient range of housing choices to suit all solar occupations, many workers are likely to commute to the SEZ from larger communities elsewhere in the ROI, reducing the potential impact of solar development on social change. Regardless of the pace of population growth associated with the commercial development of solar resources and the likely residential location of in-migrating workers and families in communities some distance from the SEZ itself, the number of new residents from outside the region of influence is likely to lead to some demographic and social change in small rural communities in the ROI. Communities hosting solar development are likely to be required to adapt to a different quality of life, with a transition away from a more traditional lifestyle involving ranching and taking place in small, isolated, close-knit, homogenous communities with a strong orientation toward personal and family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing dependence on formal social relationships within the community.

Livestock Grazing Impacts

Cattle ranching and farming supported 847 jobs and $5.0 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed SEZ could result in a decline in the amount of land available for livestock grazing, resulting in the loss of a total (direct plus indirect) of 1 job and less than $0.1 million in income in the ROI. There would also be a decline in grazing fees payable to the BLM and to the USFS by individual permittees based on the number of AUMs required to support livestock on public land. Assuming the 2008 fee of $1.35 per AUM, grazing fee losses would amount to $74 annually on land dedicated to solar development in the SEZ.

Access Road Impacts

The impacts of construction of an access road connecting the Los Mogotes SEZ could include the addition of 60 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 10.4.19.2-1). Construction activities in the peak year would constitute less than 1% of total ROI employment. Access road construction would also produce $1.8 million in ROI income. Direct sales taxes and direct income taxes would each be less than $0.1 million.

Total operations (maintenance) impacts in the ROI (including direct and indirect impacts) of an access road would be less than 1 job during the first year of operation (Table 10.4.19.2-1) and less than $0.1 million in income. Direct sales taxes would be less than $0.1 million in the first year, and direct income taxes, less than $0.1 million.

Construction and operation of an access road would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets

TABLE 10.4.19.2-1 ROI Socioeconomic Impacts of an Access Road Connecting the Proposed Los Mogotes East SEZ[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	35	<1
Total	60	<1
Income[b]		
Total	1.8	<0.1
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	<0.1	<0.1
In-migrants (no.)	0	0
Vacant housing[c] (no.)	0	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts assume 3 mi (5 km) of access road are required for the SEZ. Construction impacts are assessed for the peak year of construction.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

in the ROI would be expected, and no new community service employment would be required in order to meet existing levels of service in the ROI.

10.4.19.2.2 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 is presented 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) in 2021 from the use of solar trough technologies would be 2,885 jobs (Table 10.4.19.2-2), assuming that one 600-MW facility was constructed. Construction activities would constitute 4.4% of total ROI employment. A solar development would also produce $153.7 million in income. Direct sales taxes would be $0.1 million, with direct income taxes of $5.9 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 1,827 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 914 rental units expected to be occupied in the ROI. This occupancy rate would represent 28.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would 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, 21 new teachers, 3 physicians, and 1 public safety employee (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 1.4% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using solar trough technologies would be 323 jobs

TABLE 10.4.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Los Mogotes East SEZ with Trough Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	1,641	206
Total	2,885	323
Income[b]		
Total	153.7	10.2
Direct state taxes[b]		
Sales	0.1	0.1
Income	5.9	0.3
BLM payments[b]		
Rental	NA	0.4
Capacity[d]	NA	6.2
In-migrants (no.)	1,827	131
Vacant housing[c] (no.)	914	118
Local community service employment		
Teachers (no.)	21	1
Physicians (no.)	3	0
Public safety (no.)	1	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 600 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 947 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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.

(Table 10.4.19.2-2). Such a solar development would also produce $10.2 million in income. Direct sales taxes would be $0.1 million, and direct income taxes, $0.3 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $6.2 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 131 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 118 owner-occupied units expected to be occupied in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (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.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) in 2021 from the use of power tower technologies would be 1,149 jobs (Table 10.4.19.2-3), assuming that one 333-MW facility was constructed. Construction activities would constitute 1.7% of total ROI employment. Such a solar development would also produce $61.2 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $2.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with between 728 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 364 rental units expected to be occupied in the ROI. This occupancy rate would represent 11.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, eight new teachers, one physician, and one public safety employee (career firefighters and uniformed

TABLE 10.4.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Los Mogotes East SEZ with Power Tower Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	654	107
Total	1,149	151
Income[b]		
Total	61.2	4.7
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	2.4	0.2
BLM payments[b]		
Rental	NA	0.4
Capacity[d]	NA	3.5
In-migrants (no.)	728	68
Vacant housing[c] (no.)	364	61
Local community service employment		
Teachers (no.)	8	1
Physicians (no.)	1	0
Public safety (no.)	1	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 526 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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.

police officers) would be required in the ROI. These increases would represent 0.5% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using power tower technologies would be 151 jobs (Table 10.4.19.2-3). Such a solar development would also produce $4.7 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $3.5 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 68 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 61 owner-occupied units expected to be required in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI.

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) in 2021 using dish engine technologies would be 467 jobs (Table 10.4.19.2-4), assuming that one 333-MW facility was constructed. Construction activities would constitute 0.7% of total ROI employment. Such a solar development would also produce $24.9 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $1.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 296 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 148 rental units expected to be occupied in the ROI. This occupancy rate would represent 4.6% of the vacant rental units expected to be available in the ROI.

TABLE 10.4.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Los Mogotes East SEZ with Dish Engine Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	266	104
Total	467	146
Income[b]		
Total	24.9	4.5
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	1.0	0.2
BLM payments[b]		
Rental	NA	0.4
Capacity[d]	NA	3.5
In-migrants (no.)	296	66
Vacant housing[c] (no.)	148	59
Local community service employment		
Teachers (no.)	3	1
Physicians (no.)	1	0
Public safety (no.)	0	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 526 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

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.

In addition to the potential impact on housing markets, in-migration would also affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, three new teachers and one physician would be required in the ROI. These increases would represent 0.2% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using dish engine technologies would be 146 jobs (Table 10.4.19.2-4). Such a solar development would also produce $4.5 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $3.5 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 66 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 59 owner-occupied units expected to be required in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI.

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of PV technologies would be 218 jobs (Table 10.4.19.2-5), assuming that one 333-MW facility was constructed. Construction activities would constitute 0.3% of total ROI employment. Such a solar development would also produce $11.6 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.4 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 138 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large,

TABLE 10.4.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Los Mogotes East SEZ with PV Facilities[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	124	10
Total	218	15
Income[b]		
Total	11.6	0.5
Direct state taxes[b]		
Sales	<0.1	<0.1
Income	0.4	<0.1
BLM Payments[b]		
Rental	NA	0.4
Capacity[d]	NA	2.8
In-migrants (no.)	138	7
Vacant housing[c] (no.)	69	6
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 526 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

[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.

with 69 rental units expected to be occupied in the ROI. This occupancy rate would represent 2.1% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, two new teachers would be required in the ROI. This increase would represent 0.1% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) of a build-out using PV technologies would be 15 jobs (Table 10.4.19.2-5). Such a solar development would also produce $0.5 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010b), acreage rental payments would be $0.4 million, and solar generating capacity payments would total at least $2.8 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 seven persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation on the number of vacant owner-occupied housing units is not expected to be large, with six 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.

10.4.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Los Mogotes East SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program, would reduce the potential for socioeconomic impacts during all project phases.

10.4.20 Environmental Justice

10.4.20.1 Affected Environment

On February 11, 1994, the President signed E. O. 12898,"Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which formally requires federal agencies to incorporate environmental justice as part of their missions (*Federal Register*, Vol. 59, page 7629, Feb. 11, 1994). Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the 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 of 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 origins may choose up to six racial groups as the basis of

their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or “Other Race” (U.S. Bureau of the Census 2009k).

The CEQ guidance proposed that minority populations should be identified where either (1) the minority population of the affected area exceeds 50%, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

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 10.4.20.1-1 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 in Colorado, 47.0% of the population is classified as minority, while 19.0% is classified as low-income. Although the number of minority individuals does not exceed 50% of the total population in the area, the number of minority individuals exceeds the state average by 20 percentage points or more, meaning that there is a minority population in the Colorado portion of the 50-mi (80-km) area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the Colorado portion of the SEZ.

Within the 50-mi (80-km) radius in New Mexico, 59.3% of the population is classified as minority, while 17.8% is classified as low-income. Although the number of minority individuals does not exceed the state average by 20 percentage points or more, the minority population exceeds 50% of the total population in the area, meaning that there are minority populations in the New Mexico portion of the 50-mi (80-km) area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by

TABLE 10.4.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Los Mogotes East SEZ

Parameter	Colorado	New Mexico
Total population	50,862	21,683
White, non-Hispanic	26,949	8,828
Hispanic or Latino	22,318	12,021
Non-Hispanic or Latino minorities	1,595	834
One race	988	513
Black or African American	163	47
American Indian or Alaskan Native	499	337
Asian	222	69
Native Hawaiian or other Pacific Islander	18	5
Some other race	86	55
Two or more races	607	321
Total minority	23,913	12,855
Low-income	9,651	3,867
Percent minority	47.0	59.3
State percent minority	25.5	55.3
Percent low-income	19.0	17.8
State percent low-income	9.3	18.4

Source: U.S. Bureau of the Census (2009k,l).

20 percentage points or more and does not exceed 50% of the total population in the area, meaning that there are no low-income populations in the New Mexico portion of the 50-mi (80-km) area.

Figures 10.4.20.1-1 and 10.4.20.1-2 show the locations of minority and low-income population groups in the 50-mi (80-km) radius around the boundary of the SEZ.

In the Colorado portion of the 50-mi (80-km) radius, more than 50% of the population in all but one of the block groups in Conejos County is made up of minority population groups, together with all the block groups in the adjacent Costilla County. Block groups in the cities of Alamosa (Alamosa County), Monte Vista and Del Norte (both in Rio Grande County), and Center (Saguache County) are also more than 50% minority. In the New Mexico portion of the area, Rio Arriba County has three block groups in which the minority population is more than 20 percentage points higher than the state average, and one block group that is more than 50%

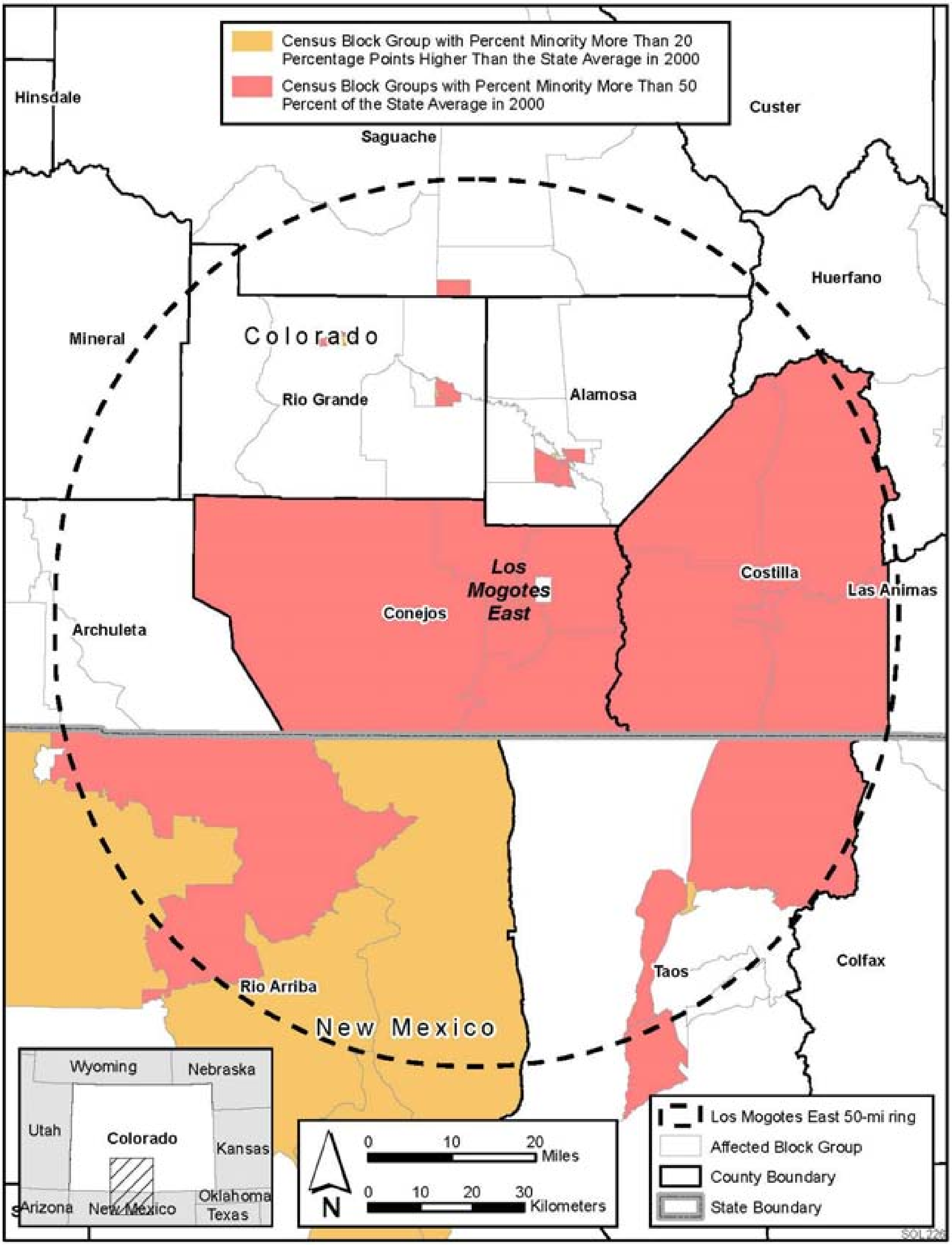

FIGURE 10.4.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Los Mogotes East SEZ

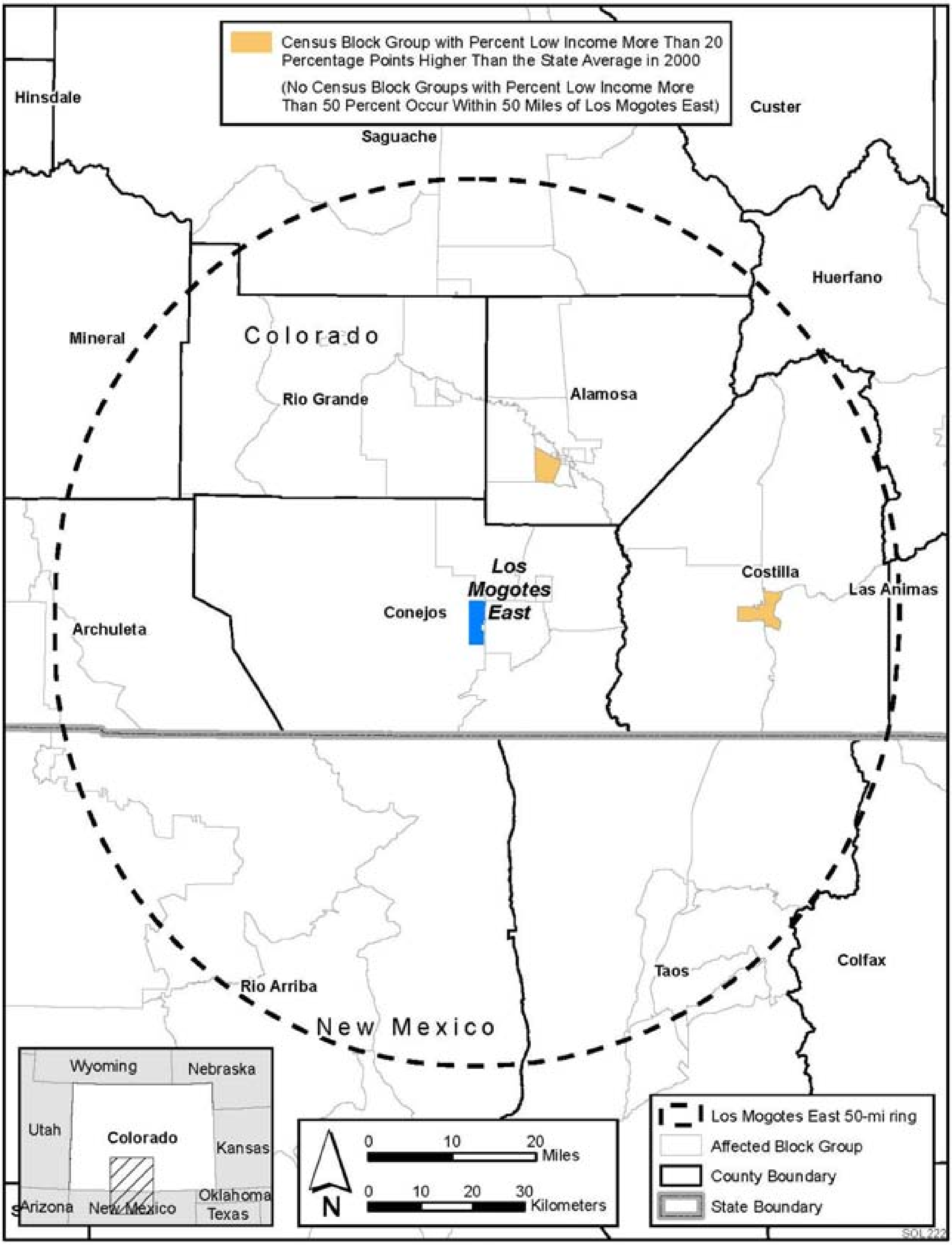

FIGURE 10.4.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Los Mogotes East SEZ

minority, while Taos County has three block groups with more than 50% minority, and one block group where the minority population is 20 percentage points higher than the state average.

Low-income populations in the 50-mi (80-km) radius are limited to two block groups in the Colorado portion, in the cities of San Luis (Costilla County) and Alamosa, both of which have low-income population shares that are more than 20 percentage points higher than the state average.

10.4.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy projects are described in detail in Section 5.18. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2, which address the underlying environmental impacts contributing to the concerns. The potentially relevant environmental impacts associated with solar development within the proposed SEZ include noise and dust during the construction of solar facilities; noise and EMF effects associated with solar project operations; the visual impacts of solar generation and auxiliary facilities, including transmission lines; access to land used for economic, cultural, or religious purposes; and effects on property values as areas of concern that might potentially affect minority and low-income populations.

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar facilities involving each of the four technologies. Although impacts are likely to be small, there are minority populations defined by CEQ guidelines (see Section 10.4.20.1) within both the Colorado and New Mexico portions of the 50-mi (80-km) radius around the boundary of the SEZ; thus any adverse impacts of solar projects would disproportionately affect minority populations. Because there are also low-income populations within the 50-mi (80-km) radius, according to CEQ guidelines, there would also be impacts on low-income populations.

10.4.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing environmental justice impacts have been identified for the proposed Los Mogotes East 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.

10.4.21 Transportation

The proposed Los Mogotes East SEZ is accessible by road and rail networks. One U.S. highway and one regional railroad serve the area. A small regional airport is located 22 mi (35 km) north of the SEZ. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

10.4.21.1 Affected Environment

U.S. 285, a two-lane highway, passes to the east of the proposed Los Mogotes East SEZ at a distance of about 3 mi (5 km), as shown in Figure 10.4.21.1-1. The small town of Romeo is located to the east of the SEZ along U.S. 285 on its way to Alamosa, 22 mi (35 km) to the north. Santa Fe, New Mexico, can be reached traveling south on U.S. 285 to U.S. 84 for a total distance of 120 mi (193 km). A number of local roads cross the SEZ. Three road/trail segments within the SEZ have been identified as Open Motorized Road, are available for OHV or vehicular travel, and also provide access to areas west of the SEZ. Annual average traffic volumes for the major roads for 2008 are provided in Table 10.4.21.1-1.

The SLRG Railroad serves the area (SLRG 2009). This regional railroad has rail stops in the towns of Romeo directly to the east of the SEZ, and Conejos and La Jara several miles to the south and north of the SEZ, respectively. A freight dock and warehouse are also available in Antonito to the south and Alamosa to the north. The SLRG Railroad runs to the northeast from Romeo for a distance of approximately 95 mi (153 km), where it connects to the UP Railroad in Walsenburg.

The nearest public airport is San Luis Valley Regional Airport located 22 mi (35 km) north of the SEZ in Alamosa along U.S. 285. The airport has two runways, one of which is restricted to light aircraft. One regional airline provides daily scheduled service to Denver. No commercial cargo shipped to or from the airport has been reported by the BTS, and about 7,800 passengers departed from or arrived at the airport in 2008 (BTS 2008).

10.4.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. U.S. 285 provides a regional traffic corridor that could experience moderate impacts for single projects that may have up to 1,000 daily workers with an additional 2,000 vehicle trips per day (maximum), an increase that is about half of the current daily traffic levels summarized in Table 10.4.21.1-1 for U.S. 285. In addition, local road improvements might be necessary on the county roads between U.S. 285 and the SEZ. Improvements would be necessary in any portion of the SEZ that might be developed so as not to overwhelm the local roads near any site access point(s).

Solar development within the SEZ would affect public access along OHV routes designated as open and available for public use. Such open routes crossing areas granted ROWs

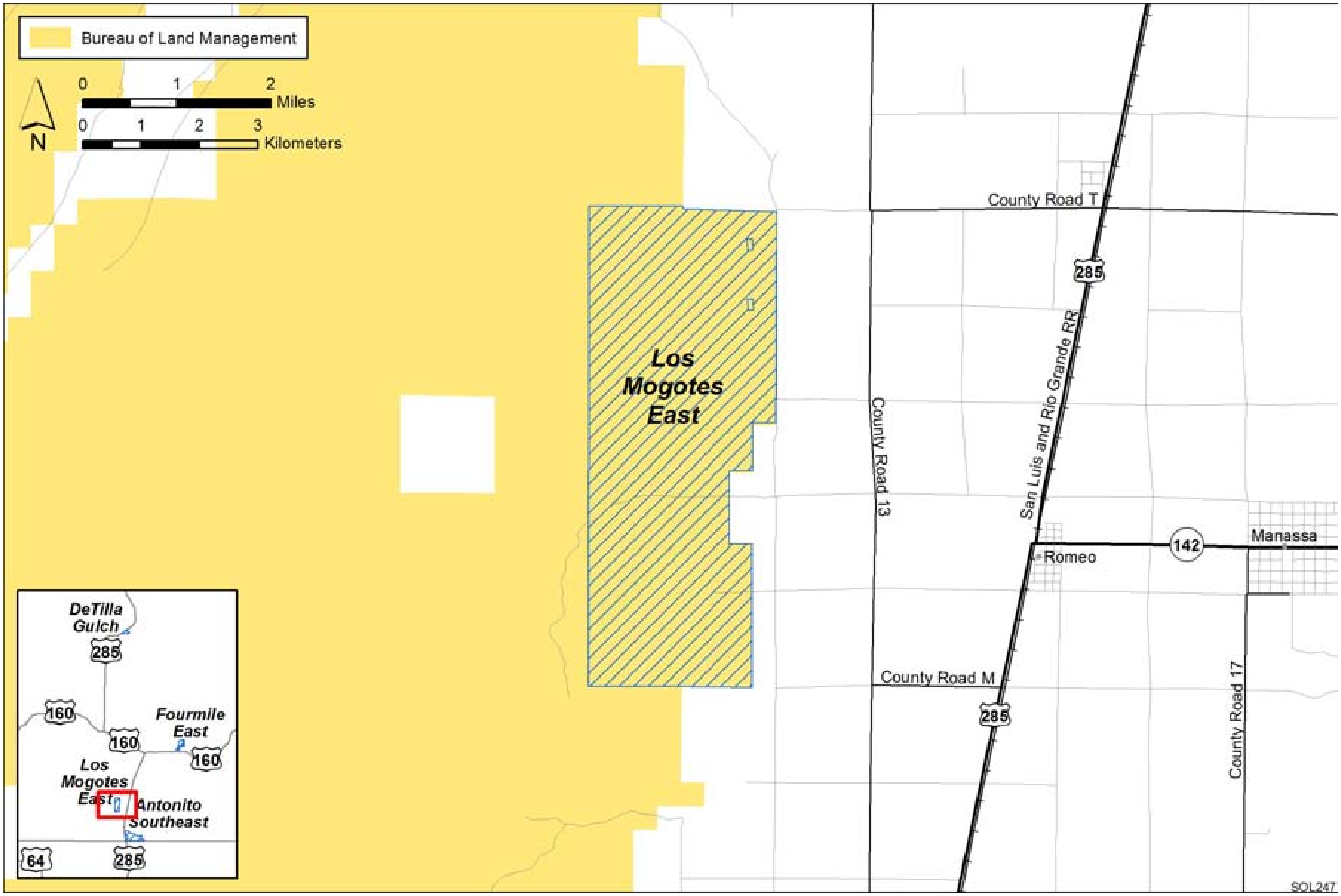

FIGURE 10.4.21.1-1 Local Transportation Network Serving the Proposed Los Mogotes East SEZ

TABLE 10.4.21.1-1 Annual Average Daily Traffic (AADT) on Major Roads near the Proposed Los Mogotes East SEZ, 2008

Road	General Direction	Location	AADT (Vehicles)
U.S. Highway 285	North-south	Junction with County Road T	4,900
		Junction with State Highway 142 in Romeo	4,700
		Junction with County Road J	3,900
CO 142	East-west	Junction with U.S. 285 in Romeo	2,100
		Junction with County Road 18 (1st St.)	970

Source: CDOT (undated).

for solar facilities would be redesignated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

10.4.21.3 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 Los Mogotes East 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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10.4.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Los Mogotes East SEZ in the southern part of the San Luis Valley, Colorado. The CEQ guidelines for implementing NEPA define cumulative impacts as environmental impacts resulting from the incremental 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 Los Mogotes East SEZ is located 7 mi (11 km) northwest of the Antonito Southeast SEZ in Conejos County, Colorado, and about 20 mi (32 km) southeast of the town of Alamosa. The SEZ is located on the eastern edge of a block of BLM-administered land that is bounded on the north and east by private lands. The private lands are primarily developed for irrigated agriculture with numerous center-pivot irrigation systems in place. There are also three sections of state-owned land in near proximity to the SEZ. The blocks of BLM-administered lands are bordered roughly on the north and south by the Alamosa and Conejos Rivers, respectively. The SEZ is located within the boundaries of the Sangre de Cristo NHA. The designated Los Caminos Antiguos Scenic Byway passes within 3 mi (5 km) of the southern and eastern boundaries of the SEZ. The SEZ is part of a grazing allotment and is being actively grazed. No closed or active oil and gas leases occur in or near the SEZ, nor are there any active mining claims in or near the area (BLM and USFS 2010a,b). The SEZ is not within a DoD airspace consultation area (BLM and USFS 2010a,b).

The geographic extent of the cumulative impacts analyses for potentially affected resources near the Los Mogotes East SEZ is identified in Section 10.4.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 10.4.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 10.4.22.3. Cumulative impacts for each resource area are discussed in Section 10.4.22.4.

10.4.22.1 Geographic Extent of the Cumulative Impacts Analysis

Table 10.4.22.1-1 presents the geographic extent of the cumulative impacts analysis for potentially affected resources evaluated near the Los Mogotes East SEZ. These geographic areas define the geographic boundaries of areas encompassing potentially affected resources. Their extent may vary 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, or administered by the USFS, NPS, or the BLM. The BLM administers approximately 11% of the lands within a 50-mi (80-km) radius of the Los Mogotes East SEZ.

TABLE 10.4.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Los Mogotes East SEZ

Resource Area	Geographic Extent
Lands and Realty	Southern San Luis Valley
Specially Designated Areas and Lands with Wilderness Characteristics	Southern San Luis Valley
Rangeland Resources	Southern San Luis Valley
Recreation	Southern San Luis Valley
Military and Civilian Aviation	Southern San Luis Valley
Soil Resources	Areas within and adjacent to the Los Mogotes East SEZ
Minerals	Southern San Luis Valley
Water Resources	
Surface Water	Conejos River, La Jara Creek, La Jara Reservoir, and Rio Grande
Groundwater	Rio Grande Basin within the San Luis Valley (unconfined and confined aquifers)
Vegetation, Wildlife and Aquatic Biota, Special Status Species	Known or potential occurrences within a 50-mi (80-km) radius of the Los Mogotes East SEZ, including Conejos, Alamosa, Costilla, Rio Grande, Archuleta, and Saguache Counties, Colorado; Rio Arriba and Taos Counties, New Mexico.
Air Quality and Climate	San Luis Valley and beyond
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Los Mogotes East SEZ
Acoustic Environment (noise)	Areas adjacent to the Los Mogotes East SEZ
Paleontological Resources	Areas within and adjacent to the Los Mogotes East SEZ
Cultural Resources	Areas within and adjacent to the Los Mogotes East SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Los Mogotes East 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 Los Mogotes East SEZ
Socioeconomics	Alamosa, Conejos, Costilla, Rio Grande Counties, Colorado; Rio Arriba and Taos Counties, New Mexico.
Environmental Justice	Conejos, Alamosa, Costilla, Rio Grande, Archuleta, and Saguache Counties, Colorado; Rio Arriba and Taos Counties, New Mexico.
Transportation	U.S. 285

10.4.22.2 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:

- 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 Iowa Pacific Holding Railway Hub) were not included in the cumulative impacts analysis.

The reasonably foreseeable future actions described below are grouped into two categories: (1) actions related to energy production and distribution, including potential solar energy projects under the proposed action (Section 10.4.22.2.1), and (2) other ongiong and foreseeable actions, including those related to mining and mineral processing, grazing management, transportation, recreation, water management, and conservation (Section 10.4.22.2.2). Together, these actions have the potential to affect human and environmental receptors within the San Luis Valley over the next 20 years.

10.4.22.2.1 Energy Production and Distribution

Reasonably foreseeable future actions related to energy development and distribution within the San Luis Valley are identified in Table 10.4.22.2-1 and are described in the following sections. Figure 10.4.22.2-1 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 10.4.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Los Mogotes East SEZ and in the San Luis Valley

Description	Status	Resources Affected	Primary Impact Location
Renewable Energy Development			
Renewable Portfolio Standards	Ongoing	Land use	State of Colorado
San Luis Valley GDA (Solar) Designation	Ongoing	Land use	San Luis Valley
Xcel Energy/SunEdison Project; 8.2 MW, PV	Ongoing	Land use, ecological resources, visual	San Luis Valley GDA
Alamosa Solar Energy Project; 30 MW, PV	Under way	Land use, ecological resources, visual	San Luis Valley GDA
Greater Sandhill Solar Project; 17 MW, PV	Under way	Land use, ecological resources, visual	San Luis Valley GDA
San Luis Valley Solar Project; Tessera Solar, 200 MW, dish engine	Proposed	Land use, ecological resources, visual, cultural	San Luis Valley GDA
Solar Reserve; 200 MW, solar tower	Preliminary application	Land use, ecological resources, visual	San Luis Valley GDA (Saguache)
Cogentrix Solar Services; 30 MW, CPV	Approved/ under way	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 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

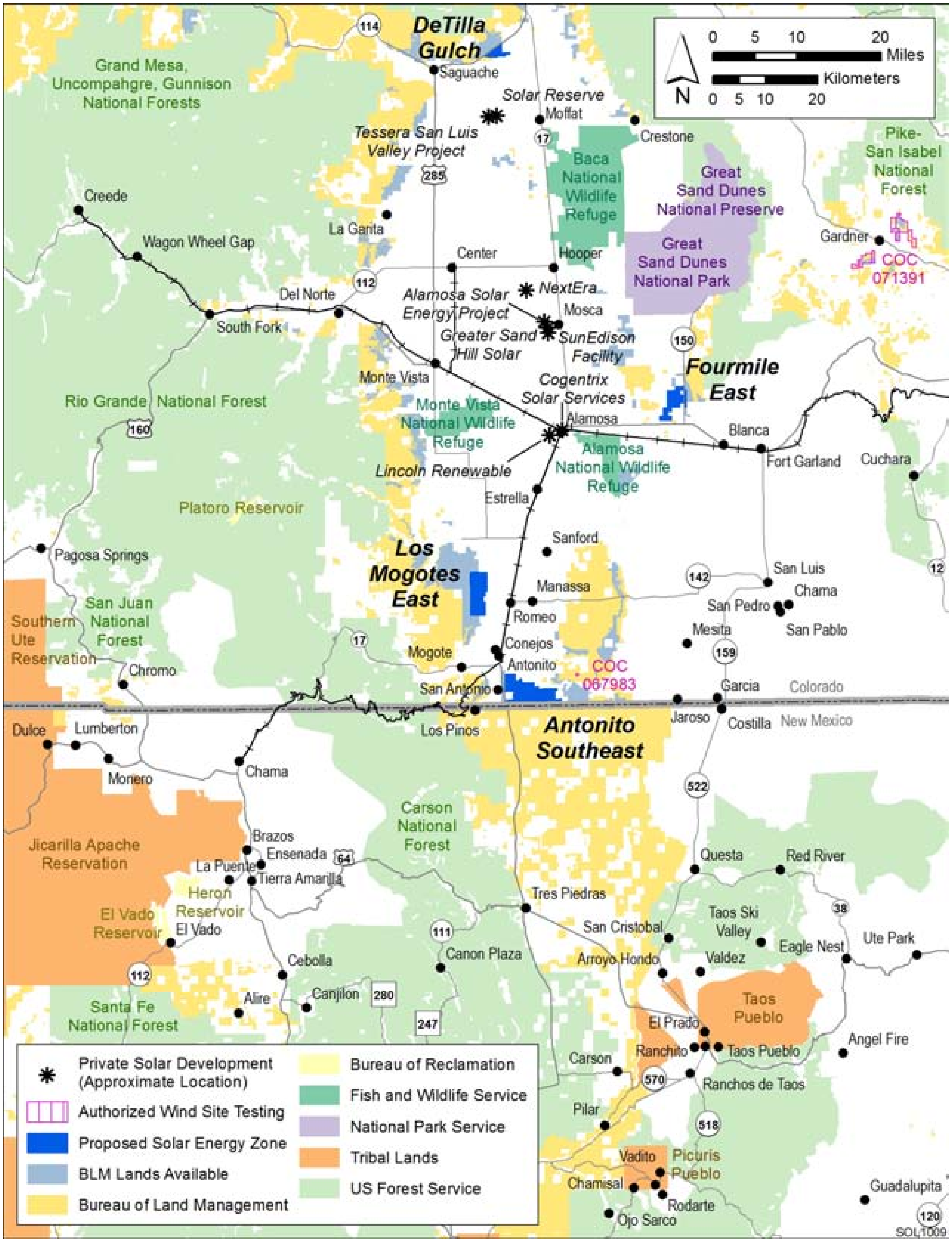

FIGURE 10.4.22.2-1 Existing and Proposed Energy Development Projects within the San Luis Valley

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 Los Mogotes East SEZ, the BLM has proposed three other SEZs in the San Luis Valley: the De Tilla Gulch SEZ (1,522 acres [6.2 km^2]), the Fourmile East SEZ (3,882 acres [15.7 km^2]), and the Antonito Southeast SEZ (9,729 acres [39.4 km^2]) (Figure 10.4.22.2-1). 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 SEZ is close to the Los Mogotes East SEZ, only 7 mi (11 km) to the southeast; the other two SEZs are much farther away (De Tilla Gulch is about 70 mi [113 km] to the north, and Fourmile East is about 30 mi [48 km] to the northeast).

Solar Energy Development. Several solar power projects are planned or under way in the San Luis Valley GDA. These include:

- *Xcel Energy/Sun Edison Project.* The 8.2-MW project began operations in August 2007. Located on 82 acres (0.3 km^2) of private land just west of CO 17 near Mosca in Alamosa County, the facility consists of three different solar technologies, including an array of PV panels, a PV system of single-axis trackers, and a system of CSP units. It generates power for distribution both within the San Luis Valley and outside the region.

- *Alamosa Solar Energy Project.* The 30-MW PV project will be located near Mosca, just west of CO 17 and 8 Mile Lane North, on private land currently being used for agriculture. The facility is being built by Iberdrola Renewables in two 15-MW phases and will connect to the San Luis Valley Substation, about 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 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 not expected to be significant. Construction would start in late 2010 (TSNA 2010). Tessera has offered to sell power to Xcel Energy. A 500-ft (150-m) transmission line would be built to connect to an existing 230-kV line owned by Xcel.

- *Solar Reserve.* Solar Reserve submitted a Preliminary 1041 Permit Application to Saguache County in July 2010 for a 200-MW solar tower facility. The project would be built in two 100-MW phases, each covering 1,400 acres 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 1,200 ac-ft/yr (1.5 million m^3/yr). An on-site switchyard would connect to an existing 230-kV line crossing the site. Construction would start in 2011 and operation in June 2013, employing 250 and 50 workers on average, respectively (Solar Reserve 2010).

- *Cogentrix Solar Services.* Cogentix Energy plans to build a 30-MW PV facility near Alamosa. The facility would use dual-axis mounted concentrating solar cells from Amonix and would be the largest facility using this technology. The facility would cost $140 to $150 million and would be located on 225 acres (0.9 km^2) adjacent to an existing Xcel Energy transmission line. It would employ up to 140 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 one to three 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).

10.4.22.2.2 Other Actions

Other ongoing and reasonably foreseeable future actions within the San Luis Valley are identified in Table 10.4.22.2-2 and are described in the following sections.

TABLE 10.4.22.2-2 Reasonably Foreseeable Future Actions near the Proposed Los Mogotes East 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
Recreation			
Rio Grande Scenic Railroad	Ongoing	Visual, ecological resources, socioeconomics	San Luis Valley, including routes adjacent to the Los Mogotes East SEZ (Conejos County)
CTSR	Ongoing	Visual, ecological resources, socioeconomics	San Luis Valley, including routes south of the Los Mogotes East SEZ (Conejos County)
Water Management			
Rio Grande Compact	Ongoing	Water, ecological resources	San Luis Valley
San Luis Valley Project – Conejos Division (CWCD)	Ongoing	Water, ecological resources	San Luis Valley
Conservation			
Rio Grande Riparian Enhancement Project	Proposed	Ecological resources	San Luis Valley (areas along the Rio Grande)
Old Spanish National Historic Trail Comprehensive Management Plan (BLM and NPS)	Proposed	Cultural, visual resources	San Luis Valley (and immediately east of the Los Mogotes East SEZ)
Sangre de Cristo National Heritage Area	Ongoing	Cultural, visual resources	San Luis Valley (areas along the east side)
San Luis Valley Regional Habitat Conservation Plan	Ongoing	Ecological resources	Areas along the Rio San Antonio (near Antonito)

Mining and Mineral Processing

The nearest mining activity is an active sand and gravel pit on the east side of the southeast corner of the proposed Los Mogotes East SEZ, between the SEZ and U.S. 285. No other mining or mineral processing activities occur in the immediate vicinity of the 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 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 Federally 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-administered 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 2009b).

Recreation

Two scenic railroads operate in the San Luis Valley:

- *Rio Grande Scenic Railroad.* Operated by the SLR&G Railroad, the scenic railroad has about 17,600 visitors each year. Scenic routes run between Alamosa and La Veta, Alamosa and Monte Vista, and Alamosa and Chama (New Mexico) via Antonito. The route between Alamosa and La Veta is especially famous for traversing over the historic La Veta Pass, the highest point (at 9,242 ft [2,817 m]) that standard gauge track crosses the Rocky Mountains (RGSR 2009).

- *Cumbres & Toltec Scenic Railroad.* The CTSR is a narrow gauge railroad that runs along the Colorado–New Mexico border. It has depots in Antonito and Chama (New Mexico) (CTSR 2010).

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 River at the Colorado–New Mexico state line (as measured at the Lobatos gauging station) less quantities available for depletion from the Rio Grande River at Del Norte and the Conejos River. If the delivery is not met, it creates a debit that has to be repaid in later years. Delivery requirements are administered by the State Engineer and the Colorado Division of Water Resources, Water Division III, in Alamosa (Hinderlider et al. 1939; SLV Development Resources Group 2007).

San Luis Valley Project—Conejos Division. The Conejos Division encompasses the Platoro Dam and Reservoir, located on the Conejos River within the Rio Grande National Forest. Managed by the Conejos Water Conservancy District, the Platoro Project provides flood control and storage of supplemental water for the irrigation of about 81,000 acres (328 km^2) within the district. The reservoir also provides recreational opportunities such as fishing, boating, hiking, and camping (Simonds 2009).

Conservation

Rio Grande Riparian Enhancement Project. This riparian enhancement project along the Rio Grande River is to be completed by the BLM with ARRA funds. The project falls under a Categorical Exclusion under NEPA.

Old Spanish Historic Trail Comprehensive Management Plan. In preparation by the BLM and the NPS. The purpose of the plan is to provide a long-term strategy for managing and interpreting the Old Spanish Historic Trail.

Sangre de Cristo National Heritage Area. The Sangre de Cristo NHA was designated 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 CTSR). 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 proposed Colorado SEZs (Fourmile East, Los Mogotes East, and Antonito Southeast) are within the Sangre de Cristo NHA; the De Tilla Gulch SEZ is about 15 mi (24 km) to the north.

San Luis Valley Habitat Conservation Plan**.** The USFWS, with the RGWCD and the State of Colorado, is developing a regional Habitat Conservation Plan to address more than 150 mi (241 km) of riparian habitat and land use activities on more than 2 million acres (8,090 km^2) of land that affect the southwestern willow flycatcher, the bald eagle, and the yellow-billed cuckoo throughout the San Luis Valley. Funds were granted in 2004 and 2005 to prepare the plan and NEPA documentation (USFWS 2009a). The NOI to prepare an environmental analysis and to hold public scoping meetings was published by the USFWS in the *Federal Register* on January 7, 2005 (70 FR 5). The agency's intent is to apply for an ITP for the flycatcher, bald eagle, and yellow-billed cuckoo and possible other rare and/or sensitive species that may be affected by various activities within the San Luis Valley. The NOA for the draft EIS and receipt of application for an ITP was published on June 23, 2006 (71 FR 121). It is not clear at the time of preparation of this report if a final EIS was issued.

Miscellaneous Other Actions

The BLM has several small-scale and administrative projects that require NEPA documentation that are not addressed individually in this cumulative impacts analysis. These 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 Los Mogotes East SEZ.

10.4.22.3 General Trends

Table 10.4.22.3-1 lists general trends within the San Luis Valley with the potential to contribute to cumulative impacts; the trends are discussed in the following sections.

10.4.22.3.1 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 10.4.22.3-2). The growth rate in Conejos County over the same 6-year period was 2.2%. Most of this growth was in unincorporated areas. Population growth 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-year period between 2006 and 2016, population growth within Conejos County is projected to be 9.2% (SLV Development Resources Group 2007).

TABLE 10.4.22.3-1 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

TABLE 10.4.22.3-2 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 County	14,966	15,765	5.3	16,948	18,326	22.5
Conejos County	8,400	8,587	2.2	8,966	9,373	11.6
Saguache County	5,917	6,568	11.0	7,078	7,582	28.1

Source: SLV Development Resources Group (2007).

10.4.22.3.2 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 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).

10.4.22.3.3 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 10.4.22.3-3 compares daily water use by sector. Total daily water withdrawals and consumptive use are highest in Conejos County, a county that has a large share of its crops in alfalfa (accounting for 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

TABLE 10.4.22.3-3 Daily Water Use by Sector in Colorado, 1995

	Withdrawals					
			Sector (Mgal)			
Region	Total (Mgal)	Percentage Groundwater	Irrigation	Public Supply	Industrial	Consumptive Use (Mgal)
Alamosa	414	29	411 (109)[a]	2	2	171
Conejos	732	3.9	727 (111)	3	–[b]	264
Saguache	426	34	423 (210)	2	–	66
San Luis Valley	2,176	19	2,159	15	4	843
Colorado	13,840	16	12,735 (3,404)	705	123	5,235

[a] Numbers in parentheses represent the number of irrigated acres (in thousands) in the region (USGS 2000).

[b] A dash indicates no water use for the sector.

Source: SLV Development Resources Group (2007).

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 10.4.22.3-3). 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).

10.4.22.3.4 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).[17] These

[17] The effects of climate change are not as well studied in the Rio Grande Basin as in the Upper Colorado River Basin.

changes in the water cycle, combined with increasing temperatures and related changes in groundwater recharge rates and soil moisture and evaporation rates, will increase the potential for severe drought and reduce the total water supply, while creating greater demand pressures on water resources.

In general, the physical effects of climate change in the western United States include warmer springs (with earlier snowmelt), melting glaciers, longer summer drought, and increased wildland fire activity (Westerling et al. 2006). All these factors contribute to detrimental changes to ecosystems (e.g., increases in insect and disease infestations, shifts in species distribution, and changing in the timing of natural events). Adverse impacts on human health, agriculture (crops and livestock), infrastructure, water supplies, energy demand (due to increased intensity of extreme weather and reduced water for hydropower), and fishing, ranching, and other resource-use activities are also predicted (GAO 2007; NSTC 2008; Backlund et al. 2008).

The State of Colorado has plans to reduce its GHG emissions by 80% over the next 40 years (Ritter 2007). Initiatives to accomplish this goal will focus on modifying farm practices (e.g., less frequent tilling, improving storage and management of livestock manure, and capturing livestock-produced methane), improving standards in the transportation sector, providing reliable and sustainable energy supplies (e.g., small-scale hydropower, solar, wind, and geothermal energy), and joining the Climate Registry of North American GHG emissions, among others.

10.4.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Los Mogotes East 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 4,734 acres (19 km^2) (80% of the entire proposed SEZ). For purposes of analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. An existing 69-kV transmission line is connected to the SEZ. It is likely that this line will need to be upgraded for utility-scale solar facilities on the SEZ. No designated transmission corridor is close to the SEZ. Regarding site access, U.S. 285 passes 3 mi (5 km) to the east of the proposed SEZ. A new road would need to be constructed to connect the SEZ to U.S. 285. The cumulative impacts discussions in this section include the impacts that would be associated with this potential road construction.

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.

10.4.22.4.1 Lands and Realty

The area covered by the proposed Los Mogotes East SEZ is largely undeveloped. Just to the east of the SEZ are some private agricultural lands. In general, the areas surrounding the SEZ are rural in nature. Three county roads provide access to the SEZ from U.S. 285. 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. Access to BLM, state, and private lands to the west of the SEZ could be affected by solar energy development if provision is not made to retain legal access through solar development areas.

If the area is developed as an SEZ, it is likely that improvements to the infrastructure and increased availability of energy from the solar facilities could attract other users to the area. As a result, the area could acquire more industry. Development of the SEZs could introduce a highly contrasting industrialized land use into areas that are largely rural. As a result, the contribution to cumulative impacts of utility-scale solar projects on public lands on and around the Los Mogotes East SEZ could be significant, particularly if the SEZ is fully developed with solar projects.

10.4.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

There are no specially designated areas within the SEZ but there are such areas in the general vicinity. These areas include four ACECs (three in Colorado and one in New Mexico), two WSAs, portions of two WA, portions of two scenic byways, a NHA, and a historic trail. Construction of utility-scale solar energy facilities within the SEZ would have the potential for cumulatively contributing to the visual impacts on these specially designated areas. The exact nature of impacts would depend on the specific technologies employed and the locations selected within the SEZ. These impacts would be in addition to impacts from any other ongoing or future activities. However, development of the SEZ, especially full development, would be a dominant factor in the viewshed from large portions of these specially designated areas.

10.4.22.4.3 Rangeland Resources

The main current land use of the BLM-administered public lands in the SEZ is grazing. If utility-scale solar facilities are constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. If water rights supporting agricultural use are purchased to support solar development, some areas that are currently farmed by using that water would be converted to dryland uses.

Because the closest wild horse HMA is more than 70 mi (113 km) from the proposed SEZ, solar energy development would not contribute to cumulative impacts on wild horses and burros managed by the BLM.

10.4.22.4.4 Recreation

It is likely that limited outdoor recreation (e.g., backcountry driving, OHV use, and 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, improvements to or additional access roads could increase the amount of recreational use in unaffected areas of the SEZ or in the immediate vicinity. There would be a potential for visual impacts on recreational users of the surrounding specially designated areas (Section 10.4.22.3.2). The overall cumulative impacts on recreation could be large for the users of the areas affected by the solar projects, but would be relatively small for users of areas outside of the affected areas.

10.4.22.4.5 Military and Civilian Aviation

The SEZ is not affected by any MTRs. The nearest civilian airport is at Alamosa about 20 mi (32 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 10.4.22.2, the cumulative impacts from the solar energy development in the proposed SEZ would be small.

10.4.22.4.6 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 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 10.4.22.3.12). As discussed in Section 10.4.7.3, design features would be employed to minimize erosion and loss of soil during the construction, operation, and decommissioning phases of the solar facilities. 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.

10.4.22.4.7 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.

10.4.22.4.8 Water Resources

The water requirements for various technologies if they were to be employed on the proposed Los Mogotes East SEZ to develop utility-scale solar energy facilities are described in Sections 10.4.9.2. If the SEZ was to be fully developed over 80% of its available land area, the amount of water needed during the peak construction year for all evaluated solar technologies would be 686 to 964 ac-ft (846,200 to 1.2 million m^3). During operations, the amount of water needed would be a strong function of the cooling technology employed, ranging from 27 ac-ft/yr (33,300 m^3/yr) for PV systems to as high as 14,216 ac-ft/yr (17.5 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 1,100 ac-ft/day (402,680 ac-ft/yr) in Conejos 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 (0.1 to 4%, the ratio of the annual operations water requirement to the annual amount withdrawn in Conejos County). However, as discussed in Sections 10.4.9.1.3, the water resources in the area are fully appropriated, and any new users would have to purchase a more senior water right (e.g., an old irrigation right), retire that historic consumptive use, and transfer that amount of historic consumptive use to the new project. Additionally, the proposed water management rules being developed for the Rio Grande Basin will impose limits on groundwater withdrawals and set requirements for augmentation water plans that can affect the process of securing water supplies (see Sections 10.4.9.1.3 and 10.4.9.2.4). 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 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 9 to 74 ac-ft (11,100 to 91,300 m^3) during the peak construction year and would range from less than 1 to 13 ac-ft/yr (up to 16,000 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 149 to 269 ac-ft/yr (183,800 to 331,800 m^3/yr) of blowdown water from cooling towers. This water would be treated on-site (e.g., in settling ponds) and injected into the ground, released to surface water bodies, or reused.

10.4.22.4.9 Vegetation

The proposed Los Mogotes East SEZ is located primarily within the San Luis Alluvial Flats and Wetlands ecoregion, which supports shrublands, grasslands, and, on upper elevations of the San Luis Hills, pinyon-juniper woodlands. These plant community types generally have a wide distribution within the San Luis Valley area, and thus other ongoing and reasonably foreseeable future actions would have a cumulative effect on them. Because of the long history of livestock grazing, the plant communities present within the SEZ have likely been affected by grazing. If utility-scale solar energy projects were to be constructed within the SEZ, all vegetation within the footprints of the facilities would likely be removed during land-clearing and -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. Design features would be used to reduce the impacts from solar energy projects and thus reduce the overall cumulative impacts on plant communities and habitats.

10.4.22.4.10 Wildlife and Aquatic Biota

As discussed in Section 10.4.11, a number of amphibian, reptile, bird, and mammal species occur in and around the proposed Los Mogotes East SEZ. The construction of utility-scale solar energy projects in the SEZ and any associated transmission lines and roads in or near the SEZ would have an impact on wildlife through habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, and wildlife injury or mortality. Unless mitigated, these impacts, when added to impacts that would result from other activities in the general area, could be moderate to large. In general, impacted species with broad distributions and occurring in a variety of habitats would be less affected than species with a narrowly defined habitat within a restricted area. Implementation of required design features would reduce the severity of impacts on wildlife. The design features may include pre-disturbance biological surveys to identify key habitat areas used by wildlife followed by avoidance or minimization of disturbance to those habitats.

The proposed De Tilla Gulch and Fourmile East SEZs, and the operating and planned solar facilities near the Fourmile East SEZ are smaller areas and likely too far away from the Los Mogotes East SEZ to have cumulative impacts on wildlife and aquatic biota. However, the proposed Antonito Southeast SEZ is only about 7 mi (11 km) from the Los Mogotes East SEZ. Additionally, there are other ongoing and reasonably foreseeable future actions (Section 10.4.22.2) occurring in the vicinity of the Los Mogotes East SEZ. If development of solar facilities occurred at both proposed SEZs in the future, or if other actions occurred in the vicinity, there could be cumulative impacts on wildlife and aquatic biota habitat. However, many of the wildlife species have extensive available habitat within the affected counties (e.g., elk and pronghorn). Nonetheless, several new solar facilities and the other actions would have a cumulative impact on wildlife. Where projects are closely spaced, the cumulative impact on a particular species could be moderate to large.

For example, solar energy development in the proposed Los Mogotes East SEZ would encompass an area of severe winter range for elk. Design features would be used to 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 or within the potential area for new road construction. There are some perennial streams and small wetlands outside but in close proximity to the SEZ. Among them are the Alamosa River, Conejos River, and La Jara Creek (Section 10.4.11.4). 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 wetlands and downgradient streams. Although there may be a small net increase in impacts on aquatic biota in certain areas around the SEZ, since net groundwater use should not change because of regulations governing use in the San Luis Valley, cumulative impacts on aquatic biota and habitats from groundwater drawdown should not occur. Design features to prevent erosion and sedimentation would reduce cumulative impacts on stream habitat and aquatic biota.

10.4.22.4.11 Special Status Species (Threatened, Endangered, Sensitive, and Rare)

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 Los Mogotes East SEZ. Numerous additional species occurring on or in the vicinity of the SEZ are listed as threatened or endangered by the states of Colorado or New Mexico, or listed as a sensitive species by the BLM. Design features that could be used to reduce or eliminate the potential for effects on these species from the construction and operation of utility-scale solar energy projects include avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. The impacts of full-scale solar energy development on threatened, endangered, and sensitive species would be minimized if design features, including avoidance of occupied or suitable habitats, avoidance of occupied areas, and translocation of individuals, were implemented successfully. This approach would also minimize the contribution of potential solar energy projects to cumulative impacts on protected species. Depending on other projects occurring in the area at the time, there may still be some cumulative impacts on protected species. However, other projects would likely also employ mitigation measures to reduce or eliminate the impacts on protected species as required by the ESA and other applicable federal and state laws and regulations.

The proposed De Tilla Gulch and Fourmile East SEZs, and the operating and planned solar facilities near the Fourmile East SEZ are smaller areas and likely too far away from the Los Mogotes East SEZ to have cumulative impacts on special status species. However, the proposed Antonito Southeast SEZ is only about 7 mi (11 km) from the Los Mogotes East SEZ. Special status species with potential habitat impacts from solar development that are common to both the Los Mogotes East SEZ and the Antonito Southeast SEZ are the Bodin milkvetch, grassy slope sedge, least moonwort, northern moonwort, Rocky Mountain blazing-star, western moonwort, short-eared owl, Rio Grande chub, Rio Grande sucker, and southwestern willow flycatcher.

There are also other ongoing and reasonably foreseeable future actions (Section 10.4.22.2) occurring in the vicinity of the proposed Los Mogotes East SEZ. Together, several new solar facilities and the other actions would have a cumulative impact on species status species. Where projects are closely spaced, the cumulative impact on a particular species could be moderate to large.

10.4.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuels, the site preparation and construction activities associated with solar energy facilities would be responsible for some amount of air pollutants. Most of the emissions would be particulate matter (fugitive dust) and emissions from vehicles and construction equipment. When these emissions are combined with those from other projects near solar energy development or when they are added to natural dust generation from winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency, or road paving or treatment.

Other planned energy production and distribution activities in the San Luis Valley include construction and operation of two smaller (less than 300 acres [1.2 km^2]) PV facilities near the Fourmile East SEZ, and construction of a power line running east from Alamosa to Walsenburg. In addition a 30-MW PV facility is being constructed in Colfax County in northeastern New Mexico. Construction of these projects would result in a temporary increase in particulate emissions. In addition, since the Los Mogotes East and Antonito Southeast SEZs are within about 12 mi (19 km) of each other, construction of solar facilities at the two SEZs could have cumulative impacts. However, because of the limited duration of construction activities and the likelihood that those activities would occur at different times, adverse cumulative air quality impacts are not expected. If two solar facilities were being constructed at approximately the same time at the two SEZs, specific schedules could be managed to reduce air quality impacts.

Over the long term and across the region, the development of solar energy may have beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need for energy production that results in higher levels of emissions, such as coal, oil, and natural gas. As discussed in Section 10.4.13, 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 Los Mogotes East SEZ was fully developed with solar facilities up to 80% of its size, the quantity of pollutants avoided could be as large as 3.5% of all emissions from the current electric power systems in Colorado.

10.4.22.4.13 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, the inventory indicated high visual sensitivity for the SEZ and surrounding lands, primarily because the SEZ is within the viewshed of the Los Caminos Antiguos Scenic Byway and the viewshed of the West Fork of the North Branch of the Old Spanish Trail.

Development of utility-scalesolar energy projects within the SEZ would contribute to the cumulative visual impacts in the general vicinity of the SEZ and in the San Luis Valley. However, the exact nature of the visual impact and the mitigation measures that would be appropriate would depend on the specific project locations within the SEZ and on the solar technologies used for the project. Such impacts and potential mitigation measures would be considered in visual analyses conducted for future specific projects. In general, large visual impacts on the SEZ would be expected to occur as a result of the construction, operation, and decommissioning of utility-scale solar energy projects. These impacts would be expected to involve major modification of the existing character of the landscape and could dominate the views for some nearby viewers. Additional impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines.

Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, some lands outside the SEZ would also be subjected to visual impacts related to the construction, operation, and decommissioning of utility-scale solar energy facilities. Some of the affected lands outside the SEZ would include potentially sensitive scenic resource areas, including the San Luis Hills, Los Mogotes, Cumbres &Toltec, and San Antonio Gorge ACECs; the San Luis Hills and San Antonio WSAs; portions of South San Juan and

Cruces Basin WAs; portions of three scenic byways; the Sangre de Cristo NHA; and portions of 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 projects, 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 facilities 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.

10.4.22.4.14 Acoustic Environment

The areas around the proposed Los Mogotes East SEZ and in the San Luis Valley area, in general, are relatively quiet. The existing noise sources include road traffic, railroad traffic, aircraft flyover, agricultural activities, animal noise, and community activities and events. The construction of solar energy facilities could increase the noise levels over short durations because of the noise generated by construction equipment during the day. After the facilities are constructed and begin operating, there would be little or minor noise impacts for any of the technologies except from solar dish engine facilities and from parabolic trough or power tower facilities using TES. If one or more of these types of facilities were to be constructed close to the boundaries of an SEZ or on different SEZs relatively close to each other (i.e., Antonito Southeast and Los Mogotes East), residents living nearby could be affected by the noise generated by these machines, particularly at night when the noise is more discernable due to relatively low background levels.

10.4.22.4.15 Paleontological Resources

Little surveying for paleontological resources has been conducted in the San Luis Valley. For reasons described in Section 10.4.16, few, if any, impacts on significant paleontological resources are likely to occur in the proposed SEZ. However, the specific sites selected for future projects would be surveyed if determined necessary by the BLM, and any paleontological resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. No significant cumulative impacts on paleontological resources are expected.

10.4.22.4.16 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, only a very small portion (about 0.02%) of the area occupied by the proposed Los Mogotes East SEZ has been surveyed for cultural resources, no archeological sites have been recorded within the SEZ to date. There are, however, several historic properties, including a scenic railroad (Cumbres & Toltec) and an historic trail (the Old Spanish Trail), close to the SEZ, and there is a potential for properties of significance to the Hispanic community to exist in the area. It is possible that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, could contribute cumulatively to cultural resource impacts. However, the specific sites selected for future projects would be surveyed, and any cultural resources discovered through surveys or during the construction of the projects would be avoided or mitigated to the extent possible. Similarly, through ongoing consultation with the Colorado SHPO and appropriate Native American governments, it is likely that most adverse effects on significant resources in the San Luis Valley could be mitigated to some degree, but not necessarily eliminated.

10.4.22.4.17 Native American Concerns

Government-to-government consultation is under way with Native American governments with possible traditional ties to the San Luis Valley. To date no specific concerns regarding the proposed Los Mogotes East SEZ have been raised to the BLM. The Jicarilla Apache have judicially established a tribal land claim in proximity to the SEZ, but on the basis of available maps, the claim does not appear to include any portions of the SEZ and should not contribute to any impacts on that claim. In addition, the Taos Pueblo has a judicially established land claim to the south of the SEZ in New Mexico. 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 the impacts in the valley that may be of concern to Native American Tribes. Continued discussions with the area Tribes through government-to-government consultation is necessary to effectively consider and mitigate the Tribes' concern tied to solar energy development in the San Luis Valley.

10.4.22.4.18 Socioeconomics

Solar energy development projects in the proposed Los Mogotes East SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZs and in the surrounding multicounty ROI. The effects could be positive (e.g., creation of jobs and generation of extra income, increased revenues to local governmental organizations through additional taxes paid by the developers and workers) or negative (e.g., added strain on social institutions such as schools, police protection, and health care facilities). Impacts from solar development would be most intense during facility construction, but of greatest duration during operations. Construction would temporarily increase the number of workers in the area needing housing and services in combination with temporary workers involved in other new projects in the area, including other renewable energy development. The number of workers involved in the construction of solar projects in the peak construction year could range from about 120 to 1,600 depending on the technology being employed, with solar PV facilities at the low end and solar trough facilities at the high end. The total number of jobs created in the area could range from approximately 220 (solar PV) to as high as 2,900 (solar trough). Cumulative socioeconomic effects in the ROI from construction of solar facilities would occur to the extent that multiple construction projects of any type were ongoing at the same time. It is a reasonable expectation that this condition would occur within a 50-mi (80-km) radius of the SEZ occasionally over the 20-or-more year solar development period.

Annual impacts during the operation of solar facilities would be less, but of 20- to 30-year duration, and could combine with those from other new projects in the area. The number of workers needed at the solar facilities would be in the range of 10 to 200, with approximately 15 to 320 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.

10.4.22.4.19 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 and low-income populations. If needed, mitigation measures can be employed to reduce the impacts on the population in the vicinity of the SEZ, including the minority and low-income populations. As the overall scale and environmental impacts of potential projects within the ROI are expected to be generally low, it is not expected that the proposed Los Mogotes East SEZ would contribute to cumulative impacts on minority and low-income populations.

10.4.22.4.20 Transportation

A two-lane highway (U.S. 285) passes 3 mi (5 km) to the east of the proposed Los Mogotes East SEZ. The SLRG Railroad also serves the area. The nearest public airport is San Luis Valley Regional Airport, 22 mi (35 km) north of the SEZ in Alamosa. The AADT on U.S. 285 in the vicinity of the SEZ ranges from about 3,900 to 4,900. During construction activities, there could be up to 1,000 workers commuting to the construction site at the SEZ, which could increase the AADT on this highway by 2,000 vehicles. This increase in highway traffic from construction workers could have moderate cumulative impacts in combination with existing traffic levels and increases from additional future projects in the area. However, if construction is occurring concurrently in the proposed Los Mogotes East and Antinito Southeast

SEZs, which are relatively close to each other and are both served by U.S. 285, the increase in traffic during shift changes could be significant. Local road improvements may be necessary near site access points. Any impacts during construction activities would be temporary. The impacts could be mitigated to some degree by having different work hours within an SEZ or between two SEZs. Traffic increases during operation would be relatively small because of the low number of workers needed to operate solar facilities and would have little contribution to cumulative impacts.

10.4.23 References

Note to Reader: This list of references identifies Web pages and associated URLs where reference data were obtained for the analyses presented in this PEIS. It is likely that at the time of publication of this PEIS, some of these Web pages may no longer be available or their URL addresses may have changed. The original information has been retained and is available through the Public Information Docket for this PEIS.

AECOM (Architectural Engineering, Consulting, Operations and Maintenance), 2009, *Project Design Refinements*. Available at http://energy.ca.gov/sitingcases/beacon/documents/applicant/refinements/002_WEST1011185v2_Project_Design_Refinements.pdf. Accessed Sept. 2009.

Alamosa-La Jara Water Users Protection Association v. Gould, 1983, 674 P.2d 914, 931, Colo.

Backlund, P., et al., 2008, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*, Synthesis and Assessment Product 4.3 by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C., May. Available at http://www.sap43.ucar.edu/documents/SAP_4.3_6.18.pdf. Accessed July 2008.

Beacon Solar, LLC, 2008, *Application for Certification for the Beacon Solar Energy Project*, submitted to the California Energy Commission, March. Available at http://www.energy.ca.gov/sitingcases/beacon/index.html.

Beranek, L.L., 1988, *Noise and Vibration Control*, rev. ed., Institute of Noise Control Engineering, Washington, D.C.

BLM (Bureau of Land Management), 1980, *Green River—Hams Fork Draft Environmental Impact Statement: Coal*, Denver, Colo.

BLM, 1983, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program,* Colorado State Office, Denver, Colo., Jan.

BLM, 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28, U.S. Department of the Interior, Jan.

BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Jan.

BLM, 1991, *San Luis Resource Area*, Proposed Resource Management Plan and Final Environmental Impact Statement, U.S. Department of the Interior, Sept.

BLM, 1996, *White River Resource Area Proposed Resource Management Plan and Final Environmental Impact Statement*, Colorado State Office, White River Resource Area, Craig District, Colo., June.

BLM, 2001, *BLM Manual 6840—Special Status Species Management*, Release 6-121, U.S. Department of the Interior, Jan. 17.

BLM, 2007*, Proposed Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado, Utah, and Wyoming and Programmatic Environmental Impact Statement,* FES 08-2, Sept.

BLM, 2008a*, Assessment and Mitigation of Potential Impacts to Paleontological Resources*, Instruction Memorandum No. 2009-011, with attachments, Washington, D.C., Oct. 10.

BLM, 2008b*, Rangeland Administration System*, Allotment Master, Feb. 7. Available at http://www.blm.gov/ras/index.htm. Accessed Nov. 24, 2009.

BLM, 2009b, *Proposed Decision Record (CO-500-2005-016-EA) to Amend Off-Highway Vehicle Designations in the San Luis Area Resource Management Plan*, BLM San Luis Valley Public Lands Center, signed by D.S. Dallas on June 4, 2009.

BLM, 2010a, *San Luis Valley Resource Area Noxious and Invasive Species Management Environmental Assessment*, DOI-BLM-CO-140-2009-004-EA.

BLM, 2010b, *Solar Energy Interim Rental Policy*, U.S. Department of Interior. Available at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2010/IM_2010-141.html.

BLM, 2010c, *Visual Resource Inventory*, prepared for U.S. Department of Interior Bureau of Land Management, Needles Field Office, Needles, Calif., Sept.

BLM and USFS, 2010a, *GeoCommunicator: Mining Claim Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

BLM and USFS, 2010b, *GeoCommunicator: Energy Map*. Available at http://www.geocommunicator.gov/GeoComm/index.shtm. Accessed June 21, 2010.

Blume, F., and A.F. Sheehan, 2002, *Quantifying Seismic Hazard in the Southern Rocky Mountains through GPS Measurements of Crustal Deformation—Abstract*, Paper No. 227-5, The Geological Society of America, 2002 Annual Meeting, Denver, Colo.

Brendle, D. L., 2002, *Geophysical Logging to Determine Construction, Contributing Zones, and Appropriate Use of Water Levels Measured in Confined-Aquifer Network Wells, San Luis Valley, Colorado*, *1998–2000*, U.S. Geological Survey, Water Resources Investigations Report, 02–4058.

Brister, B.S., and R.R. Gries, 1994, *Tertiary Stratigraphy and Tectonic Development of the Alamosa Basin (Northern San Luis Basin), Rio Grande Rift, South-Central Colorado*, Geological Society of America Special Paper 291.

BTS (Bureau of Transportation Statistics), 2008, *Air Carriers: T-100 Domestic Segment (All Carriers)*, Research and Innovative Technology Administration, Bureau of Transportation Statistics, U.S. Department of Transportation, Dec. Available at http://www.transtats.bts.gov/Fields.asp?Table_ID=311. Accessed June 23, 2009.

Burnell, J.R., et al., 2008, *Colorado Mineral and Energy Industry Activities, 2007*, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

Burroughs, R.L., 1974, *Neogene Volcanism in the Southern San Luis Basin*, *New Mexico,* Geological Society Guidebook, 25th Field Conference, Ghost Ranch (Central-Northern New Mexico). Available at: http://nmgs.nmt.edu/publications/guidebooks/downloads/25/25_p0291_p0294.pdf. Accessed Jan. 20, 2010.

Burroughs, R.L., 1981, *A Summary of the Geology of the San Luis Basin, Colorado–New Mexico with Emphasis on the Geothermal Potential for the Monte Vista Graben*, Special Publication 17, DOE/ET/28365-10, Colorado Geological Survey, Department of Natural Resources, Denver, Colo.

CDA (Colorado Department of Agriculture), 2010, *Colorado Department of Agriculture, Noxious Weed Management Program, Noxious Weed* List. Available at http://www.colorado.gov/cs/Satellite?c=Page&cid=1174084048733&pagename=Agriculture-Main%2FCDAGLayout. Accessed Jan. 22, 2010.

CDC (Centers for Disease Control and Prevention), 2009, *Divorce Rates by State: 1990, 1995, 1999–2007*. Available at http://www.cdc.gov/nchs/data/nvss/Divorce%20Rates%2090%2095%20and%2099-07.pdf.

CDOT (Colorado Department of Transportation), undated, *Traffic Information for Conejos County*. Available at http://www.dot.state.co.us/App_DTD_DataAccess/Traffic/index.cfm?fuseaction=TrafficMain&MenuType=Traffic. Accessed June 20, 2009.

CDOW (Colorado Division of Wildlife), 2008, *Natural Diversity Information Source Data,* Colorado Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/ftp/ftp_response.asp. Accessed Oct. 21, 2009.

CDOW, 2009, *Natural Diversity Information Source, Wildlife Species Page,* Colorado Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlife.asp. Accessed Aug. 29, 2009.

CDPHE (Colorado Department of Public Health and Environment), 2008, *Colorado 2007 Air Quality Data Report*, Air Quality Control Division, Denver, Colo., July. Available at http://www.colorado.gov/airquality/documents/2007AnnualDataReport.pdf. Accessed Sept. 2, 2009.

CDW (Colorado Division of Wildlife), 2009, *Natural Diversity Information Source, Wildlife Species Page,* Colorado Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlife.asp. Accessed Aug. 29, 2009.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., Dec. Available at http://www.whitehouse.gov/CEQ/.

CGS (Colorado Geological Survey), 2001, "When the Ground Lets You Down – Ground Subsidence and Settlement Hazards in Colorado," in *Rock Talk*, Vol. 4, No. 4, October.

Chapman, S.S., et al., 2006, *Ecoregions of Colorado* (color poster with map, descriptive text, summary tables, and photographs; map scale 1:1,200,000), U.S. Geological Survey, Reston, Va.

Chick, N., 2009, personal communication from Chick (Colorado Department of Public Health and Environment, Denver, Colo.) to Y.S. Chang (Argonne National Laboratory, Argonne, Ill.), Sept. 4.

CNHP (Colorado Natural Heritage Program), 2009, *Colorado Natural Heritage Program.* Available at http://www.cnhp.colostate.edu. Accessed Sept. 9, 2009.

Colorado District Court 2004, *Case Number 2004CW24, Concerning the Matter of the Rules Governing New Withdrawals of Ground Water in Water Division No. 3 Affecting the Rate or Direction of Movement of Water in the Confined Aquifer System*, District Court, Water Division No. 3.

Colorado District Court 2010, *Case Number 06CV64 & 07CW52, In the Matter of the Rio Grande Water Conservation District, in Alamosa County, Colorado and Concerning the Office of the State Engineer's Approval of the Plan of Water Management for Special Improvement District No. 1 of the Rio Grande Water Conservation District*, District Court, Water Division No. 3.

Colorado DWR 2005, *Water Well Construction Rules*, 2 CCR 402-2.

Colorado DWR (Division of Water Resources), 2008, Guide to Colorado Well Permits, Water Rights, and Water Administration, Jan.

Colorado DWR, 2010a, Colorado's Decision Support Systems. Available at http://cdss.state.co.us/DNN/default.aspx.

Colorado DWR, 2010b, *Water Administration*. Available at http://water.state.co.us/wateradmin/waterright.asp.

Colorado DWR, 2010c, *San Luis Advisory Committee*. Available at http://water.state.co.us/wateradmin/SanLuisValleyBasin.asp.

Colorado Governor's Energy Office, 2007, *Connecting Colorado's Renewable Resources to the Markets—Report of the Colorado Senate Bill 07-091 Renewable Resource Generation Development Areas Task Force*, Denver, Colo.

Colorado SHPO (State Historic Preservation Office), 2009, Data on file, Denver, Colo.

Cowherd, C., et al., 1988, *Control of Open Fugitive Dust Sources*, EPA 450/3-88-008, U.S. Environmental Protection Agency, Research Triangle Park, N.C.

Csiki S. J. C., and C. W. Martin, 2008, "Spatial variability of heavy-metal storage in the floodplain of the Alamosa River, Colorado," Physical Geography, 24(4): 306-319.

CTSR (Cumbres & Toltec Scenic Railroad), 2010, home page. Available at http://www.cumbrestoltec.com. Accessed Feb. 1, 2010.

CWCB (Colorado Water Conservation Board), 2005, *Alamosa River Watershed Restoration Master Plan and Environmental Assessment, Final Report,* July. Available at http://www.fws.gov/mountain-prairie/nrda/SummitvilleColo/Summitville.htm. Accessed Feb. 12, 2010.

Diefenbach, A.K., Guffanti, M., and J.W. Ewert, 2009, *Chronology and References of Volcanic Eruptions and Selected Unrest in the United States, 1980-2008*, U.S. Geological Survey Open File Report 2009-1118.

DOE (U.S. Department of Energy, 2009a, *Report to Congress, Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation,* Jan. 13.

DOE, 2009b, *Jobs and Economic Development Impacts (JEDI) Mode,* U.S. Department of Energy, Energy Efficiency and Renewable Energy. July. Available at http://www.windpoweringamerica.gov/filetail.asp?itemid=707.

EIA (Energy Information Administration), 2009, *Annual Energy Outlook 2009 with Projections to 2030*, DOE/EIA-0383, March.

Eldred, K.M., 1982, "Standards and Criteria for Noise Control—An Overview," *Noise Control Engineering* 18(1):16–23, Jan.–Feb.

Emery, P.A., 1979, "Geohydrology of the San Luis Valley, Colorado, USA," IAHS-AISH Publication. No. 128, in *The Hydrology of Areas of Low Precipitation—L'Hydrologie des Régions à Faibles Precipitations*, Proceedings of the Canberra Symposium (Actes du Colloque de Canberra), Dec.

Emery, P.A., 1994, *Hydrogeology of the San Luis Valley, Colorado, An Overview—National Park Service*, Field Trip 20, Section 2, Paper 3. Available at www.nps.gov/archive/grsa/resources/docs/Trip2023.pdf. Accessed June 29, 2009.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA-550/9-74-004, Washington, D.C., March. Available at http://www.nonoise.org/library/levels74/levels74.htm. Accessed Nov. 17, 2008.

EPA, 2009a, *Energy CO_2 Emissions by State*. Available at http://www.epa.gov/climatechange/emissions/state_energyco2inv.html, last updated June 12, 2009. Accessed June 23, 2009.

EPA, 2009b, *National Ambient Air Quality Standards (NAAQS)*. Available at http://www.epa.gov/air/criteria.html, last updated Feb. 20, 2009. Accessed June 3, 2009.

EPA, 2009b, *AirData: Access to Air Pollution Data.* Available at http://www.epa.gov/oar/data/. Accessed Sept. 12, 2009.

EPA, 2009c, *Preferred/Recommended Models—AERMOD Modeling System.* Available at http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed Nov. 8, 2009.

EPA, 2009d, *eGRID.* Available at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, last updated Oct. 16, 2008. Accessed Jan. 12, 2009.

EPA, 2010, *National Ambient Air Quality Standards (NAAQS)*. Available at http://www.epa.gov/air/criteria.html, last updated June 3, 2010. Accessed June 4, 2010.

FEMA (Federal Emergency Management Agency), 2009, FEMA Map Service Center. Available at http://www.fema.gov. Accessed Nov. 20.

Fire Departments Network, 2009, *Fire Departments by State*. Available at http://www.firedepartments.net.

GAO (Government Accounting Office), 2007, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, Report to Congressional Requesters, GAO-07-863, Aug.

Gibson, M., 2010, personal communication from Gibson (San Luis Valley Water Conservancy District, Alamosa, Colo.) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

Haas, J., 1980, *Report on the 1980 Season of the San Luis Valley Archaeological Project*, Contract 80-013-00-S, Department of Anthropology, University of Denver, Denver, Colo.

Haas, D., 2010, personal communication with attachment regarding the West Fork of the Old Spanish Trail, from Haas (BLM State Archaeologist, Colorado State Office, Lakewood, Colo.) to K. Wescott (Argonne National Laboratory, Argonne, Ill.), Jan. 19, 2010.

Hanson, C.E., et al., 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson Inc., Burlington, Mass., for U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., May. Available at http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf.

Heide, R., 2009, *National Heritage Area in the Works.* Available at http://www.coloradopreservation.org/news/articles/Heritage_Area_04.doc. Accessed Oct. 19, 2009.

Hinderlider, M.C., et al, 1939, *Rio Grande Compact, with Amendments,* adopted Dec. 19. Available at http://wrri.nmsu.edu/wrdis/compacts/Rio-Grande-Compact.pdf. Accessed Nov. 10, 2009.

Joe, T., 2008, personal communication regarding tribal consultation request for solar energy development on BLM lands from Joe (Program Manager for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to Ms. S. Sierra (State Director, Bureau of Land Management, Salt Lake City, Utah), July 3.

Joe, T.H., Jr., 2009, personal communication regarding joint BLM and DOE PEIS for solar energy development, from Joe (Supervisory Anthropologist for the Navajo Nation Historic Preservation Department—Traditional Cultural Program, Window Rock, Ariz.) to S. Borchard (California Desert District Manager, Bureau of Land Management, Riverside, Calif.), July 3.

Kenny, J. F, et al., 2009, *Estimated Use of Water in the United States in 2005*, U.S. Geological Survey, Circular 1344, http://pubs.usgs.gov/circ/1344, County data accessed Jan. 4, 2010.

Kirkham, R.M. (compiler), 1998, "Fault Number 2315, Faults near Monte Vista (Class A)," in *Quaternary Fault and Fold Database of the United States*. Available at http://earthquakes.usgs.gov/regional/qfaults. Accessed Sept. 11, 2009.

Kirkham, R.M., and W.P. Rogers, 1981, "Earthquake Potential in Colorado," *Colorado Geological Survey Bulletin 43*.

Laney, P., and J. Brizzee, 2005, *Colorado Geothermal Resources*, INEEL/MIS-2002-1614, Rev. 1, prepared for U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Geothermal Technologies Program, Nov.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

Leonard, G.J., and K.R. Watts, 1989, *Hydrogeology and Simulated Effects of Ground-Water Development on an Unconfined Aquifer in the Closed Basin Division, San Luis Valley*, *Colorado*, Water Resources Investigations Report 87-4284, U.S. Geological Survey, Denver, Colo.

Lindsey, K.D., 1983, *Paleontological Inventory and Assessment of the San Luis Resource Area,* prepared by Denver Museum of Natural History for U.S. Department of the Interior, Bureau of Land Management, Canon City District, Dec. 31.

Lipman, P.W., 2006, *Geologic Map of the Central San Juan Caldera Cluster, Southwestern Colorado*, U.S. Geological Survey pamphlet to accompany Geologic Investigations Series I-2799.

Lipman, P.W., and H.H. Mehnert, 1979, "The Taos Plateau Volcanic Field, Northern Rio Grande Rift, New Mexico," in *Rio Grande Rift: Tectonics and Magmatism*, Robert E. Riecker (Ed.), American Geophysical Union.

Lipman, P.W., Steven, T.A., and H.H. Mehnert, 1970, *Volcanic History of the San Juan Mountains, Colorado, as Indicated by Potassium-Argon Dating*, Geological Society of America Bulletin, Vol. 81.

Lipman, P.W., et al., 1970, *Volcanic History of the San Juan Mountains, Colorado, as Indicated by Potassium-Argon Dating*, Geological Society of America Bulletin, Vol. 81.

Machette, M.N., and R.A. Thompson, 2007, "Water in the San Luis Basin—Lake Alamosa's Legacy," *Geological Society of America Abstracts with Programs*, Vol. 39, No. 6, p. 365.

Manci, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service National Ecology Research Center, Ft. Collins, Colo.

Mayo, A.L., et al., 2007, "Groundwater Flow Patterns in the San Luis Valley, Colorado, USA Revisited: An Evaluation of Solute and Isotopic Data," *Hydrogeology Journal* 15:383–408.

McDermott, P., 2010, personal communication from McDermott (Engineer with Colorado Division of Water Resources, Division 3) to B. O'Connor (Argonne National Laboratory, Argonne, Ill.), Aug. 9.

Miggins, D.P., et al., 2002, *Extension and Uplift of Northern Rio Grande Rift: Evidence from* $^{40}Ar/^{39}Ar$ *Geochronology from the Sangre de Cristo Mountains, South-Central Colorado and Northern New Mexico*, Geological Society of America, Special Paper 362.

Miller, N.P., 2002, "Transportation Noise and Recreational Lands," *Proceedings of Inter-Noise 2002*, Dearborn, Mich., Aug. 19–21. Available at http://www.hmmh.com/cmsdocuments/N011.pdf. Accessed Aug. 30, 2007.

Murphey, P.C., and D. Daitch, 2007, "Figure D2, Colorado-PFYC," in *Paleontological Overview of Oil Shale and Tar Sands Areas in Colorado, Utah, and Wyoming*, prepared for U.S Department of the Interior, Bureau of Land Management, Dec.

National Research Council, 1996, *Alluvial Fan Flooding*, Committee on Alluvial Fan Flooding, Water Science and Technology Boar, and Commission on Geosciences, Environment, and Resources, National Academy Press, Washington D.C.

NatureServe, 2010, *NatureServe Explorer: An Online Encyclopedia of Life*. Available at http://www.natureserve.org/explorer/. Accessed Sept. 9, 2009.

NCDC (National Climatic Data Center), 2009a, *Integrated Surface Data (ISD), DS3505 Format*, database, Asheville, N.C. Available at ftp://ftp3.ncdc.noaa.gov/pub/data/noaa. Accessed Aug. 26, 2009.

NCDC, 2009b, *2008 Local Climatological Data Annual Summary with Comparative Data, Alamosa, Colorado (KALS),* National Oceanic and Atmospheric Administration. Available at http://www7.ncdc.noaa.gov/IPS/lcd/lcd.html. Accessed Aug. 26, 2009.

NCDC, 2009c, *Climates of the States (CLIM60): Climate of Colorado*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl. Accessed Aug. 26, 2009.

NCDC, 2010, *Storm Events*, National Oceanic and Atmospheric Administration, Satellite and Information Service. Available at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms. Accessed Oct. 8, 2010.

NCES (National Center for Education Statistics), 2009, *Search for Public School Districts*, U.S. Department of Education. Available at http://www.nces.ed.gov/ccd/districtsearch.

NDCNR (Nevada Department of Conservation and Natural Resources), 2002, *Nevada Natural Heritage Program: Vertebrate Taxonomic Checklists.* Available at http://heritage.nv.gov/spelists.htm. Accessed June 30, 2010.

NMDGF (New Mexico Department of Game and Fish), 2009, *Biota Information System of New Mexico Database Query,* Sante Fe, N.M. Available at http://www.bison-m.org/databasequery.aspx. Accessed Oct. 9, 2009.

NPS (National Park Service), 2008, *National Heritage Areas*, National Heritage Areas Program Office, Washington, D.C. Available at http://www.nps.gov/history/heritageareas.

NPS, 2009, *Sangre de Cristo National Heritage Area*. Available at http://www.nps.gov/grsa/parknews/sangre-de-cristo-nha.htm. Accessed Nov. 10, 2009.

NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO) Database for Conejos County, Colorado*. Available at: http://SoilDataMart.nrcs.usds.gov.

NRCS, 2009, *Custom Soil Resource Report for Conejos County (covering the proposed Los Mogotes SEZ), Colorado*, U.S. Department of Agriculture, Washington, D.C., Aug. 21.

NSTC (National Science and Technology Council), 2008, *Scientific Assessment of the Effects of Global Change on the United States*, A Report of the Committee on Environment and Natural Resources, May.

Pew Center on Global Climate Change, 2009, *Renewable and Alternative Energy Portfolio Standards (with reference to Colorado House Bill 07-1281)*. Available at http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm. Accessed Nov. 4, 2009.

Ray, A.J., et al., 2008, *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation*, a report by the Western Water Assessment for the Colorado Water Conservation Board. Available at http://cwcb.state.co.us/NR/rdonlyres/B37476F5-BE76-4E99-AB01-6D37E352D09E/0/ClimateChange_FULL_Web.pdf. Accessed Nov. 2, 2009.

RGSR (Rio Grande Scenic Railroad), 2009, *Rio Grande Scenic Railroad Information Web Site*. Available at http://www.riograndescenicrailroad.com. Accessed Nov. 11, 2009.

RGWCD (Rio Grande Water Conservation District), 2009, *Proposed Plan of Water Management—Special Improvement District 1 (aka Closed Basin Subdistrict)*, May 11, 2009 draft. Available at http://www.rgwcd.org/Pages/Subdistricts/Subdistrict1_1.htm. Accessed Nov. 9, 2009.

RGWCD, 2010, *Draft: San Luis Valley Well and Water-Level Database*. Available at http://www.rgwcd.org/wl. Accessed Aug. 4, 2010.

Ritter, B., Jr., 2007, *Colorado Climate Action Plan: A Strategy to Address Global Warming*, Nov.

Robson, S. G., and E. R. Banta, 1995, *Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah,* U.S. Geological Survey, HA 730-C.

SAMHSA (Substance Abuse and Mental Health Services Administration), 2009, *National Survey on Drug Use and Health, 2004, 2005 and 2006*, Office of Applied Studies, U.S. Department of Health and Human Services. Available at http://oas.samhsa.gov/substate2k8/StateFiles/TOC.htm#TopOfPage.

SES (Sterling Energy Systems) Solar Two, LLC, 2008, Application for Certification, submitted to the Bureau of Land Management, El Centro, Calif., and the California Energy Commission, Sacramento, Calif., June. Available at http://www.energy.ca.gov/sitingcases/solartwo/documents/applicant/afc/index.php. Accessed Oct. 2008.

Simonds, W.J., 2009, *The San Luis Valley Project*, Bureau of Reclamation. Available at http://www.usbr.gov/history/sanluisv.html. Accessed Nov. 4, 2009.

SLRG (San Luis & Rio Grande Railroad), 2009, *San Luis & Rio Grande Railroad.* Available at http://www.sanluisandriogranderailroad.com. Accessed June 25, 2009.

SLV (San Luis Valley) Development Resources Group, 2007, *Comprehensive Economic Development Strategy*, prepared with support from Planning and Assistance Grant 05-83-04371, Alamosa, Colo. Available at http://www.slvdrg.org/ceds.php. Accessed Nov. 3, 2009.

SLV Development Resources Group, 2009, *SLV TIGER Discretionary Grant Application with Appendices (Appendix 1—SLVRMI Map Showing the Sangre de Cristo NHA).* Available at http://slvdrg.org/tigergrant.php. Accessed Nov. 10, 2009.

Smith, M.D., et al., 2001, "Growth, Decline, Stability and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Communities," *Rural Sociology* 66:425-450.

Solar Reserve, 2010, *Saguache Solar Energy Project, Preliminary 1041 Permit Application for Saguache County, Colorado*, July 20, 2010.

State Demography Office, 2009, *Preliminary Population Forecasts for Colorado Counties, 2000–2010*. Available at http://dola.colorado.gov/dlg/demog/population/forecasts/counties1yr.xls.

Stebbins, R.C., 2003, *A Field Guide to Western Reptiles and Amphibians,* Houghton Mifflin Company, Boston, Mass.

Stoeser, D.B., et al., 2007, *Preliminary Integrated Geologic Map Databases for the United States: Central States – Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Iowa, Missouri, Arkansas, and Louisiana, Version 1.2*, U.S. Geological Survey Open File Report 2005-1351, updated Dec. 2007.

Stout, D., 2009, personal communication from Stout (U.S. Fish and Wildlife Service, Acting Assistant Director for Fisheries and Habitat Conservation, Washington, D.C.) to L. Jorgensen (Bureau of Land Management, Washington, D.C.), and L. Resseguie (Bureau of Land Management, Washington, D.C.), Sept. 14, 2009.

Strait, R., et al., 2007, *Colorado Greenhouse Gas Inventory and Reference Case Projections 1990–2020*, prepared by Center for Climate Strategies, Washington, D.C., for Colorado Department of Public Health and Environment, Denver, Colo., Jan. Available at http://www.cdphe.state.co.us/ap/down/GHGEIJan07.pdf. Accessed Sept. 11, 2009.

Texas v. Colorado, 1968, 391 U.S. 901, 88 S. Ct. 1649, 20 L. Ed.2d 416, Colo.

Thompson, R.A., Johnson, C.M., and H.H. Mehnert, 1991, *Oligocene Basaltic Volcanism of the Northern Rio Grande Rift: San Luis Hills, Colorado*, Journal of Geophysical Research, Vol. 96, No. B8, July 30.

Thompson, K., 2002, *Dealing with Drought: Part Two*, prepared for Agro Engineering, Inc. Available at http://www.agro.com/WaterResources/Dealingwithdrought2.PDF. Accessed Nov. 9, 2009.

Thompson, R.A., et al., 1991, *Oligocene Basaltic Volcanism of the Northern Rio Grande Rift: San Luis Hills, Colorado*, Journal of Geophysical Research, Vol. 96, No. B8, July 30.

Topper, R., et al., 2003, *Ground Water Atlas of Colorado*, Colorado Geological Survey, Special Publication 53. Available at http://geosurvey.state.co.us/wateratlas.

Tri-State Generation and Transmission Association, Inc., 2008, *San Luis Valley Electric System Improvement Project Alternative Evaluation and Macro Corridor Study*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State Generation and Transmission Association, Inc., 2009, *San Luis Valley–Calumet-Comanche Transmission Project Alternative Evaluation*, submitted to U.S. Department of Agriculture Rural Development, June.

Tri-State and Public Service Company of Colorado, 2009, *Southern Colorado Transmission Improvements—Renewable Energy Development.* Available at http://www.socotransmission.com/Purpose/renewables.cfm. Accessed Nov. 4, 2009.

TSNA, 2010, *San Luis Valley Solar Project Tessera Solar North America 1041 Final Application to Saguache County, Colorado*, June 2010.

Tweto, O., 1979, Geologic Map of Colorado (Scale 1:500,000), U.S. Geological Survey, prepared in cooperation with the Geological Survey of Colorado.

University of New Mexico, 2009, *Population Projections for New Mexico and Counties*, Bureau of Business and Economic Research. Available at http://bber.unm.edu/demo/table1.htm.

U.S. Bureau of the Census, 2009a, *County Business Patterns, 2008*. Washington, D.C. Available at http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html.

U.S. Bureau of the Census, 2009b, *CT-T1. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009c, *QT-P32. Income Distribution in 1999 of Households and Families: 2000. Census 2000 Summary File (SF 3) – Sample Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009d, *S1901. Income in the Past 12 Months. 2006–2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009e, *GCT-PH1. GCT-PH1. Population, Housing Units, Area, and Density: 2000. Census 2000 Summary File (SF 1) – 100-Percent Data.* Available at http://factfinder.census.gov./

U.S. Bureau of the Census, 2009f, *T1. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009g, *GCT2510. Median Housing Value of Owner-Occupied Housing Units (Dollars). 2006–2008 American Community Survey 3-Year Estimates*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009h, *QT-H1. General Housing Characteristics, 2000. Census 2000 Summary File 1 (SF 1) 100-Percent Data*. Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009i, *GCT-T9-R. Housing Units, 2008. Population Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009j, *S2504. Physical Housing Characteristics for Occupied Housing Units 2006–2008 American Community Survey 3-Year Estimates.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009k, *Census 2000 Summary File 1 (SF 1) 100-Percent Data.* Available at http://factfinder.census.gov/.

U.S. Bureau of the Census, 2009l, *Census 2000 Summary File 3 (SF 3) – Sample Data* Available at http://factfinder.census.gov/

USDA (U.S. Department of Agriculture), 2004*, Understanding Soil Risks and Hazards—Using Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property*, G.B. Muckel (editor).

USDA, 2009a, *2007 Census of Agriculture: Colorado State and County Data, Volume 1, Geographic Area Series,* National Agricultural Statistics Service, Washington, D.C. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Colorado/index.asp.

USDA, 2009b, *2007 Census of Agriculture: New Mexico State and County Data, Volume 1, Geographic Area Series,* National Agricultural Statistics Service, Washington, D.C. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New Mexico/index.asp.

USDA, 2010c, *United States Department of Agriculture Plants Database*. Available at http://plants.usda.gov/index.html. Accessed Jan. 25, 2010.

U.S. Department of Commerce, 2009, *Local Area Personal Income*, Bureau of Economic Analysis. Available at http://www.bea.doc.gov/bea/regional/reis.

U.S. Department of the Interior, 2010. Native American Consultation Database. National NAGPRA Online Databases. National Park Service. Available at http://grants.cr.nps.gov/nacd/index.cfm.

U.S. Department of Justice, 2008, "Table 80: Full-time Law Enforcement Employees, by State by Metropolitan and Nonmetropolitan Counties, 2007," *Crime in the United States: 2007*. Available at http://www.fbi.gov/ucr/cius2006/about/table_title.html.

U.S. Department of Justice, 2009a, *2008 Crime in the United States*, "Table 8: Offences Known to Law Enforcement, by State and City," Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Justice, 2009b, *2008 Crime in the United States*, "Table 10: Offences Known to Law Enforcement, by State and by Metropolitan and Non-metropolitan Counties," Federal Bureau of Investigation, Criminal Justice Information Services Division. Available at http://www.fbi.gov/ucr/cius2008/data/table_08.html.

U.S. Department of Labor, 2009a*, Local Area Unemployment Statistics: States and Selected Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007, Annual Averages*, Bureau of Labor Statistics. Available at http://www.bls.gov/lau/staadata.txt.

U.S. Department of Labor, 2009b, *Local Area Unemployment Statistics: Unemployment Rates by State,* Bureau of Labor Statistics. Available at http://www.bls.gov/web/laumstrk.htm.

U.S. Department of Labor, 2009c, *Local Area Unemployment Statistics: County Data,* Bureau of Labor Statistics. Available at http://www.bls.gov/lau.

U.S. Department of Labor, 2009d, *Consumer Price Index, All Urban Consumers—(CPI-U) U.S. City Average, All Items,* Bureau of Labor Statistics. Available at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt.

USFS (U.S. Forest Service), 2005, *Rio Grande Chub (Gila Pandora): A Technical Conservation Assessment*, prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project, Fort Collins, Colo.

USFWS (U.S. Fish and Wildlife Service), 2009a, *San Luis Valley, Colorado Regional Habitat Conservation Plan (HCP)*. Available at http://www.fws.gov/mountain-prairie/endspp/conservation/index.htm. Accessed Nov. 10, 2009.

USFWS, 2009b, *National Wetland Inventory*, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Available at http://www.fws.gov/wetlands.

USGS (U.S. Geological Survey), 2000, *Estimated Use of Water in the United States, County Level Data for 2000*. Available at: http://water.usgs.gov/watuse/data/2000. Accessed Oct. 22, 2009.

USGS, 2004, *National Gap Analysis Program, Provisional Digital Land Cover Map for the Southwestern United States*. Version 1.0, RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2005, *National Gap Analysis Program, Southwest Regional GAP Analysis Project—Land Cover Descriptions,* RS/GIS Laboratory, College of Natural Resources, Utah State University.

USGS, 2007, *National Gap Analysis Program*, 2007, *Digital Animal-Habitat Models for the Southwestern United States*. Version 1.0, Center for Applied Spatial Ecology, New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University. Available at http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm. Accessed Jan. 22, 2010.

USGS, 2008, *National Seismic Hazard Maps – Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 Years (Interactive Map)*. Available at: http://gldims.cr.usgs.gov/nshmp2008/viewer.htm. Accessed August 4, 2010.

USGS, 2010a, *National Earthquake Information Center (NEIC) – Circular Area Database Search (within 100-km of the center of the proposed Fourmile East SEZ)*. Available at: http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php. Accessed August 5, 2010.

USGS, 2010b, Glossary of Terms on Earthquake Maps – Magnitude. Available at: http://earthquake.usgs.gov/earthquakes/glossary.php#magnitude. Accessed August 8, 2010.

USGS, 2010c, *Water Resources of the United States—Hydrologic Unit Maps*. Available at http://water.usgs.gov/GIS/huc.html. Accessed April 12, 2010.

USGS, 2010d, National Water Information System. Available at http://wdr.water.usgs.gov/nwisgmap. Accessed Aug 3.

USGS and CGS (Colorado Geological Survey), 2009, *Quaternary Fault and Fold Database for the United States*. Available at: http://earthquake.usgs.gov/regional/qfaults/. Accessed: September 11, 2009.

Wells, S. J., 2008, *Archaeological Inventory and National Register Evaluation for the Baca Land Exchange La Jara Parcels Conejos County, Colorado*, prepared by the Western Archaeological and Conservation Center, Tucson, Ariz., and Fort Lewis College, Durango, Colo., for the National Park Service, Denver, Colo., the Bureau of Land Management, Lakewood, Colo., and the U.S. Fish and Wildlife Service, Lake, Colo., WACC Publications in Anthropology 101, Nov.

Westerling, A.L., et al., 2006, "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity," *Science* 313: 940–943.

Wolfe, D., 2008, Order Establishing Advisory Committee for Rules and Regulations Governing the Diversion and Use of Underground Waters in Water Division 3, Colorado Division of Water Resources, Dec. 31. Available at http://water.state.co.us/SurfaceWater/RulemakingAndAdvising/SLVAC/Pages/SLVNews.aspx.

WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System (EDMS)*. Available at http://www.wrapedms.org/default.aspx. Accessed June 4, 2009.

WRCC (Western Regional Climate Center), 2009, *Western U.S. Climate Historical Summaries.* Available at http://www.wrcc.dri.edu/Climsum.html. Accessed Aug. 21, 2009.

WRCC 2010a, Monthly Climate Summary, Blanca, Colorado (050776), Available at: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co0776, Accessed: July 22.

WRCC 2010b, Monthly Climate Summary, La Vetta Pass, Colorado (054870), Available at: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?co4870, Accessed: July 22.

WRCC, 2010c, *Average Pan Evaporation Data by State*. Available at http://www.wrcc.dri.edu/htmlfiles/westevap.final.html. Accessed Jan. 19, 2010.