APPENDIX E
Biological Resources

E-1. 2013 Biological Resources Technical Report

E-2. Draft Integrated Weed Management Plan

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APPENDIX E-1
2013 Biological Resources Technical Report

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Biological Resources Technical Report

Soda Mountain Solar
San Bernardino County, CA

BLM Case Number CACA 49584

March 2013

PANORAMA ENVIRONMENTAL, INC.

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ENVIRONMENTAL, INC.

Biological Resources Technical Report

Soda Mountain Solar Project
San Bernardino, California

BLM Case Number CACA 49584

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1 INTRODUCTION

1.1 PURPOSE

This Biological Resources Technical Report has been prepared for the proposed Soda Mountain Solar Project (project). The proposed project consists of a 350-megawatt (MW) photovoltaic (PV) solar energy generating facility located within an approximately 4,559-acre right-of-way (ROW)[1] that would be granted by the U.S. Department of the Interior, Bureau of Land Management (BLM). The facility will include an on-site substation and switchyard, solar arrays, collector lines, an equipment yard, an operations and maintenance building, transformers and inverters, access roads, hydraulic structures for stormwater control, and reserve land. The project will provide power to a high-voltage transmission line adjacent to the ROW. Soda Mountain Solar, LLC (SMS), is the proposed developer of the project. The BLM case number for the project is CACA49584.

This report summarizes the information presented in the following biological reports:

- *2009 Desert Tortoise Survey Report* (URS 2009a)
- *2009 Spring and Fall Avian Survey Report* (URS 2010)
- *Biological Resources Technical Report* (URS 2009b)
- *2009 Focused Special-status Plant Survey Report* (URS 2009c)
- *2009 Mojave Fringe-toed Lizard Survey Report* (URS 2009d)
- *Final 2009 Desert Tortoise Survey Report* (Caithness Soda Mountain, LLC [Caithness] 2010a)
- *Final 2009 Spring and Fall Avian Survey Report* (Caithness 2010b)
- *Final 2009 Biological Resources Technical Report* (Caithness 2010c)
- *Final 2009 Focused Special-status Plant Survey Report* (Caithness 2010d)
- *Final 2009 Mojave Fringe-toed Lizard Survey Report* (Caithness 2010e)
- *Golden Eagle Nest Surveys and Desert Bighorn Sheep Observations March 21-25, 2011 and May 9-10, 2011* (BioResource Consultants, Inc. [BRC] 2011)

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[1] The project was initially proposed in 2008 by Caithness Soda Mountain Solar, LLC, within a 6,770-acre ROW. Surveys conducted in 2009 and 2010 covered the 6,770-acre study area. The ROW was revised in 2011 to 4,508 acres through use of a more efficient technology and to avoid resource conflicts. The ROW was further revised in 2012 to 4,559 acres to avoid additional resource conflicts. The requested ROW is 4,559 acres.

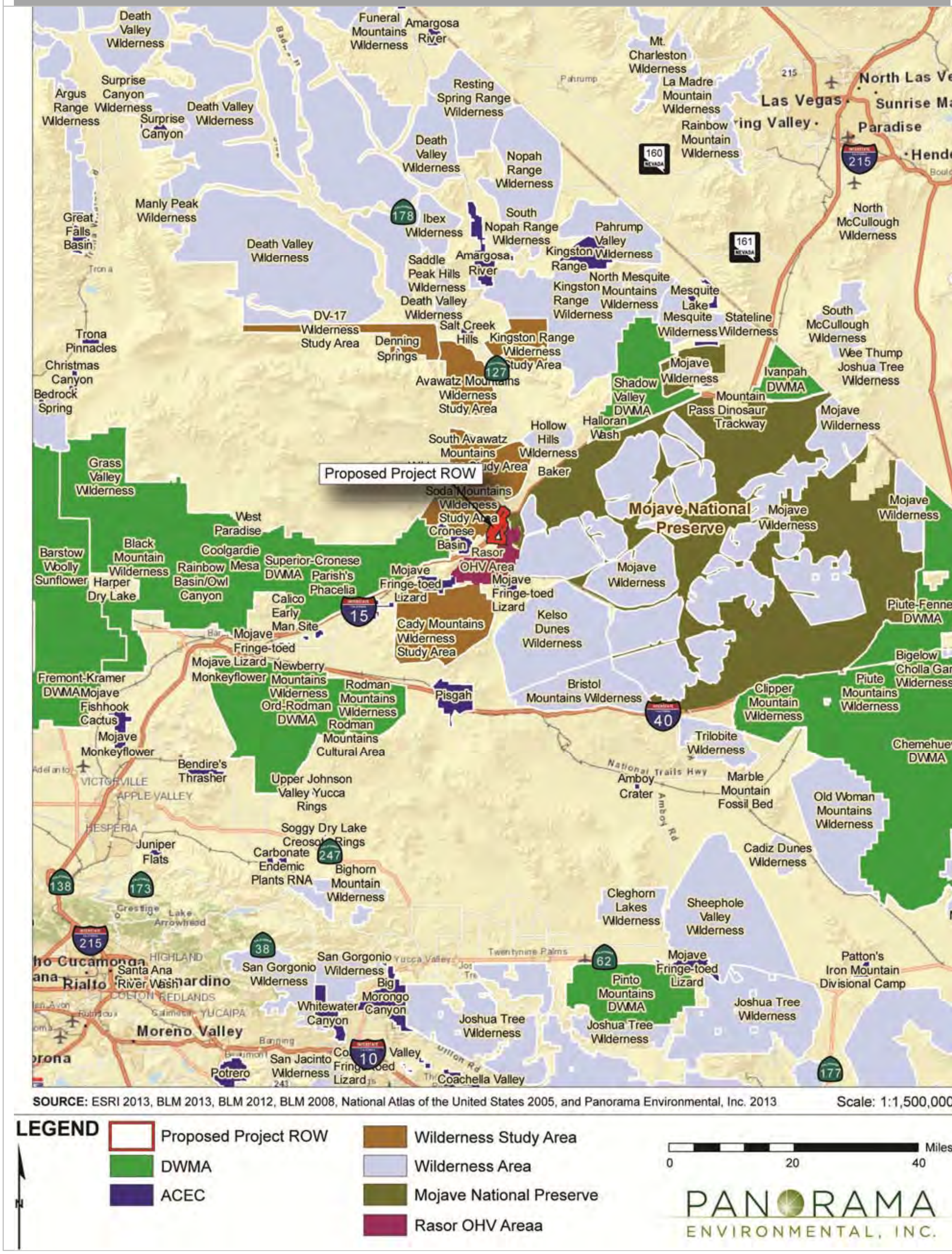
- *Bat Habitat Assessment* (Brown-Berry Biological Consulting 2012)
- *Protocol Desert Tortoise Survey For Soda Mountain Solar Project, Fall 2012* (Kiva Biological Consulting 2012a)
- *Protocol Desert Tortoise Survey for Soda Mountain Solar Project Geotechnical Work* (Kiva Biological Consulting 2012b)
- *Focused Fall Special-status Plant Survey* (C.S. Ecological Surveys and Assessments [CSESA] 2012)
- *Draft Jurisdictional Determination Report* (URS 2009e)

1.2 PROJECT LOCATION AND SETTING

The project is located along the Interstate 15 (I-15) corridor between the north and south Soda Mountains (Figure 1.2-1). The project area is located approximately 6 miles southwest of the town of Baker, California, within an intermontane desert valley composed of alluvial fan deposits and surrounded by the Soda Mountains. Elevations within the project area range from approximately 1,200 feet above mean sea level (amsl) to 1,600 feet amsl. Slopes within the project area range from 2 to 5 percent. The proposed project ROW would cover approximately 38 percent of the 12,000-acre valley.

Portions of the project area are located within a designated federal utility corridor under Section 368 of the Energy Policy Act of 2005. The northwestern portion of the project area (northwest of Highway I-15) is bounded by Zzyzx Road, two transmission lines, mining areas, pipelines, and fiber optic lines. The southern portion of the project area (southeast of I-15) is bounded by Rasor Road, I-15, and the Rasor Off-highway Vehicle (OHV) area. The project is not located within an Area of Critical Environmental Concern (ACEC), Wilderness, Wilderness Study Area, or a Desert Wildlife Management Area (DWMA) (Figure 1.2-1). The Soda Mountain Wilderness Study Area is located in the Soda Mountains approximately 0.2 miles west of the west boundary of the project area. The northwest boundary of the Mojave National Preserve follows the ridgeline of the Soda Mountains 0.5 miles to 2.9 miles east of the east boundary of the project area. The Cronese Basin Area of Critical Environmental Concern (ACEC) and the Superior-Cronese DWMA are located approximately 5 miles west of the project area. The Baker Sink, a relic of one of the drainages that fed Pleistocene Lake Manley in Death Valley, is located northeast of the project area and east of the south Soda Mountains. Average annual precipitation in the project area is approximately 4.1 inches (WRCC 2013).

Figure 1.2-1: Project Location



1.3 PROJECT OVERVIEW

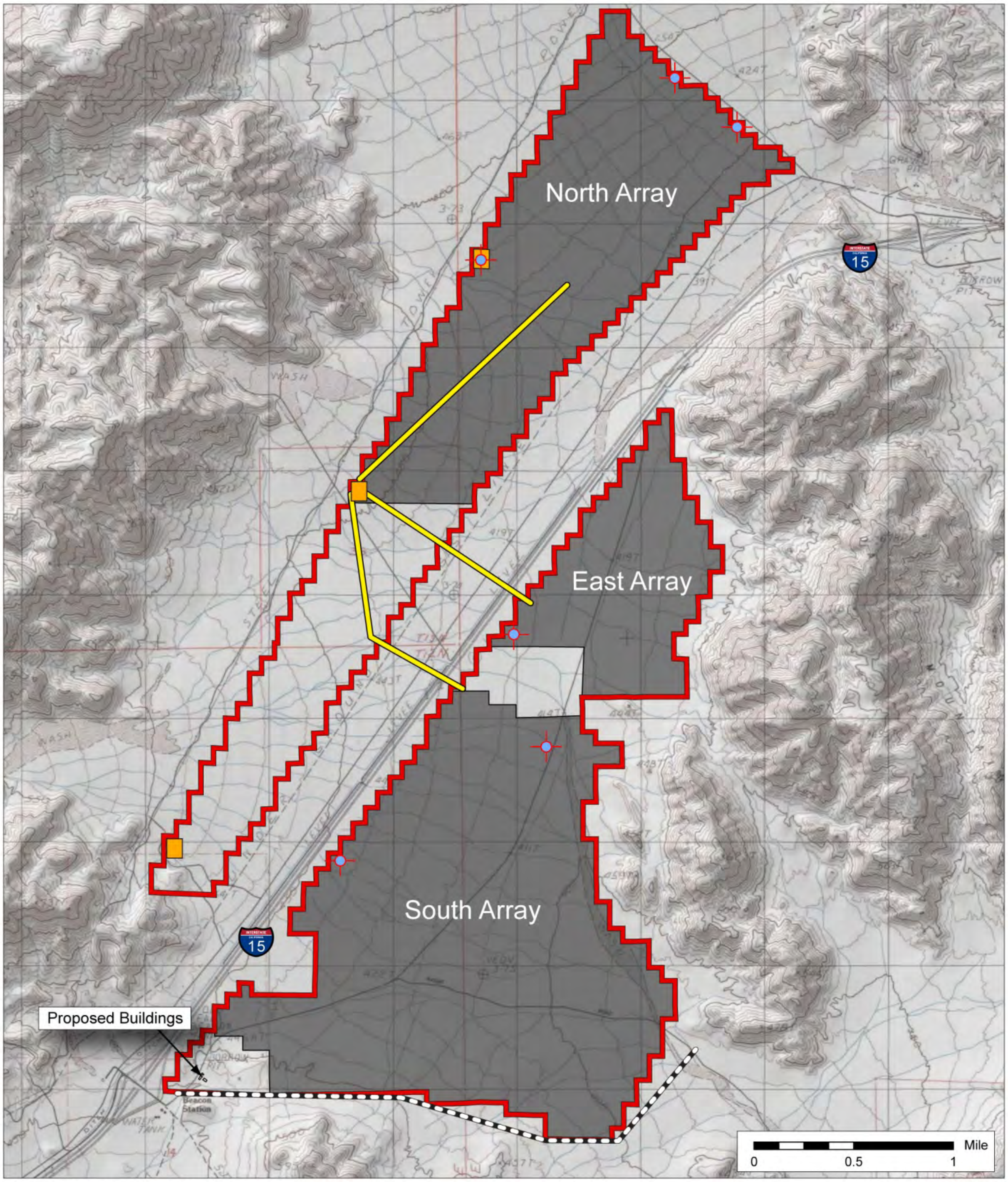
The proposed project includes construction and operation of a 350-MW PV solar electric power generating facility (project). The major components of the project include:

- PV panel arrays (North, South, and East Arrays), inverters, medium-voltage collector transformers, and ancillary equipment
- Unpaved access roads between the arrays
- 34.5-kilovolt (kV) collector lines to connect the panel arrays to the substation
- Substation and switchyard for interconnection to the transmission system
- Water wells and water storage tanks
- Reverse osmosis water treatment system with brine ponds
- Control room/office building, maintenance facility, storage warehouse, and other ancillary structures
- Temporary storage facility for materials and supplies required during construction
- Berms

The proposed ROW area includes 4,559 acres, of which approximately 2,700 acres would contain solar array fields. Table 1.3-1 shows the breakdown of surface disturbance by project component. The remaining acreage would be used for stormwater control, access roads, ancillary buildings, and reserve land. The proposed project layout is shown on Figure 1.3-1.

Consistent with the BLM *Draft Methodology Report for the Soda Mountain EIS/EIR*, all areas of disturbance in the desert are considered to be permanent impacts (ESA 2012). The definitions of permanent and temporary impacts to vegetation in desert habitat are based on the long recovery time needed for desert vegetation communities to recover from disturbance. Desert ecosystems are slow to recover from anthropogenic activities. Recovery time varies depending on the impact type and intensity. It can take approximately 5 years for a creosote bush canopy to resprout after it has undergone damage from heavy vehicle traffic (ESA 2012). Vegetation removal and soil disturbance from larger projects can result in recovery periods of 50 to 300 years for partial recovery and more than 3,000 years for total recovery (ESA 2012). The temporary impacts specified in Table 1.3-1 are therefore considered to be permanent as well. Not all of the acreage will be covered with permanent facilities. The area remaining for revegetation during project operation is also provided in Table 1.3-1.

Figure 1.3-1: Project Layout



SOURCE: ESRI 2012 and Panorama Environmental, Inc. 2012

Scale: 1:50,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Proposed Well
- Potential Substation Location
- Proposed O&M or Storage Building
- Proposed Collector Route
- Proposed Rasor Road Realignment

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Table 1.3-1: Estimated Surface Disturbance (Acres)

Component	Permanent[1] Area of Disturbance Acreage (net permanent disturbance)[2]	Areas with No Permanent Facilities
North Array	602	13
East Array	393	13
South Array	1,747	25
Subtotal Arrays	***2,742***	***51***
Substation and Switchyard	40	25
Operations & Maintenance Buildings, Warehouses, and Water Tank	4	3
Project Wells (3)	1.5	1
Reverse Osmosis Facility	2	1
Brine Ponds	6	2
Rasor Road Realignment	60	48
Access Roads	64	57
Berms	11	8
Collector Routes	38	38
Subtotal Other Components	***226.5***	***183***
TOTAL	**2,968.5**	**234**

Notes

1 The definition of "permanent" in this table is consistent with that described in the preceding text: all areas of disturbance in the desert are considered to be permanent impacts.

2 Actual areas disturbed will be determined in construction design plans and verified during the as-built surveys.

2 METHODS

2.1 LITERATURE REVIEW

Relevant literature, including relevant plans, policies, and biological information, was reviewed to determine what biological resources may occur near or in the project area. Research included:

- Review of agency plans pertaining to sensitive and special-status species
- Queries of special-status species occurrence records
- Review of literature on sensitive species and biological resources in the project area and region
- Correspondence and consultation with state and federal resource agencies

A summary of the sources reviewed is provided below.

2.1.1 Review of Applicable Plans

BLM land use management plans were reviewed for application to special-status species management within the project area. The applicable plans reviewed were:

- The California Desert Conservation Area Plan (BLM 1980 as amended).
- The West Mojave Plan and the associated Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS) (BLM 2005).
- Resource Management Plan Amendments for Solar Energy Development in Six Southwestern States and its associated Final Programmatic Environmental Impact Statement (PEIS) (EERE et al. 2012a). The proposed project is a "pending project" in the PEIS and is thus exempt from the specific recommendations and requirements of the PEIS.
- Desert Tortoise Recovery Plan (USFWS 1994).
- Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report (CEC 2012a) and alternatives (2013).

2.1.2 Special-status Species Records Queries and Literature Review

Several database queries were conducted to identify recorded and potential occurrences of special-status plants and wildlife species in and near the project area. The list of sensitive species was updated in September 2012 to determine whether more recent species occurrences were reported within the project area. Queries and reviews included:

- Query of the U.S. Fish and Wildlife Service (USFWS) Critical Habitat Portal to determine if critical habitat for federally listed species is present in the project vicinity
- Geographic information system review of the California Natural Diversity Database (CNDDB) (5-mile buffer from project area for wildlife and 50-mile buffer for sensitive plants)
- Geographic information system review of the Biogeographic Information and Observation System (BIOS) maintained by the California Department of Fish and Wildlife (CDFW) (10-mile buffer from project area)
- California Native Plant Society (CNPS) Inventory of Rare and Endangered Vascular Plants of California for additional information regarding sensitive plant species

In addition, background information, including scientific papers and agency documents on plant and wildlife species, was reviewed in order to identify species with the potential to occur in the project area and obtain information about these species. These documents included, but were not limited to, the following:

- Baseline biology reports and species habitat models
- Scientific reports and articles on species distribution and habitat
- Desert Studies Center bird observation list
- Species survey protocols

After review of the literature, the following criteria were used to determine the potential for special-status species to occur within the project area:

- ***Present:*** The species was observed in the project area, either anecdotally or during field surveys.
- ***High Potential:*** Habitat quality combined with CNDDB occurrences or other records indicate the species is likely to occur on the project site. Individuals were not observed in the project area during field surveys; however, the species would likely occur in the project area.
- ***Moderate Potential:*** CNDDB occurrences or surveys have recorded the species within 10 miles of the project area and suitable habitat is present. The species could be present.
- ***Low Potential:*** Marginally suitable habitat may occur in the project area, but individuals were not observed during surveys and are not anticipated to be present.
- ***Absent:*** Species, sign, or habitat were not observed on the site during protocol surveys and suitable habitat is not present.

2.2 FIELD SURVEYS

2.2.1 Agency Consultation

SMS consulted with BLM, CDFW, and USFWS regarding survey methods and requirements. Table 2.2-1 identifies the individuals who were consulted for each biological survey conducted.

Table 2.2-1: Agency Consultation

Survey	Survey Date	Individuals Contacted, Affiliation
Desert Tortoise Survey	Spring 2009	Chris Otahal, BLM Larry LaPre, BLM
Desert Tortoise Survey	Fall 2012	Chris Otahal, BLM Larry LaPre, BLM Wendy Campbell, CDFW Ray Bransfield, USFWS
Rare Plant Survey	Spring 2009	Chris Otahal, BLM
Rare Plant Survey	Fall 2012	Chris Otahal, BLM Anthony Chavez, BLM Wendy Campbell, CDFW
Bighorn Sheep and Golden Eagle Survey	March 2011 and May 2012	Regina Abella, CDFW Andy Pauli, CDFW
Bat Survey	August and September 2012	Chris Otahal, BLM Wendy Campbell, CDFW
Mojave Fringe-toed Lizard Survey	July and August 2009	Chris Otahal, BLM
Avian Point Counts	Spring and Fall 2009	Chris Otahal, BLM
Wetland/Waters Delineation	Summer 2009 and Fall 2012	Shannon Pankratz, U.S. Army Corps of Engineers (USACE) Wendy Campbell, CDFW

Sources: URS 2009a; Kiva Biological 2012; URS 2009c; CSESA 2012; BRC 2011; Brown-Berry Biological Consulting 2012; URS 2009d; URS 2010; Caithness 2010a; Caithness 2010b; Caithness 2010d; Caithness 2010e

2.2.2 Study Areas

The 2009 biological surveys covered the 6,770 acre ROW identified in the March 2009 Plan of Development. After conducting surveys in 2009, the ROW area was reduced to avoid sensitive resources. Subsequent studies were conducted on a smaller study area to reflect the reduction in the ROW. Table 2.2-2 identifies the study area for each of the surveys discussed in this report.

Table 2.2-2: Survey Study Areas

Species	Survey Data	Survey Study Area
Rare and Special-status Plants and Succulent	Spring: April and May 2009 (included cacti)	6,770-acre 2009 ROW
	Fall: October and November 2012	4,075 acre proposed project area[1]
Desert Tortoise	May 2009	6,770-acre 2009 ROW
	October 2012	220 acres and zone of influence Geotechnical survey routes and locations
Mojave Fringe-toed Lizard	July and August 2009	703 acres of potential habitat south and southeast of the project
Bighorn Sheep and Golden Eagle	March and May 2011	Lands within a 10-mile radius of the boundaries of the proposed project[2]
Bats	August 2012	Select mines within 10 miles of the project area, 4,559-acre ROW
Avian Point Count	Spring and Fall 2009	6,770-acre 2009 ROW
Waters Delineation	May 2009	6,770-acre 2009 ROW
	2012 Update	4,559-acre ROW

Notes

1 The 2012 plant survey area is smaller than the ROW area because the area south of the North Array is not likely to be subject to surface disturbance.

2 The south Soda Mountains east of the project area were not surveyed upon request from CDFW to avoid this area during the lambing season.

Sources: URS 2009a; Kiva Biological 2012a; URS 2009c; CSESA 2012; BRC 2011; Brown-Berry Biological Consulting 2012; URS 2009d; URS 2010

2.2.3 Vegetation

Rare and Special-status Plants

Special-status plants as discussed in this report include:

- Federally listed endangered, threatened, or proposed species
- California listed endangered, threatened, and rare species
- BLM sensitive species, including species with California Rare Plant Rank of 1B

Other rare plants ranked by CNPS were included in vegetation surveys and are discussed in this document as rare plants. These rare plants are not considered special-status and are not protected under state or federal law. BLM has a special policy regarding the salvage of cactus species; therefore, the 2009 vegetation survey also analyzed the density of these species on site.

Survey Protocols

Rare and special-status plant surveys were conducted in the spring (April and May 2009) and fall (October and November 2012). The 2009 spring rare plant survey was conducted in accordance with guidelines issued by USFWS (USFWS 1996), CDFW (CDFW 2000), and CNPS (CNPS 2001), with guidance from the Barstow BLM Field Office. The 2012 fall rare plant survey followed the guidelines published by CDFW (CDFW 2009), USFWS (1996b), CNPS (2001), and BLM (2009), with guidance from the Barstow BLM Field Office and CDFW. Botanist qualifications were reviewed by BLM and CDFW prior to surveys.

Focal Species and Reference Populations

Focal rare and special-status plant species for the surveys were identified through literature reviews and botanist experience with similar habitats in the Mojave Desert. Table 2.2-3 contains a list of the focal plant species for the spring and fall botanical surveys. Figure 2.2-1 shows the survey area for the surveys.

Nearby reference populations were visited prior to initiating the focused rare and special-status plant surveys. Reference populations were visited on April 6, 28, and 29, 2009 (spring survey), and on October 21, 22, and 23, 2012 (fall survey). Reference populations were visited to observe if plants had germinated and to observe the phenological state of the various rare and special-status species (CDFW 2009; URS 2009c).

The focused surveys were conducted in 2009 and 2012 by botanists walking parallel transects spaced at approximately 30 feet (9 meters) throughout the study area. Each rare or special-status plant observed was documented with a sub-meter accuracy Trimble® Geo XH global positioning system (GPS) and CNDDB data sheets were filled out for each special-status plant population (CSESA 2012). A list of all plant species observed in the survey area was compiled during the botanical surveys in accordance with the BLM, CDFW, and CNPS guidelines for a full floristic survey. Incidental wildlife observations were noted during the fall 2012 survey.[2] Incidental observance of special-status wildlife species and sign were documented with GPS locations (see Appendix A). Plant nomenclature for the 2009 survey followed *The Jepson Manual: Higher Plants of California* (Hickman, ed. 1993) and the 2012 survey followed *Jepson Manual 2nd Edition* (Baldwin, ed. 2012).

[2] The documentation of incidental wildlife during the rare plant survey is not intended to replace the requirement for protocol-level wildlife surveys. These documented occurrences were incidental to the focused rare plant survey and are summarized in this report to provide additional information in assessing species occurrence and potential impacts.

Table 2.2-3: Rare and Special-status Plant Survey Focal Species		
Common Name	**Species Name**	**Status**
2009 Spring Survey		
Small-flowered androstephium	*Androstephium breviflorum*	CRPR: 2.2
White bearpoppy	*Arctomecon merriamii*	CRPR: 2.2
Emory's crucifixion-thorn	*Castela emoryi*	CRPR: 2.3
White-bracted spineflower	*Chorizanthe xanti* var. *leucotheca*	CRPR: 1B.2
Desert pincushion	*Coryphantha chlorantha*	CRPR: 2.1
Utah vine milkweed	*Funastrum utahense*	CRPR: 4.3
Parish club-cholla	*Grusonia parishii*	CRPR: 2.3
Short-joint beavertail cactus	*Opuntia basilaris* var. *brachyclada*	CRPR: 1B.2
Latimer's woodland gilia	*Saltugilia latimeri*	CRPR: 1B.2
2012 Fall Survey		
Desert wing fruit	*Acleisanthes nevadensis*	CRPR: 2.1
Wright's beebrush	*Aloysia wrightii*	CRPR: 4.3
Mojave milkweed	*Asclepias nyctaginifolia*	CRPR: 2.1
Three-awned grama	*Bouteloua trifida*	CRPR: 2.3
Emory's crucifixion-thorn	*Castela emoryi*	CRPR: 2.3
Abram's spurge	*Chamaesyce abramsiana*	CRPR: 2.2
Parry's spurge	*Chamaesyce parryi*	CRPR: 2.3
Revolute spurge	*Chamaesyce revolute*	CRPR: 4.1
Death Valley sandmat	*Chamaesyce vallis-mortae*	CRPR: 4.2
Nine-awned pappus grass	*Enneapogon desvauxii*	CRPR: 2.2
Cave evening-primrose	*Oenothera cavernae*	CRPR: 2.1
Long-stem evening primrose	*Oenothera longissima*	CRPR: 2.2
Desert portulaca	*Portulaca halimoides*	CRPR: 4.2
Jackass clover	*Wislizenia refracta* ssp. *Refracta*	CRPR: 2.2
Desert pincushion	*Coryphantha chlorantha*	CRPR: 2.1

California Rare Plant Rank (CRPR) designations:

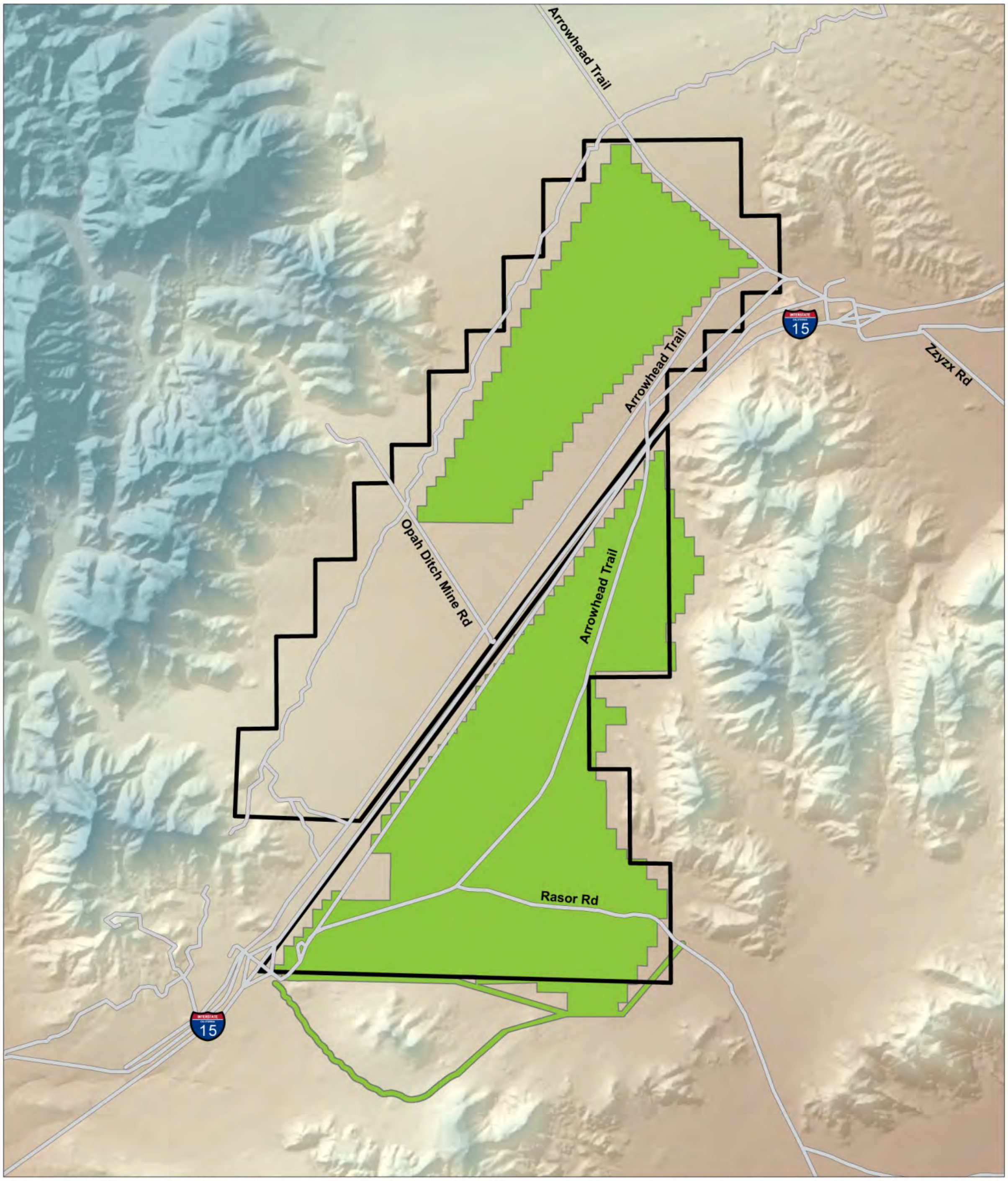
1B	Rare, threatened, or endangered in California and elsewhere.
2	Rare, threatened, or endangered in California, but more common elsewhere.
3	More information is needed – a review list.
4	Limited distribution – a watch list.

California Rare Plant Rank threat categories:

.1	Seriously endangered in California.
.2	Fairly endangered in California.
.3	Not very endangered in California.

Sources: URS 2009c; CSESA 2012

Figure 2.2-1: Focused Rare and Special-status Plant Survey Study Areas



SOURCE: ESRI 2012, URS 2009, C.S. Ecological Surveys and Assessments 2012, and Panorama Environmental, Inc. 2012 Scale: 1:65,000

LEGEND

2009 Botanical Survey Area

2012 Botanical Survey Area

0 1 2 Miles

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General Vegetation

Vegetation communities were mapped in 2009 using the criteria and definitions of Holland (1986) and Sawyer and Keeler-Wolfe (1995). Vegetation communities were remapped in fall 2012 at the alliance level using the keys and descriptions provided in *A Manual of California Vegetation* (Sawyer et al. 2009).

Cactus Species Inventory

An inventory of cactus species was documented in representative portions of the study area at the direction of the Barstow BLM Field Office in 2009. Type and quantity of cactus were documented using GPS locations, which were subsequently mapped using Geographic Information Systems (GIS) mapping software to determine cactus density.

Invasive Species

Both the spring 2009 and fall 2012 rare and special-status plant surveys included documentation of all plants observed in the survey area, including invasive species (URS 2009c; CSESA 2012). The locations of the invasive species located during the surveys were not mapped, although general locations and abundance of weeds were noted in the fall 2012 survey.

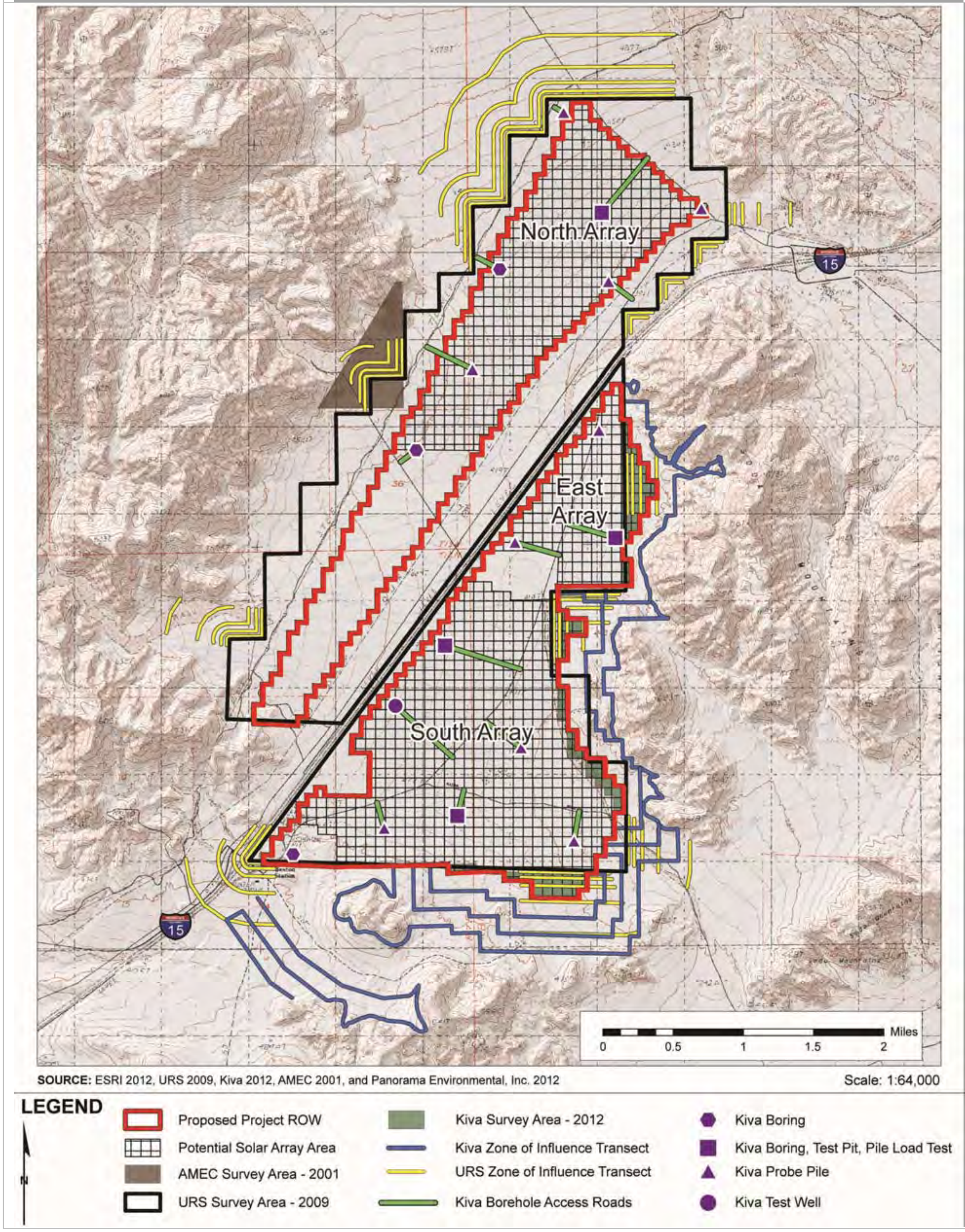
2.2.4 Desert Tortoise

2009 Survey

The 2009 desert tortoise (*Gopherus agassizii*) field survey adhered to the USFWS protocol for desert tortoises in the *Field Survey Protocol for Any Federal Action that May Occur within the Range of the Desert Tortoise* (USFWS 1992) and the survey protocol identified within *Preparing for Any Action that May Occur within the Range of the Mojave Desert Tortoise (Gopherus agassizii)* (USFWS 2009b). The survey protocol used is consistent with the current protocol for desert tortoise surveys (i.e., USFWS 2010). Survey protocols were defined through coordination with the Barstow BLM Field Office. Field surveys were conducted between May 4 and May 29, 2009, and October 11 and 19, 2012. The results of a 2001 survey for desert tortoise at the Opah Ditch Mine (AMEC 2001) were reviewed prior to conducting field surveys. Precipitation in winter 2008 and spring 2009 was average for the area. The weather monitoring station closest to the project area is located in Baker, California. Average precipitation between October and April is 2.86 inches in Baker. Rainfall between October 2008 and April 2009 measured 2.29 inches in Baker (WRCC 2013).

The 2009 field surveys consisted of 100 percent coverage transects spaced at 33-foot (10-meter) intervals within the 6,700-acre study area (URS 2009a). Surveyors also walked zone of influence transects outside of the survey area. Zone of influence transect locations were developed and approved in consultation with biologists from the Barstow BLM Field Office (Otahal 2009; Otahal 2012). The zone of influence for the 2009 survey included transects spaced at 100 feet (30 meters), 300 feet (91 meters), 600 feet (183 meters), 1,200 feet (366 meters), and 2,400 feet (732 meters), where applicable. Survey areas and the zone of influence transects are shown on Figure 2.2-2.

Figure 2.2-2: Desert Tortoise Survey Areas and Zone of Influence Transects



SOURCE: ESRI 2012, URS 2009, Kiva 2012, AMEC 2001, and Panorama Environmental, Inc. 2012

Scale: 1:64,000

To validate the accuracy of the 2009 protocol surveys, biologists conducted an additional intensive quality assurance/quality control (QA/QC) survey on 5 percent of the study area (USFWS 1992) (URS 2009a). This intensive survey effort was composed of 100 percent coverage using belt transects with spacing reduced to 10-foot (3-meter) widths and was conducted in randomly chosen, representative habitats within the study area. QA/QC transects were conducted perpendicular to the initial transect survey direction in order to maximize tortoise detection. A comparison was then made between data recorded from transects during the 100 percent survey effort (33-foot [10-meter] belt transects) and data obtained during the intensive QA/QC survey effort (10-foot [3-meter] belt transects). The data obtained from the QA/QC survey matched the data obtained from the 100 percent coverage survey.

2012 Supplemental Surveys

Desert tortoise surveys were conducted in October 2012 in a 220-acre area along the eastern and southern edges of the project site. This smaller area was surveyed because it was not included in the surveys conducted in 2009. These surveys were also conducted using the survey protocol identified within *Preparing for Any Action that May Occur within the Range of the Mojave Desert Tortoise (Gopherus agassizii)* (USFWS 2010). The fall 2012 survey included 100 percent coverage and transects were spaced at 33 feet (10 meters) throughout the 220-acre survey area. Zone of influence transects were also surveyed at spacings of 655 feet (200 meters), 1,312 feet (400 meters), and 1,968 feet (600 meters). Where areas within the zone of influence could not be accessed, additional suitable habitat areas were surveyed in nearby accessible areas (Figure 2.2-2) (Kiva Biological 2012a). Survey protocols and methods were defined in consultation with BLM, CDFW, and USFWS. Surveyor qualifications were reviewed and approved by BLM, CDFW, and USFWS prior to the survey. Precipitation during the summer of 2012 was above average for the area. The average precipitation in Baker during the summer monsoon season (July through September) is 1.14 inches. Rainfall between July and September of 2012 measured 3.08 inches (WRCC 2013).

An additional desert tortoise survey was conducted on October 19 and November 10 to 12, 2012, in areas proposed for geotechnical investigations (Figure 2.2-2). Two protocol transects were walked on each side of the existing access roads, and four protocol transects were walked for cross-country travel routes to each site. A protocol survey was conducted for a 200-foot by 200-foot area at each of the proposed 17 geotechnical investigation sites. All transects were walked at 10-meter intervals for the sites and access routes. Transects were not walked in the zone of influence adjacent to each of the geotechnical investigation sites because the area surrounding each site was surveyed in 2009 (Kiva Biological 2012b).

2.2.5 Mojave Fringe-toed Lizard

Mojave fringe-toed lizards (*Uma scoparia*) are found where wind-blown sand collects in isolated areas throughout the Mojave Desert (Stebbins 2003). The project area and surrounding areas were reviewed and suitable habitat areas (aeolian sand deposits) were defined using aerial photography and GIS data, and during field surveys (URS 2009d). In consultation with BLM, it was determined that focused surveys for Mojave fringe-toed lizards should be conducted in areas of suitable habitat downstream of the project ROW (URS 2009d). The suitable habitat covers approximately 703 acres and is located south-southeast of the project ROW, as shown on Figure 2.2-3. This area is defined as the Mojave fringe-toed lizard study area.

Surveys were conducted on July 19 through 22 and August 4 and 5, 2009. The study area was surveyed during daylight hours when the substrate temperatures (non-shade) were above 82.4 and below 122.0 degrees Fahrenheit (28 to 50 degrees Celsius). In the northern region of the study area (nearest to the project site), transects were walked in a manner to cover 100 percent of potential habitat areas. In the southern region, surveys focused on determining the presence and activity of the previously documented population. Detailed surveys were not conducted within the southern region (URS 2009d).

2.2.6 Bighorn Sheep

2011 SMS Survey

Surveys for Nelson's bighorn sheep (*Ovis canadensis nelsoni*) were conducted in the Soda Mountains in 2011 and 2012 (BRC 2011; Abella 2012a). BRC consulted with Regina Abella, CDFW Desert Bighorn Sheep Program Coordinator, to define the survey protocol.

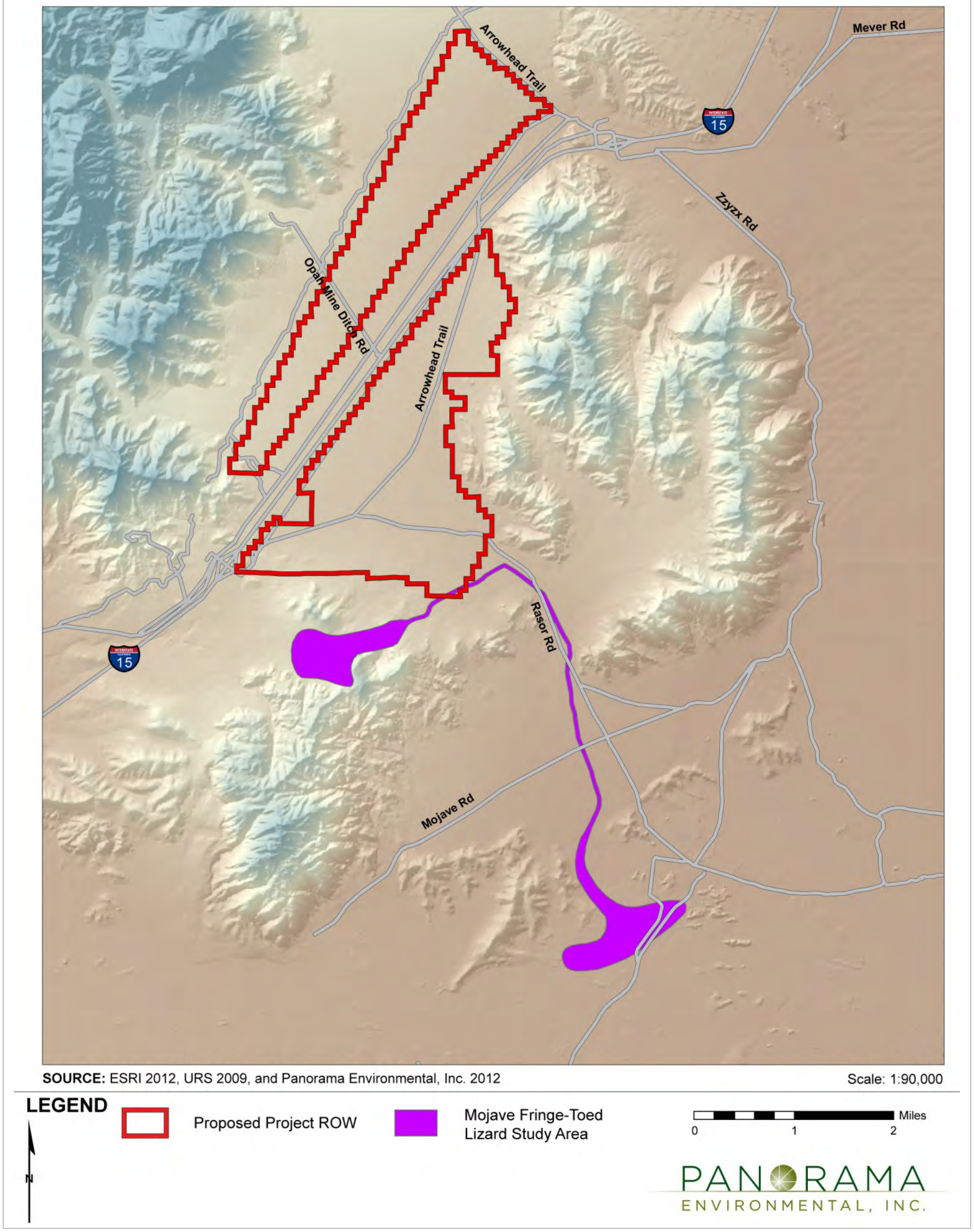
BRC conducted aerial surveys for bighorn sheep on March 21 and 22, 2011, and May 9, 2011, and ground surveys between March 23 and 25, 2011 (BRC 2011). The aerial surveys included six 2-hour flights. Aerial surveys were conducted north of I-15 within the Soda Mountains. Each canyon was flown up and down. Contouring passes were made at different elevations to fully cover tall cliffs and long, steep slopes. Ground surveys of the south Soda Mountains were conducted from observation points. During all aerial and ground-based surveys, biologists also scanned for any movement, sign, or habitat settings (e.g., water sources) that might accommodate or predict the presence of desert bighorn sheep. Potential water sources within the search area were identified in advance for surveying and evaluation. Data collected during the surveys included numbers of animals, age of animals, and herd composition, general behavior, location, and habitat, where feasible (BRC 2011). The areas that were aerially surveyed in 2012 are shown on Figure 2.2-4.

2012 CDFW Survey

CDFW conducted a ground survey for bighorn sheep on April 30 and May 1, 2012, in the south Soda Mountains near Zzyzx (Abella 2012a). All sheep that could be located on the east side of the range were counted. Three groups of biologists explored areas not visible from the road.

One group climbed from the Desert Studies Center to the main ridge top above the road and followed the ridge north. Another group ascended a wash northwest of the main ridge and climbed into a separate section of the range. The third group searched further south of the field station along the main ridge. The location, number of sheep, class, and gender were logged at each sheep siting (Abella 2012a).

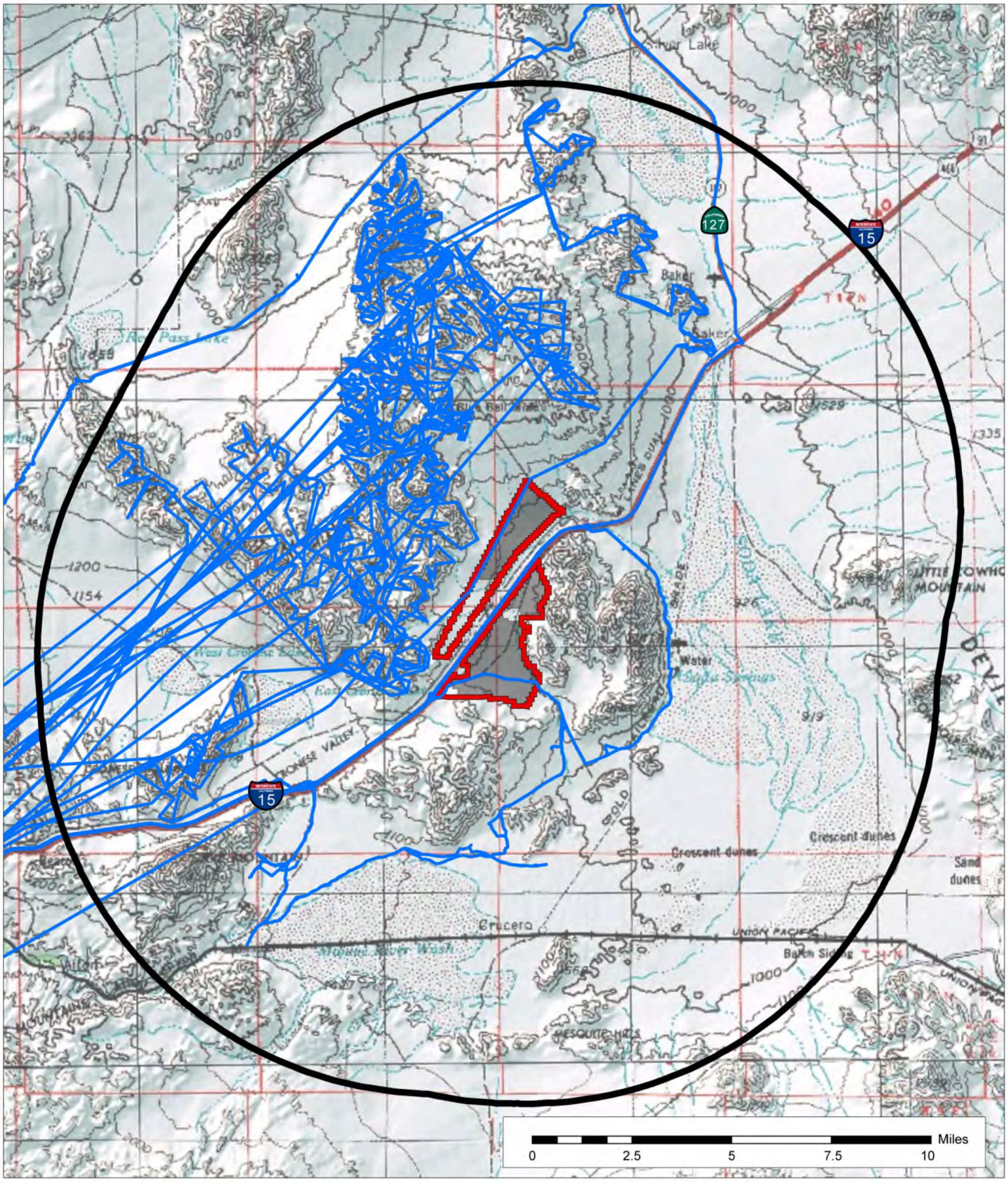
Figure 2.2-3: Mojave Fringe-toed Lizard Survey Area



SOURCE: ESRI 2012, URS 2009, and Panorama Environmental, Inc. 2012

Scale: 1:90,000

Figure 2.2-4: 2011 Bighorn Sheep and Golden Eagle Survey Locations



SOURCE: ESRI 2012, BRC 2011, and Panorama Environmental, Inc. 2012

Scale: 1:250,000

LEGEND

N

Proposed Project ROW

Potential Solar Array Area

BRC Survey Routes

10 Mile Buffer

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CDFW subsequently installed game cameras at the Opah Ditch and Zzyzx Road underpasses at I-15. Two game cameras were installed at each underpass in August 2012 (Burke 2012). Data are downloaded from the cameras monthly and analyzed by CDFW (Abella 2012b).

2.2.7 Golden Eagle

BRC conducted aerial surveys for golden eagle on March 21 and 22, 2011, and May 9, 2011, and ground surveys between March 23 and 25, 2011 (BRC 2011). Golden eagle surveys were conducted in conformance with guidelines provided in the *Interim Golden Eagle Inventory and Monitoring Protocols; and other Recommendations* (Pagel et al. 2010). Aerial surveys included two to four passes performed at slower speeds at cliffs that had large nests, copious whitewash, or that were suspected of having nests. Multiple passes were made to allow closer observation. Where golden eagles were observed nest conditions including presence of nestlings and adult birds were documented (BRC 2011).

2.2.8 Bats

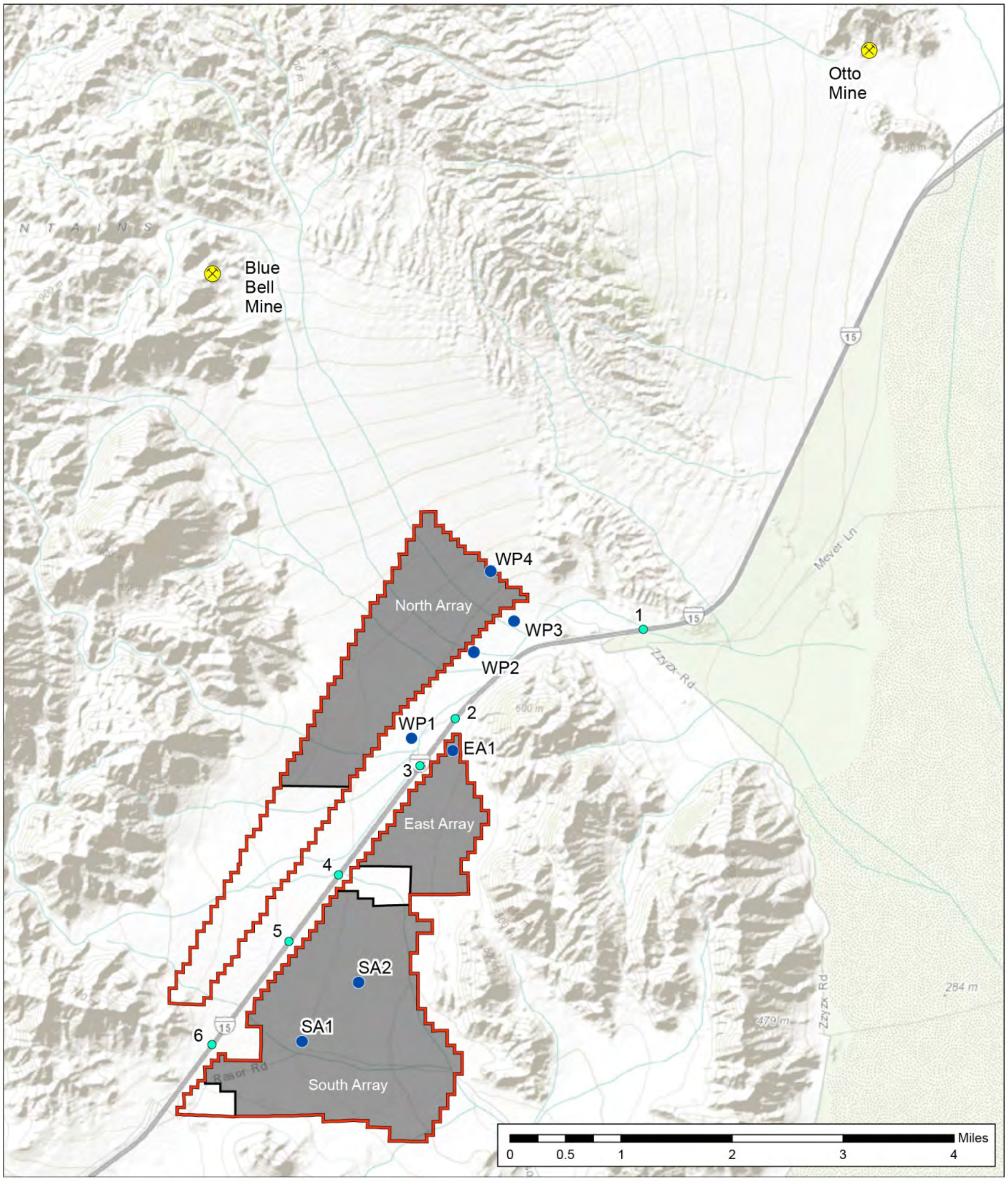
Bat surveys were conducted using acoustic monitoring and roost surveys (Brown-Berry Biological Consulting 2012). Survey methods and biologist qualifications were submitted to and approved by BLM and CDFW prior to conducting surveys. Acoustic monitoring was conducted to identify bat species using the project area and sample seasonal bat activity levels. Acoustic surveys included monitoring at up to seven locations between August 31 and September 4, 2012 (Figure 2.2-5). Six locations (three in the western portion of the project area and three in the eastern portion of the project area) were monitored acoustically for 3 or 4 nights. A seventh location, WP3, was monitored for the first night and then relocated to WP4 (Figure 2.2-5).

Roost surveys were conducted at the Blue Bell Mine complex (approximately 2 miles north of the project site) and at culverts, overpasses, and bridges along I-15 between Rasor Road and Zzyzx Road. Roost surveys were conducted both during the day and at night. Occupied mines were monitored at dusk to obtain exit counts.

2.2.9 Avian Point Counts

Avian point counts were conducted in the spring and fall of 2009 (URS 2010). Field survey methods were derived and adapted from the *BLM Solar Facility Point Count Protocol* (2009) and *Managing and Monitoring Birds Using Point Counts* (Ralph et al. 1995). Survey methods were approved by the Barstow BLM Field Office (Otahal 2009) prior to initiating field surveys.

Figure 2.2-5: Bat Survey Locations



SOURCE: Dr. Patricia Brown 2012, ESRI 2012, USGS 2012, and Panorama Environmental, Inc. 2012

Scale: 1:85,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Bat Detector
- Culvert
- Mine

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Each point was surveyed by a qualified biologist[3] over four consecutive weeks during the spring (breeding season) and the fall (wintering season). Eighty point count locations were established for the fall and spring surveys (Figure 2.2-6). Point count locations were identified to provide representative spacing throughout the project area (one point count transect per square mile with eight point counts per transect). Point count locations were marked and numbered in the field. Each point count survey started at sunrise and continued during the morning hours. During the survey, every point was visited for a 10-minute observation period and data were collected on all avian species observed within a 100-meter radius. The presence of avian species was based on direct observation, vocalization, or avian sign (e.g., nests, pellets, and whitewash). Avian taxonomy followed *The Sibley Guide to Birds* (Sibley 2000).

2.3 WATERS

2.3.1 Waters of the United States

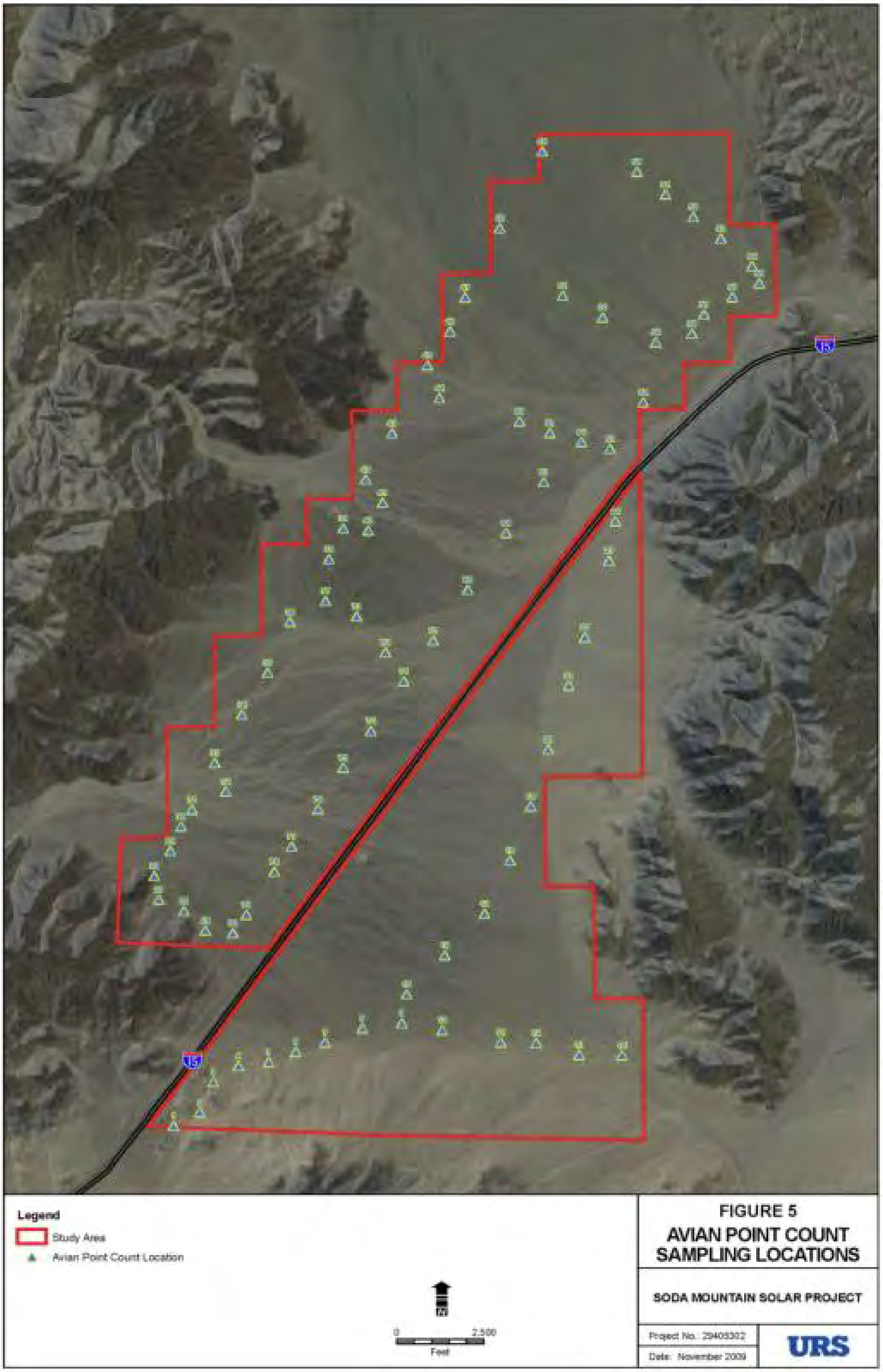
2009 Delineation

A waters of the United States (WoUS) delineation, including wetlands, was conducted for the project in May and July of 2009 (URS 2009e). Data related to USACE-defined WoUS, including wetlands, were recorded in the field with hand-held GPS units, on aerial maps, and wetland data sheets, where applicable. Wetlands were defined in accordance with the methodology for routine determinations set forth in the *USACE Wetland Delineation Manual* (EL 1987) and the *Arid West Regional Supplement* (USACE 2006).

WoUS features were identified in the field by the presence of a well-defined bed and bank and Ordinary High Water Mark (OHWM). Identification and location of the OHWM followed guidance provided in Lichvar and Wakely (2004) and Lichvar et al. (2006). Because of the vast size and complexity of wash features within the study area, the characterization and mapping of the OHWM within features was determined through a combination of field methods and mapping using high resolution (approximately 1-meter), color aerial map imagery. These methods included pedestrian-based transects (generally positioned perpendicular to large braided wash features), and meandering pedestrian surveys along the length of representative features. Preliminary reconnaissance-based surveys were also performed along access roads and trails to more easily initially identify features supporting an OHWM for subsequent pedestrian-based mapping. For a portion of the excessively braided features within the study area, several perpendicular transects (e.g., upper and middle elevations) were walked and the

[3] For the purposes of the avian point count surveys, a qualified biologist is an individual who is familiar with the vocalizations and plumage characteristics of adult and juvenile birds whose range includes southern California and the Mojave Desert. The qualified biologist has sufficient education and field experience in southern California ecology and biology to be able to identify likely local species and to understand wildlife behavior.

Figure 2.2-6: Avian Point Count Locations



width of the OHWM was inferred between transects using the high-resolution aerial maps. Some features were also mapped prior to performing transects in order to field-verify the accuracy of the aerial mapping being used by field surveyors.

USACE will determine jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus with a Traditionally Navigable Waters (TNW) (USACE 2008):

- Non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to, but that do not directly abut, a relatively permanent non-navigable tributary

In general, USACE does not assert jurisdiction over the following features (USACE 2007):

- Ditches: "Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water (greater than three months) generally are not jurisdictional under the CWA, because they are not tributaries or they do not have a significant nexus to TNWs;"
- Swales: "Swales are generally shallow features in the landscape that may convey water across upland areas during and following storm events. Swales usually occur on relatively flat slopes and typically have grass or other low-lying vegetation throughout the swale. Swales are generally not waters of the U.S. because they are not tributaries or they do not have a significant nexus to TNWs."

USACE will apply the significant nexus standard as follows:

- A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of downstream traditional navigable waters. Significant nexus includes consideration of hydrologic and ecologic factors.

2012 Delineation Update

The 2009 wetland delineation (URS 2009e) was updated with additional field work on June 20 and December 13, 2012, in response to consultation with USACE staff. Water features were identified in the field using *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Lichvar and McColley 2008). The OHWM was defined using hydrologic indicators including changes in soil texture and deposition, changes in vegetation density, deposition of debris, and a defined bed and bank. Water features were located west of I-15 by travelling along the fuel pipeline road just east of the North Array area. Water features were located within the East and South Array areas by travelling along Rasor Road to Arrowhead Trail Highway and following Arrowhead Trail Highway to I-15. Both the fuel pipeline road and Arrowhead Trail are perpendicular to the direction of flow through the project area. A GPS point was recorded at each location where a water feature was observed along these routes. Field data sheets were completed at representative water features.

Acreage of water features/minor drainages were calculated by determining an average width for waters within each area delineated. The acreage of major drainages or washes was calculated using GIS tools.

2.3.2 Waters of the State

2009 Delineation

Suspected CDFW jurisdictional areas were assessed in the field for the presence of definable streambeds (bed, bank, and channel), a defined bed and bank, and any associated riparian habitat. Streambeds and suspected riparian habitats were evaluated using California Fish and Game Code Section 1600 (et seq.) and guidance described in *A Field Guide to Lake and Streambed Alteration Agreements Sections 1600-1607* (CDFW ESD 1994).

The location of the bed and bank for each feature was determined in the field and the results were delineated on a high-resolution aerial map. Vegetation within and adjacent to features containing a defined bed, bank, or channel and OHWM were recorded based on Hickman, ed. (1993) and Holland (1986).

2012 Update

The delineation of Waters of the State (WoS) was updated in 2012 to respond to updated guidance and consultation with CDFW. WoS were delineated consistent with the methods defined in *A Review of Stream Processes and Forms in Dryland Watersheds* (Vyverberg 2010). Vyverberg (2010) defines the watercourse boundary by the larger flow zone bounding the channel network where channel relocations are likely to occur. The distributary channel network within the watercourse may include single-thread, compound, and/or discontinuous channel types. The watercourse boundary was defined primarily by changes in sediment types and vegetation conditions.

Data sources used in defining WoS included:

- *Draft Jurisdictional Determination Report* (URS 2009e)
- Aerial photography
- USGS topographic map (West of Soda Lake Quadrangle)
- GPS data for field verification

An initial desktop WoS delineation was conducted using the data sources listed above. WoS boundaries were defined where changes in landscape patterns coincided with likely WoS boundaries.

The desktop WoS delineation was verified in the field by collecting WoS data points with a GPS device. The WoS delineation was refined to reflect the field data. Lateral channel migration was assessed through evaluation of channel incision, concretion, and review of historical aerial photographs from 1953, 1978, 1984, 2002, and 2010 (RMT 2010).

3 RESULTS

3.1 INTRODUCTION

This section describes the results of the literature review and field surveys. It also includes, where appropriate, analyses of whether a species could occur based on the species' known habitat requirements and the type of habitat present in the project area.

3.2 VEGETATION

A list of vascular plants identified in the survey area during the 2009 and 2012 surveys is provided in Appendix A. Nine of these plants are considered invasive (CDFA 2012).

3.2.1 Vegetation Communities

The 6,770-acre survey area was mapped in 2009 as Mojave creosote bush scrub and Mojave wash scrub vegetation communities. Areas surveyed as Mojave wash scrub habitat in 2009 (i.e., west of I-15 between the highway and the fuel pipeline) were removed from the proposed ROW in 2011. Vegetation communities within the revised project area were re-mapped in 2012 at the alliance level. Four vegetation alliances and two cover types (disturbed and developed ground) were observed within the SMS survey area in 2012 (Table 3.2-1 and Figure 3.2-1). Mojave wash scrub was not identified within the revised project area (CSESA 2012).

Vegetation Alliances

Creosote Bush-White Bursage Scrub

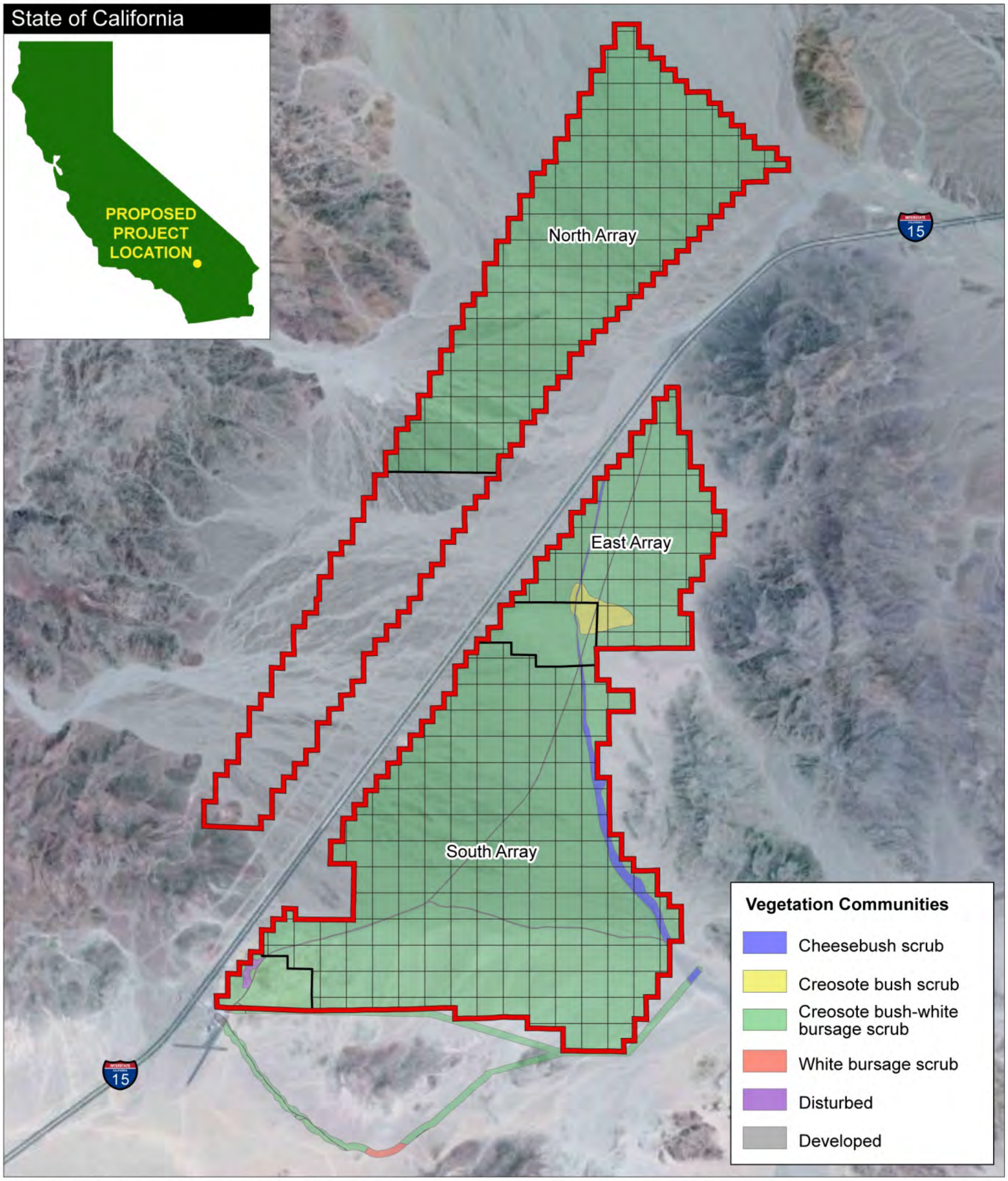
The creosote bush-white bursage scrub vegetation community is common throughout the lower elevations of the Mojave Desert and covers about 97 percent of the 2012 survey area. There was little understory cover present in this community during the surveys. Devil's spineflower (*Chorizanthe rigida*) was the predominant herbaceous species in areas of desert pavement. The alluvial fans that support this vegetation type contain numerous intermittent braided channels, washes, and gullies that occasionally support species typical of desert washes, as listed in Table 3.2-1. These wash species occurred intermixed with other vegetation species in areas where creosote and white bursage were dominant. Vegetation alliances were defined in accordance with *A Manual of California Vegetation, Second Edition* (Sawyer et al. 2009). Alliances are determined based on the dominant species and can include other non-dominant species. Wash species were not present in stands with enough cover or of sufficient size to warrant mapping as separate vegetation alliances.

Table 3.2-1: Vegetation Alliance and Cover Type Acreages

Vegetation Alliance/Cover Type	Dominant Species	Understory and Associated Species	Acres
Creosote bush-white bursage scrub	Creosote bush (*Larrea tridentata*) White bursage (*Ambrosia dumosa*)	Saltbush species (*Atriplex* spp.) Leafy rattan (*Krameria erecta*) Cholla species (*Cylindropuntia* spp.) Sandmat species (*Chamaesyce* spp.) Hairy dalea (*Dalea mollissima*) Manybristle cinchweed (*Pectis papposa* var. *papposa*) Devil's spineflower (*Chorizanthe rigida*) Sweetbush (*Bebbia juncea* var. *aspera*) Woolly brickellbush (*Brickellia incana*) Slender poreleaf (*Porophyllum gracile*) Desert senna (*Senna armata*) Brittlebush species (*Encelia* spp.)	3,961
Cheesebush scrub	Cheesebush (*Ambrosia salsola*)	Sweetbush (*Bebbia juncea* var. *aspera*) Woolly brickellbush (*Brickellia incana*) Thurber's sandpaper plant (*Petalonyx thurberi* ssp. *thuberi*) White bursage (*Ambrosia dumosa*) Creosote bush (*Larrea tridentata*)	47
Creosote bush scrub	Creosote bush (*Larrea tridentata*)	White bursage (*Ambrosia dumosa*)	35
White bursage scrub	White bursage (*Ambrosia dumosa*) Big galleta (*Hilaria rigida*)	Creosote bush (*Larrea tridentata*) Sand verbena (*Abronia villosa* var. *villosa*) Hairy prairie clover (*Dalea mollis*) Desert lily (*Hesperocallis undulata*)	5
Developed	N/A	N/A	20
Disturbed	N/A	N/A	5
		Total	**4,073**

Source: CSESA 2012

Figure 3.2-1: Vegetation Communities Observed within the Study Area



SOURCE: C.S. Ecological Surveys and Assessments 2012, ESRI 2012, and Panorama Environmental, Inc. 2012

Scale: 1:55,000

LEGEND

Proposed Project ROW

Potential Solar Array Area

0 0.25 0.5 0.75 1 2 Miles

N

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Cheesebush Scrub

Cheesebush scrub vegetation community is typically found in washes, intermittent channels, and arroyos in the Mojave Desert. A large wash that runs southwest to northeast through the South Array and East Array was mapped as this alliance. The wash is the only location of this community in the project area.

Creosote Bush Scrub

Creosote bush scrub vegetation community is similar to creosote bush-white bursage scrub, but white bursage is absent, or present at less than 1 percent cover (Sawyer et al. 2009). One moderately sized area within the East Array was mapped as this alliance. Shrub diversity in this area was very low, consisting primarily of widely spaced creosote bush and occasional white bursage at very low cover.

White Bursage Scrub

The white bursage scrub alliance occurs in a small area with deep, sandy soils along the proposed Rasor Road realignment. Creosote bush cover is very low, and the vegetation is co-dominated by white bursage and big galleta (*Hilaria rigida*) in this area.

Developed and Disturbed Land

The existing unpaved roads within the SMS survey area were mapped as developed land. The abandoned mine near the proposed operations and maintenance facility in the southwestern corner of the South Array was mapped as disturbed ground.

3.2.2 Invasive Species

At least nine weed species were identified during plant surveys, as shown in Table 3.2-2. The 2009 surveys also resulted in identification of several plants that were not classified to the species or subspecies level. Some of these plants may represent additional invasive species, depending on which species or subspecies is present (Table 3.2-3).

3.2.3 Rare and Special-status Plants

Rare and special-status plant species with the potential to occur in the project area were identified through literature reviews and botanist experience with similar habitats in the Mojave Desert. The potential for species occurrence was verified during spring 2009 and fall 2012 rare and special-status plant surveys, as shown in Table 3.2-4. A discussion of local populations, habitat requirements, and life history is provided for rare and special-status plant species found in the project area or determined to have at least a low potential to occur in the area. No special-status plants were located within the project area. Rare plants located within the project area are shown on Figure 3.2-2.

Table 3.2-2: Weed Species Identified During Project Area Surveys

Common Name (*Scientific Name*)	Weed List	Abundance[1]	CAL-IPC Rating[2] Impact	Invasiveness	Distribution	Documented Level	CDFA Rating
Crystalline iceplant (*Mesembryanthemum crystallinum*)	CAL-IPC	Several patches observed in the South Array.	B	B	C	3.7	N/A
Sahara mustard (*Brassica tournefortii*)	CAL-IPC[3], BLM	Most abundant in sandy soils in the South Array. Scattered in patches throughout survey area.	A	A	B	2.3	N/A
Redstem filaree (*Erodium cicutarium*)	CAL-IPC	Several plants observed in the South Array.	C	C	A	3.1	N/A
Mediterranean barley (*Hordeum marinum*)	CAL-IPC	No record of abundance.	B	B	A	2.8	N/A
Mediterranean grass (*Schismus barbatus*)	CAL-IPC, BLM	Widespread throughout the survey area.	B	C	A	2.3	N/A
Rattail fescue (*Vulpia myuros*)	CAL-IPC	No record of abundance.	B	B	A	3	N/A
Toothed dodder (*Cuscuta denticulata*)	CDFA[4]	No record of abundance.	N/A	N/A	N/A	N/A	C
Five-stamen tamarisk (*Tamarix chinensis*)	BLM, CDFA	One population observed in the South Array.	N/A	N/A	N/A	N/A	B
Cheatgrass (*Bromus tectorum*)	BLM, CAL-IPC	Several plants observed in the South Array.	A	B	A	3.1	N/A

Notes

1 Abundance was recorded only during the fall 2012 (October and November) survey. All species observed in fall 2012 are annuals except for five-stamen tamarisk (a perennial tree), and their abundance is more appropriately assessed in spring.

2 Key A: high B: moderate C: limited D: none

3 California Invasive Plant Council

4 California Department of Food and Agriculture

Sources: URS 2009c; CSESA 2012

Table 3.2-3: Potential Additional Weed Species in the Project Area

Identified Plant	Listed Weed Species BLM	CDFA	IPC
Foxtail chess (*Bromus madtritensis*)	Not listed	Not listed	Red brome (*Bromus madritensis* ssp. *rubens*)
Mustard (*Sisymbrium* sp.)	Not listed	Not listed	London rocket (*Sisymbrium irio*)

Source: URS 2009c

Table 3.2-4: Rare and Special-status Plants and Potential to Occur in the Project Area

Species	Status	Habitat Requirements	Potential to Occur in Project Area	Blooming Season
Desert wing fruit (*Acleisanthes nevadensis*)	CRPR: 2.1	Rocky, gravelly soil with various geological origins in Joshua tree woodland and Mojavean desert scrub at elevations between 2,610 and 4,100 feet amsl.	**Low:** Suitable habitat is present, but this species was not observed during surveys conducted after the flowering period. Conditions for its detection were marginal during the surveys. All known locations are at higher elevations. The nearest known occurrence is approximately 35 miles to the northeast in Shadow Valley (CDFW 2012c).	April to September
Wright's beebrush (*Aloysia wrightii*)	CRPR: 4.3	Rocky, often carbonate substrates, in Joshua tree woodland and pinyon and juniper woodland at elevations between 2,950 and 5,250 feet amsl.	**Absent:** Suitable habitat is not present and the species was not observed in surveys conducted during the flowering period. The nearest known occurrence is approximately 40 miles to the northeast in the Clark Mountains (CCH 2012).	April to October
Small-flowered androstephium (*Androstephium breviflorum*)	CRPR: 2.2	The small-flowered androstephium occurs in the deserts of the southwestern states, including deserts in eastern California, where the plant is at the edge of its range and its occurrences are poorly documented. It has been identified from I-15 northwest of Afton Canyon to Cave Mountain and Cronese Valley, as well as east of Twentynine Palms in Cadiz Valley; there are two unconfirmed reports in other California locations. Its habitat consists of open sandy flats and bajadas, typically stabilized blowsands, at elevations between 890 and 2,100 feet amsl in California, and in locations that are cold in the winter and have relatively high summer rainfall levels.	**Low:** The small-flowered androstephium was not observed during a May 2009 survey of the project area; however, the survey was outside the flowering season. There is marginally suitable habitat within the project area and south of the project area. The nearest occurrence is approximately 10 miles west (CDFW 2012c).	March to April

Table 3.2-4 (*Continued*): Special-status Plants and Potential to Occur in the Project Area

Species	Status	Habitat Requirements	Potential to Occur in Project Area	Blooming Season
White bearpoppy (*Arctomecon merriamii*)	CRPR: 2.2	Perennial herb. Occurs in chenopod scrub and Mojavean desert scrub on rocky soils. From 1,610 to 5,905 feet amsl in elevation.	**Absent:** Suitable habitat is present; however, this species was not observed during surveys conducted in May 2009, during the flowering period (URS 2009c). The closest occurrence is approximately 15 miles north (CDFW 2012c).	April to May
Mojave milkweed (*Asclepias nyctaginifolia*)	CRPR: 2.1	Mojavean desert scrub and pinyon and juniper woodland, often in washes at elevations between 2,870 and 5,580 feet amsl.	**Absent:** Suitable habitat is present, but this species was not observed during surveys conducted during the flowering period (URS 2009c). The nearest known occurrence is approximately 35 miles to the northeast in Shadow Valley near Valley Wells (CDFW 2012c).	May to June
Three-awned grama (*Bouteloua trifida*)	CRPR: 2.3	Mojavean desert scrub on rocky carbonate substrates at elevations between 2,300 and 6,560 feet amsl.	**Absent:** Suitable habitat is not present and the species was not observed during surveys conducted after the flowering period. The nearest known occurrence of this species is approximately 40 miles to the southeast on limestone substrates in the Providence Mountains (CDFW 2012c).	May to September
Alkali mariposa lily (*Calochortus striatus*)	CRPR: 1B.2	Perennial bulbiferous herb occurring in chaparral, chenopod, and Mojavean desert scrub, ephemeral washes, and meadows and seeps (alkaline, mesic). From 230 to 5,230 feet amsl in elevation.	**Absent:** Suitable habitat is present; however, this species was not observed during surveys conducted in May 2009, during the flowering period (URS 2009c). The nearest location is approximately 35 miles west (CDFW 2012c).	April to June
Emory's crucifixion-thorn (*Castela emoryi*)	CRPR: 2.3	Gravelly soil in Mojavean desert scrub, on playas and in Sonoran desert scrub at elevations between 300 and 2,200 feet amsl.	**Present:** This species was observed during both the 2009 and 2012 surveys of the project area (URS 2009c; CSESA 2012).	April to September

Table 3.2-4 (*Continued*): Special-status Plants and Potential to Occur in the Project Area				
Species	**Status**	**Habitat Requirements**	**Potential to Occur in Project Area**	**Blooming Season**
Abrams' spurge (*Chamaesyce abramsiana*)	CRPR: 2.2	Mojavean desert scrub, Sonoran desert scrub on sandy or silty substrates at elevations between 0 and 3,000 feet amsl.	**Absent:** Suitable habitat is present, but this species was not observed during surveys conducted during the flowering period. The nearest known occurrence is approximately 40 miles to the southeast in the Providence Mountains (CDFW 2012c).	September to November
Parry's spurge (*Chamaesyce parryi*)	CRPR: 2.3	Desert dunes and Mojavean desert scrub on sandy soils at elevations between 1,300 and 2,400 feet amsl.	**Absent:** Suitable habitat is present, but this species was not observed during surveys conducted during the flowering period. The nearest known occurrence is approximately 30 miles to the southeast in the Kelso Dunes (CDFW 2012c).	May to November
Revolute spurge (*Chamaesyce revolute*)	CRPR: 4.1	Rocky soils in Mojavean desert scrub at elevations between 3,590 and 10,170 feet amsl.	**Absent:** Suitable habitat is not present and the species was not observed during surveys conducted during the flowering period. The nearest known location of this species is approximately 40 miles to the southeast in the Providence Mountains at over 3,280 feet amsl on rocky carbonate soil (CCH 2012).	August to September
Death Valley sandmat (*Chamaesyce vallis-mortae*)	CRPR: 4.2	Mojavean desert scrub on sandy or gravelly substrates at elevations between 750 and 4,790 feet amsl.	**Absent:** Suitable habitat is present but this species was not observed during surveys conducted during the flowering period. The nearest known occurrence of this species is approximately 25 miles to the southwest at Alvord Mountain (CCH 2012).	May to October
White-bracted spineflower (*Chorizanthe xanti* var. *leucotheca*)	CRPR: 1B.2	Annual herb. Occurs in Mojavean desert scrub and pinyon and juniper woodland. From 985 to 3,950 feet amsl in elevation.	**Absent:** Suitable habitat is present; however, this species was not observed during surveys conducted in May 2009, during the flowering period (URS 2009c). There are no observances of this species within 50 miles (CDFW 2012b).	April to June

Table 3.2-4 (*Continued*): Special-status Plants and Potential to Occur in the Project Area

Species	Status	Habitat Requirements	Potential to Occur in Project Area	Blooming Season
Desert pincushion (*Coryphantha chlorantha*)	CRPR: 2.1	Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland on gravelly, rocky carbonate substrates at elevations between 150 and 5,590 feet amsl.	**Absent:** Suitable habitat for this species is not present and it was not observed during surveys conducted after the flowering period. This cactus can be detected year-round. The closest recorded occurrence of this species is approximately 15 miles to the northeast on carbonate substrates in the Shadow Mountains (CDFW 2012c).	April to September
Harwood's eriastrum (*Eriastrum harwoodii*)	CRPR: 1B.2	Harwood's eriastrum grows in relatively uncommon semi-stabilized sand dunes in the deserts of San Bernardino County. Only approximately 12 sites are known, but this may be a result of lack of collecting rather than rarity. It occurs with desert lily (*Hesperocallis undulate*), birdcage evening primrose (*Oenothera* ssp. *deltoids*), big galleta grass (*Pleuraphis rigida*), and pink sand verbena (*Abronia villosa*).	**Absent:** Suitable habitat is not present and the species was not observed during surveys conducted during the flowering period. The nearest occurrence is approximately 5 miles south in the Mojave River Wash (CDFW 2012b).	Mach to June
Nine-awned pappus grass (*Enneapogon desvauxii*)	CRPR: 2.2	Rocky carbonate soils in pinyon and juniper woodland at elevations between 4,180 and 5,990 feet amsl.	**Absent:** Suitable habitat is not present and the species was not observed during surveys conducted after the flowering period. The nearest known occurrence is approximately 40 miles to the northeast on rocky carbonate substrate in the Clark Mountains (CDFW 2012c).	August to September
Utah vine milkweed (*Funastrum utahense*)	CRPR: 4.3	Perennial herb. Occurs in Mojave desert scrub and Sonoran desert scrub on sandy or gravelly soils. From 490 to 4,710 feet amsl in elevation.	**Present:** This species was observed during both the 2009 and 2012 surveys of the project area (URS 2009c; CSESA 2012).	April to June

Table 3.2-4 (*Continued*): Special-status Plants and Potential to Occur in the Project Area

Species	Status	Habitat Requirements	Potential to Occur in Project Area	Blooming Season
Parish club-cholla (*Grusonia parishii*)	CRPR: 2.3	Perennial stem succulent. Occurs in Mojave desert scrub, Sonoran desert scrub, and Joshua tree woodland. From 985 to 5,000 feet amsl in elevation. Occasionally known to bloom as late as July.	**Absent:** Suitable habitat is present; however, this species was not observed during surveys conducted in May 2009, during the flowering period (URS 2009c). The nearest occurrence is approximately 45 miles east (CDFW 2012b).	May to June
Cave evening-primrose (*Oenothera cavernae*)	CRPR: 2.1	Great Basin scrub, Joshua tree woodland, and Mojavean desert scrub on gravelly calcareous substrates or limestone outcrops at elevations between 2,490 and 4,200 feet amsl.	**Absent:** Suitable habitat is not present and the species was not observed during surveys conducted during the flowering period. The nearest known occurrence is approximately 50 miles to the northeast in the Clark Mountains (CDFW 2012b).	March to November
Long stem evening-primrose (*Oenothera longissima*)	CRPR: 2.2	Mojavean desert scrub and pinyon and juniper woodland at seasonally mesic sites at elevations between 3,280 and 5,580 feet amsl.	**Absent:** No suitable mesic habitat is present on the project site and this species was not observed during surveys conducted after the flowering period. The closest known occurrence of this species is approximately 35 miles to the southeast in the Providence Mountains (CDFW 2012c).	July to September
Short-joint beavertail cactus (*Opuntia basilaris* var. *brachyclada*)	CRPR: 1B.2	Stem succulent shrub. Occurs in chaparral, Joshua tree "woodland," Mojavean desert scrub, alluvial scrub, and in pinyon and juniper woodland, often on sandy soils or coarse, granitic loam. Occurs from 1,395 to 5,910 feet amsl in elevation.	**Absent:** Suitable habitat is present; however, this species was not observed during surveys conducted in May 2009, during the flowering period (URS 2009c). There are no observances of this species within 50 miles (CDFW 2012b).	April to June
Desert portulaca (*Portulaca halimoides*)	CRPR: 4.2	Sandy soils in Joshua tree woodland at elevations between 3,280 and 3,940 feet amsl.	**Low:** Suitable habitat is present, but this species was not observed during surveys conducted after the flowering period. Conditions for its detection were marginal during the surveys. The nearest known occurrence of this species is approximately 35 miles to the northeast in Shadow Valley near Valley Wells (CCH 2012).	September

Table 3.2-4 (*Continued*): Special-status Plants and Potential to Occur in the Project Area

Scientific NameCommon Name	Status	Habitat Requirements	Potential to Occur in Project Area	Blooming Season
Latimer's woodland gilia (*Saltugilia latimer*)	CRPR: 1B.2	Annual herb. Occurs in chaparral, Mojavean desert scrub, and Pinyon and juniper woodland, usually on granitic rocky or sandy soils, sometimes near washes. From 1,310 to 6,235 feet amsl in elevation.	**Absent:** Suitable habitat is present; however, this species was not observed during surveys conducted in May 2009, during the flowering period (URS 2009c). The nearest observance is approximately 50 miles west near the Granite Mountains (CDFW 2012b).	March to June
Jackass-clover (*Wislizenia refracta* ssp. *refracta*)	CRPR: 2.2	Desert dunes, Mojavean desert scrub, playas, and Sonoran desert scrub at elevations between 1,970 and 2,620 feet amsl.	**Absent:** Suitable habitat is present, but this species was not observed during surveys conducted during the flowering period. The closest known occurrence of this species is approximately 35 miles to the southwest near Coyote Lake (CDFW 2012c).	April to November

California Rare Plant Rank designations:

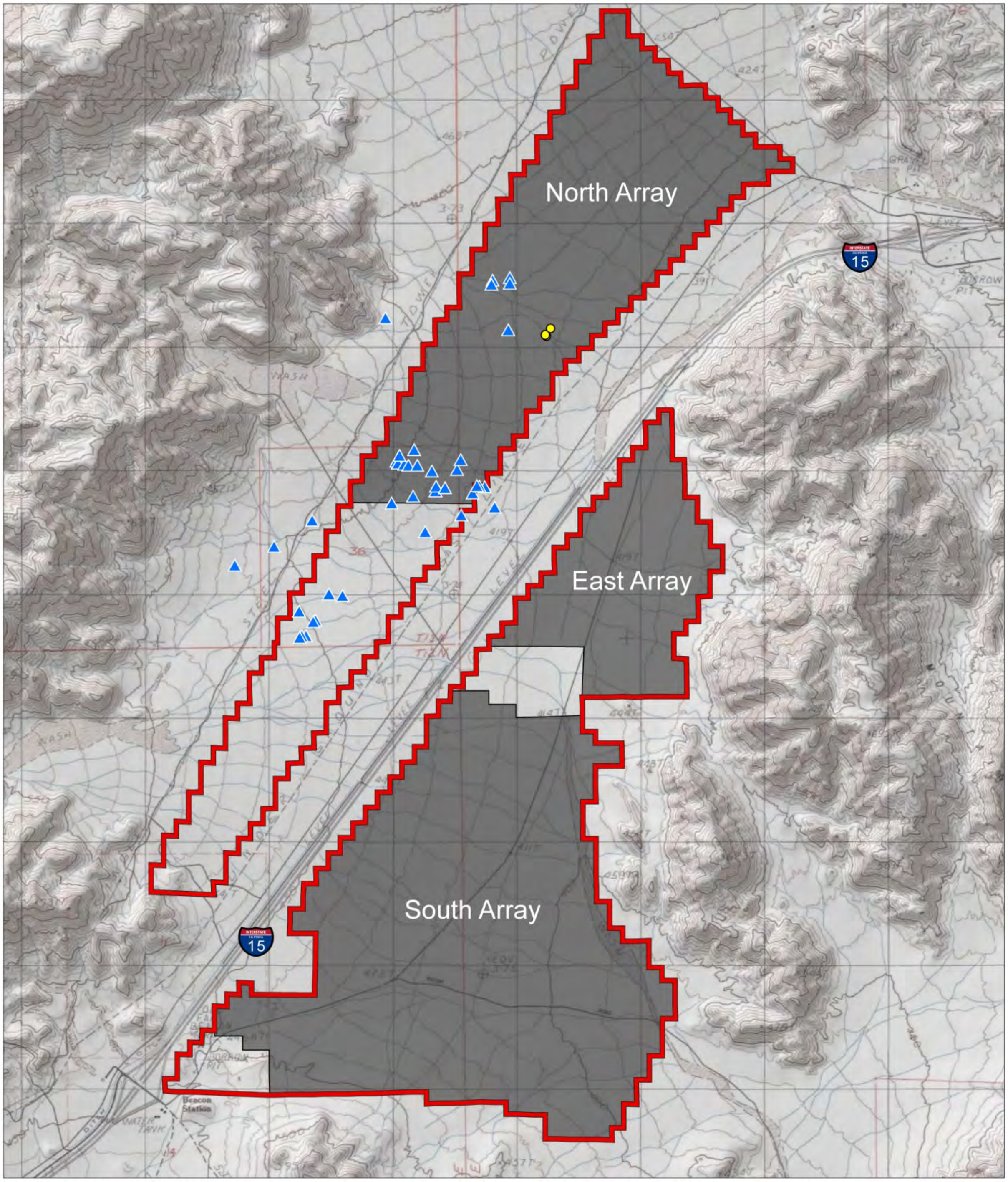
- 1B Rare, threatened, or endangered in California and elsewhere.
- 2 Rare, threatened, or endangered in California, but more common elsewhere.
- 3 More information is needed – a review list.
- 4 Limited distribution – a watch list.

California Rare Plant Rank threat categories:

- .1 Seriously endangered in California.
- .2 Fairly endangered in California.
- .3 Not very endangered in California.

Sources: URS 2009c; CSESA 2012; CNPS 2012; CDFW 2012b; CDFW 2012c; Sanders 2012a; Sanders 2012b

Figure 3.2-2: Special-status Plant Locations



SOURCE: ESRI 2012, URS 2009, C.S. Ecological Surveys and Assessmnets 2012, and Panorama Environmental, Inc. 2012

Scale: 1:50,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Utah Vine Milkweed
- Emory's Crucifiction Thorn

Miles: 0, 0.5, 1, 1.5, 2

N

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Rare and Special-status Plants Observed

Emory's Crucifixion-thorn

Emory's crucifixion-thorn (*Castela emoryi*) is a perennial shrub or small tree in the quassia family (*Simaroubaceae*) that is known to occur in dry, gravelly washes within Mojavean desert scrub, Sonoran desert scrub, and playas at elevations between 295 and 2,198 feet amsl (CNPS 2012). Crucifixion-thorn has no state or federal listing status, but is rated as CRPR 2.3, which indicates that it is rare, threatened, or endangered in California, but more common elsewhere and is not very endangered in California. Emory's crucifixion-thorn is not a special-status plant. No major threats are listed for the survival of this species (CNPS 2012). Emory's crucifixion-thorn occurs in California and Arizona and the Mexican state of Sonora. It is known to occur in Imperial, Inyo, Riverside, and San Bernardino counties. The nearest known populations are approximately 20 miles southwest of the SMS project area (CCH 2012).

Emory's crucifixion-thorn shrubs were recorded in the survey area at the margin of a desert wash in the middle of a large alluvial fan dominated by creosote bush-white bursage scrub (Figure 3.2-2). Emory's crucifixion-thorn is a dioecious species with staminate (male) and pistilate (female) flowers occurring on separate individuals. All of the stems observed were staminate (male). This population was documented in botanical surveys in 2009 and 2012 (URS 2009c; CSESA 2012).

Utah Vine Milkweed

Utah vine milkweed (*Funastrum utahense*) is a perennial herbaceous vine in the dogbane family (*Apocynaceae*) that is known to occur on sand and gravel substrates in Mojavean desert scrub and Sonoran desert scrub communities at elevations between 328 and 4,708 feet (CNPS 2012). Utah vine milkweed is not state or federally listed, but it is designated CRPR rank 4.2, indicating that it is uncommon and fairly endangered in California (CNPS 2012). Utah vine milkweed is not a special-status plant. The primary threats to Utah vine milkweed are solar energy development and OHVs.

Utah vine milkweed has been reported to occur in Imperial, Riverside, San Bernardino, and San Diego counties in California. The Utah vine milkweed is also known to occur in Arizona, Nevada, and Utah (CNPS 2012). More than 60 occurrences have been reported in San Bernardino County. The nearest reported occurrence of Utah vine milkweed is about 30 miles southwest of the project site north of I-40 in the Cady Mountains (CCH 2012).

Utah vine milkweed plants were recorded at 25 locations during spring 2009 surveys and at 13 locations during fall 2012 surveys (Figure 3.2-2). All locations were within deeply incised channels in a hydrologically active portion of the alluvial fan in the North Array (URS 2009c; CSESA 2012).

Rare and Special-status Plants with Potential to Occur

Three taxa that were not found in the project area were determined unlikely to occur in the area but could not be conclusively ruled out. These taxa meet the following criteria:

- Project area provides suitable habitat
- Species was not located during spring 2009 survey or fall 2012 survey
- Blooming period is outside of spring 2009 and/or fall 2012 survey dates
- Plant occurs within 50 miles of the project area

The desert wing fruit (*Acleisanthes nevadensis*), small-flowered androstephium (*Androstephium breviflorum*), and desert portulaca (*Portulaca halmoides*) meet these criteria and are thus assigned a low likelihood of occurrence.

Desert Wing Fruit

Desert wing fruit (*Acleisanthes nevadensis)* is designated by CNPS as rank 2.1 and it is not a special-status plant. Threats include solar energy development, vehicles, and invasive species (CNPS 2012). It was not detected at the SMS site in the late May 2009 botanical surveys, which took place during the blooming period for this species; however, desert wing fruit was not a focal species of these surveys (URS 2009c). Desert wing fruit was not found at two of the three reference sites searched for the fall 2012 plant survey. Each of these sites was reported by the same observer in May and early June of 2011 (CDFW 2012b), and the locations are considered reliable. The 2012 botanical survey may have been conducted too late in the year to reliably detect this species in the project area. The SMS survey area is lower in elevation than all of the known desert wing fruit sites, and the presence of this species is considered unlikely.

Small-flowered Androstephium

Small-flowered androstephium (*Androstephium breviflorum*) is designated by CNPS as rank 2.2 and it is not a special-status plant. It is considered threatened by solar development in California (CNPS 2012). The fall and spring surveys were conducted outside of the flowering season (March to April) for this species and it is therefore possible that the species could occur on the site and was not detected during focused surveys.

Desert Portulaca

Desert portulaca (*Portulaca halimoides*) is CNPS rank 4.2 and is not a special-status plant. Most recorded occurrences of the desert portulaca are located in the Mojave National Preserve (CalFlora 2012). The nearest recorded population is approximately 10 miles from the project area. It was found in dry and disarticulating condition at a reference site about 1,600 feet higher in elevation than the SMS survey area. The remains of these small annual plants were difficult to locate and identify at the reference site, and would have been expected to be in similar or further degraded condition if present in the SMS survey area due to the lower elevation there. A collection of dried desert portulaca was shown to the surveyors prior to the surveys and particular efforts were made to locate this species. Although many other species of dried annuals were found and identified during the surveys, desert portulaca was not found. The 2012 SMS botanical survey may have been conducted too late in the season to reliably detect this species. Its presence in the SMS survey area is considered unlikely.

Desert Native Protection Act and San Bernardino Desert Native Plant Protection

Plant species protected by the San Bernardino Desert Native Plant Protection regulations and the Desert Native Plants Act (DNPA) (California Food and Agriculture Code §§ 80001 et seq.) observed within the study area included:

- Bat claw acacia (*Acacia greggii*)
- Desert holly (*Atriplex hymenelytra*)
- Blue palo verde (*Parkinsonia floridum* ssp. *floridum*)
- Colorado buckhorn cholla (*Cylindropuntia acanthicarpa* var. *coloradensis*)
- Golden cholla (*Cylindropuntia echinocarpa*)
- Pencil cholla (*Cylindropuntia ramosissima*)
- Cotton top (*Echinocactus polycephalus*)
- California barrel cactus (*Fercactus cylindraceus*)
- Creosote bush (*Larrea tridentata*)
- Fish hook cactus (*Mammillaria tetrancistra*)
- Beavertail cactus (*Opuntia basilaris* ssp. *basilaris*)
- Mesquite (*Prosopis* sp.)

Mesquite and blue palo verde locations were identified during the fall survey and are shown on Figure 3.2-3 (CSESA 2012). Mesquite and palo verde occur at discrete locations adjacent to I-15.

A single individual of western honey mesquite and 12 individual blue palo verde trees were identified within the project area. Neither of these species was present in enough abundance or at high enough cover to warrant recognition as a distinct community type (CSESA 2012). These species occurred in areas that were dominated by creosote, white bursage, or cheesebush. Vegetation alliances were defined in accordance with *A Manual of California Vegetation, Second Edition* (Sawyer et al. 2009). Vegetation alliances are specified based on the dominant species present in an area and are not defined for individual plants. Palo verde coverage was less than 3 percent in the washes containing blue palo verde. There was one individual mesquite tree present on the site in an area dominated by creosote and white bursage.

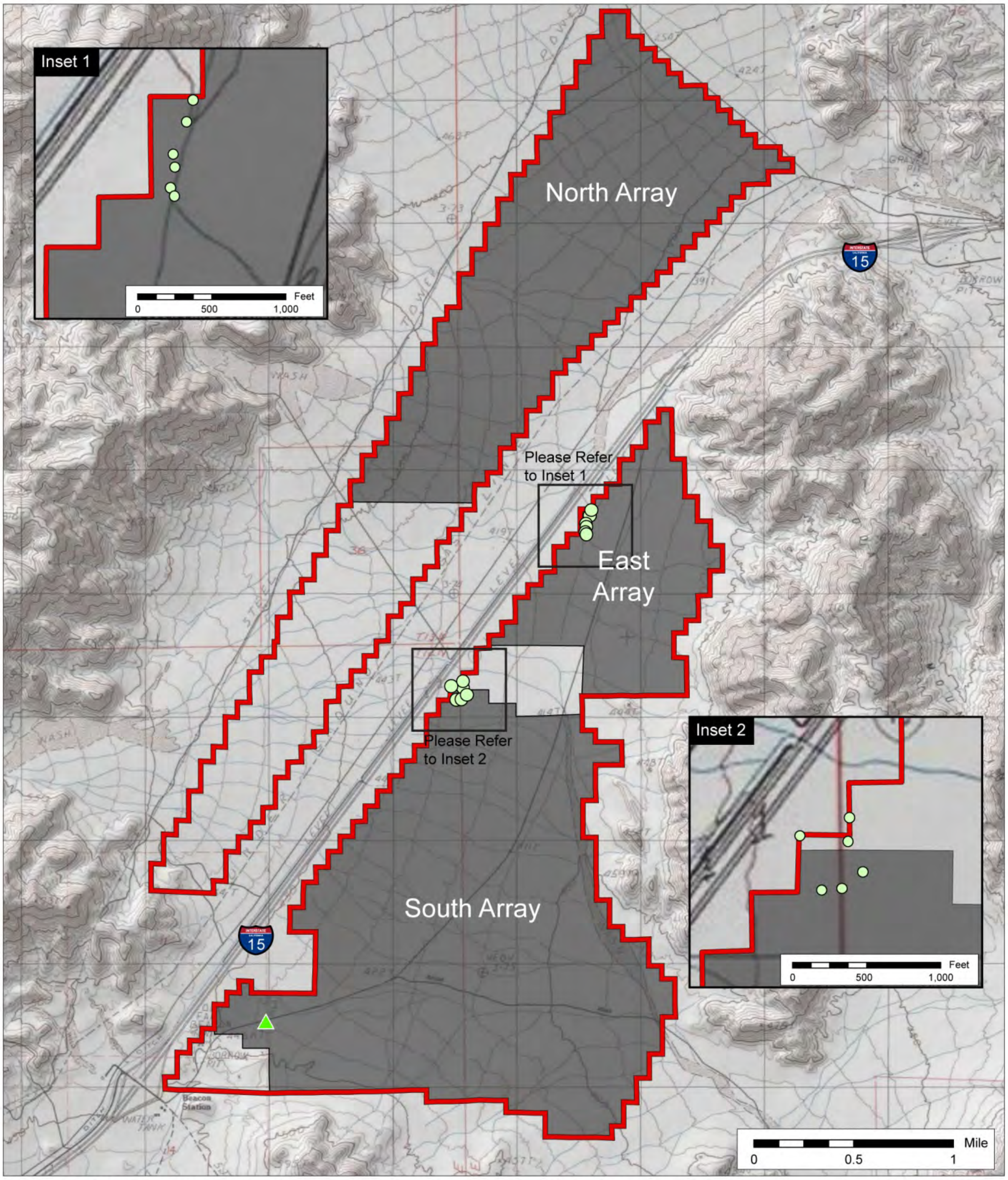
Locations and densities of cactus including beavertail cactus (*Opuntia basilaris* ssp. *basilaris*), California barrel cactus, cotton top, fish hook cactus, golden cholla, buckhorn cholla (*C. acanthicarpa* var. *coloradensis*), and pencil cholla were identified during the 2009 spring floristic surveys. Cactus densities varied by region within the study area, as shown in Table 3.2-5.

Table 3.2-5: Cactus Density by Study Area Region

Study Area Region	Cholla per Acre	Non-cholla per Acre	Total Cacti per Acre
Northern	7.0	0.5	7.5
Western	1.2	1.6	2.7
Southern	0.2	0.04	0.2

Source: URS 2009c

Figure 3.2-3: Blue Palo Verde and Mesquite Locations



SOURCE: ESRI 2012, C.S. Ecological Surveys and Assessmnets 2012, and Panorama Environmental, Inc. 2012

Scale: 1:50,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Mesquite
- Palo Verde

N

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Cactus density appeared to be related to soil composition and location on the alluvial fan. Highest densities were found in areas with cobble substrate on lower, sheet-flow portions of alluvial fans; medium density occurred in areas with large cobble substrate on upper, braided alluvial fans; and the lowest density was found within sandy regions. The northern and western regions of the study area both occur on Gunsight soils, which are characterized as very deep, somewhat excessively drained, strongly calcareous soils that formed in alluvium from mixed sources (USDA NRCS 2009). Gunsight soils occur on alluvial fan terraces or stream terraces and have slopes of 0 to 60 percent. In contrast, the southeastern region contains Rositas soils, which consist of very deep, somewhat excessively drained soils formed in sandy aeolian material. Rositas soils occur on dunes and sand sheets with slope ranging from 0 to 30 percent and a hummocky or dune micro-relief (URS 2009c).

3.3 WILDLIFE

A complete list of wildlife species observed in the project area during surveys in 2009 and 2012 is provided in Appendix B.

3.3.1 Special-status Wildlife

Table 3.3-1 contains the results of the literature review and focused surveys for special-status wildlife with a determination on their potential to occur in the project area. Where species were observed in the project area, the potential to occur is defined as present and the number of each species observed is provided.

Species Observed or Likely to Occur in the Project Area

Reptiles

Desert Tortoise. The desert tortoise is listed as a threatened species under the federal Endangered Species Act and the California Endangered Species Act. Mojave desert tortoises are known to occur from below sea level to an elevation of 7,300 feet amsl (2,225 meters) (USFWS 2011). Desert tortoises occur most commonly on gently sloping terrain (bajadas) consisting of sand- and gravel-rich soils where there is sparse cover of low-growing shrubs. Soils normally must be friable enough for digging burrows, yet firm enough so that burrows do not collapse (USFWS 2011). Tortoises generally cannot construct burrows in rocky soils or shallow bedrock (USFWS 2011). Typical habitat for the desert tortoise in the Mojave Desert has been characterized as creosote bush scrub between 1,970 feet (600 meters) and 5,900 feet amsl (1,800 meters) in elevation where precipitation ranges from 2 to 8 inches and vegetation diversity and production is high (Nussear et al. 2009). Desert tortoises are known to occupy large home ranges.

Table 3.3-1: Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
Reptiles				
Desert tortoise *(Gopherus agassizii)*	FED: FT CDFW: ST	Most habitat for the Mojave population of the desert tortoise is below 4,500 feet amsl (1,372 meters) elevation in the creosote bush-bursage series of the Mojave desert scrub biome; dominant plants are creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Desert tortoise habitat can include various cacti and yucca species. Other communities where tortoises may occur include saltbush (*Atriplex* spp.) scrub and Joshua tree (*Yucca brevifolia*) woodlands at elevations up to approximately 5,000 feet amsl (1,524 meters) (USFWS 2009b). The desert tortoise occupies an assortment of habitats. Habitat usually consists of alluvial fans and plains and slopes of colluvium and bedrock. Tortoises burrow in soil; therefore, soil must be adequately strong to allow for burrowing but must be soft enough for the tortoise to dig in. Tortoises alternatively use rock formations as shelter. They will avoid using shallow or rocky bedrock on steep slopes in the Mojave Desert as habitat because of the difficulty it poses for making a shelter.	**Present:** USFWS protocol-level desert tortoise surveys were conducted in the project area in May 2009 and supplemental surveys were conducted in 2012. No tortoises were observed during the surveys; however, sign including tortoise burrows, carcasses, and scat has been observed within the project area and in the zone of influence (AMEC 2001; URS 2009a; CSESA 2012; Kiva Biological 2012a).Survey results are mapped on Figure 3.3-1. The project area is modeled as suitable desert tortoise habitat (CEC 2012a; Nussear et al. 2009). There is generally suitable habitat for tortoise in the project area and tortoise are known to occur approximately 14 miles east of the project (CDFW 2012b). Human disturbance, and I-15, which truncates tortoise movement through the project area, may reduce the potential for tortoise to occur in the project area. The project area likely supports a low-density population of desert tortoise. A desert tortoise was observed in 2001 along Opah Ditch Road, within the project area (Jones 2013).	Desert tortoises are active during the spring and fall. Activity levels increase with greater rainfall. Surveys may be conducted in the spring (April to May) or fall (September to October).
Western pond turtle (*Emys marmorata*)	BLM: S CDFW: SSC	The western pond turtle is found in almost all kinds of habitat, as long as there is a permanent water source. Populations in the Mojave Desert are found only along the Mojave River and tributaries. Ideal habitat contains emergent vegetation, sites for basking, and places for refuge, such as undercut banks, mud, rocks, logs, and submerged vegetation.	**Absent:** There is no adequate habitat in the project area because there is no permanent water source in the project area. The nearest population is in the Mojave River, which is approximately 9.5 miles southwest of the project area.	N/A

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area				
Species	**Status**	**Habitat**	**Potential to Occur/Presence in Project Area**	**Activity Season/ Seasonal Restrictions**
Mojave fringe-toed lizard *(Uma scoparia)*	BLM: S CDFW: SSC	Mojave fringe-toed lizards (MFTL) occur on fine, loose, wind-blown sands and sand dunes, dry lakebeds, riverbanks, and desert washes. Vegetation ranges from various annuals, big galleta (*Hilaria rigida*), creosote bush (*Larrea tridentata*), desert willow (*Chilopsis linearis*), honey mesquite (*Prosopis glandulosa*), four-winged saltbush (*Atriplex canescens*), burrobush (*Ambrosia dumosa*), and sandpaper plant (*Petalonyx thurberi*). Sand deposits in the Mojave Desert are widely spaced and associated with historical lake and river drainages. The home range of male Mojave fringe-toed lizards is approximately 0.05 to 0.25 acres, and the range of females is approximately 0.08 acres.	**Present:** The majority of the project area is not suitable habitat for MTFL (URS 2009d; Caithness 2010e) because of the lack of fine, loose, wind-blown sand. The project area has extensive areas of rocky alluvial slopes and desert pavement separated by washes. A small area (5.82 acres) of suitable habitat was found at the southeast corner of the project area (Figure 3.3-6). MFTL were observed approximately 1,000 feet from the southwest corner of the South Array during surveys in 2009 (Caithness 2010e). MFTL were also found in the southern Rasor Road realignment corridor during surveys in 2012 (CSESA 2012). No Mojave fringe-toed lizards were identified within the array areas or northern Rasor Road realignment corridor during surveys in 2009 and 2012.	Highest activity level during breeding season (April to June)
Birds				
Golden eagle (*Aquila chrysaetos*)	FED: BGEPA CA: FP	The golden eagle is a permanent winter and breeding resident in California. It needs open terrain for hunting and eats mostly lagomorphs and rodents, but also takes other mammals, birds, reptiles, and some carrion. The golden eagle nests on cliffs of all heights. It maintains alternative nest sites and reuses old nests. It builds large platform nests of sticks, twigs, and greenery, and locates its nests most frequently in rugged, open habitats with canyons and escarpments.	**Moderate:** A survey for golden eagles was conducted in March and May 2011 (BRC 2011). Biologists identified one adult pair, one sub-adult, two nestlings, and two nests at Cave Mountain, approximately 8 miles southwest of the project area. The 2009 avian survey (URS 2010) did not record sightings of golden eagle within the project area, indicating that it may prefer alternate foraging grounds. There is no nesting habitat within the project area; however, the mountains to the north and south of the project area contain suitable nesting habitat. The estimated range for this species in southern California is 36 square miles,	Nesting: January to August

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
			and the observed eagles could use the project area for foraging because the project area is within 10 miles of the nest. Golden eagles may hunt jackrabbits, squirrels, woodrats, or other small animals that occur within the project area. They may also scavenge for carrion along I-15, which bisects the project area. The project area is unlikely to be common foraging grounds for golden eagles because of the 8-mile distance between the nest and the project area and because no golden eagles were observed on site during surveys.	
Long-eared owl (*Asio otus*)	CDFW: SSC	The long-eared owl nests in open oak, conifer, riparian, pinyon-juniper, and desert woodlands, or in those types of woodlands located next to grasslands, shrublands, or meadows. For nesting, it requires dense vegetation, nest platforms, and open areas. It uses the nests of hawks and corvids, but may also use, among other things, old woodrat nests and debris accumulated in trees. They forage over grasslands, meadows, agricultural land, sagebrush scrub, and desert scrub, surviving mostly on small animals—kangaroo rats and pocket mice in California deserts—but will also hunt other animals if rodents are not available. One study tracked two pairs and found they generally stayed within 0.6 miles of the nest but ventured up to 1.9 miles. The long-eared owl has been documented as distributed locally in the Mojave Desert, with nesting occurring in the Mojave River drainage.	**Low**: The habitat in the project area is not suitable nesting habitat because there is no woodland or dense vegetation in the project area. The project area, however, could be suitable foraging habitat due to the presence of rodents and desert scrub. The nearest nesting habitat is in a riparian area approximately 2 miles from the project area on the northeast edge of Soda Lake. Long-eared owls typically forage within 1.6 miles of their nest. The project area is therefore unlikely to be used as foraging habitat. Long-eared owl has been observed in riparian habitat at Zzyzx.	Nesting: March to July Resident: Year-round

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
Burrowing owl (*Athene cunicularia*)	FED: BCC CDFW: SSC BLM: S	Burrowing owl habitat can be found in annual and perennial grasslands, deserts, and scrublands characterized by low-growing vegetation (Zarn 1974). Suitable owl habitat may also include trees and shrubs if the canopy covers less than 30 percent of the ground surface. Burrows are the essential component of burrowing owl habitat: both natural and artificial burrows provide protection, shelter, and nests for burrowing owls (Henny and Blus 1981). Burrowing owls typically use burrows made by fossorial mammals, such as ground squirrels or badgers, but also may use manmade structures, such as cement culverts; cement, asphalt, or wood debris piles; or openings beneath cement or asphalt pavement (CBOC 1993).	**Present:** The project site provides suitable burrowing and foraging habitat. Burrowing owls were observed in the project area during botanical surveys in 2012 (CSESA 2012). Twenty-four burrows with recent sign of use were identified on the project site. The project site may be used by burrowing owls for foraging during migration or as resident habitat.	Nesting: February 1 through August 31(250-foot avoidance buffer during nesting season) Migration: Winter
Yellow-breasted chat (*Icteria virens*)	CDFW: SSC	Yellow-breasted chats nest in riparian habitats that have a well-developed, dense layer of shrub, typically directly adjacent to streams, creeks, sloughs, and rivers. They are infrequently found in insulated areas of habitat that measure less than 3 to 4 acres. They forage in low and dense thicket. Chats feed on insects, spiders, wild fruits, and berries. Breeding chats are occasionally located in the Mojave Desert in San Bernardino County. They have been found in the Mojave River at Victorville, the Morongo Valley, and at Cushenberry Springs.	**Low:** There is no riparian habitat in the project area, making it unsuitable for nesting. The proximity of suitable habitat in Baker and at Zzyzx, however, indicates that yellow-breasted chats may migrate through the project area. The nearest recorded nest of a yellow-breasted chat in the CNDDB is located near Baker, approximately 6 miles northeast of the project area. The Desert Studies Center at Zzyzx lists the yellow-breasted chat on its bird list.	Nesting: May to August Resident: Late March to late September Migration: Spring and Fall
Least bittern (*Ixobrychus*	CDFW: SSC	The least bittern is a common summer resident in southern California at the Salton Sea and	**Low:** There is no riparian habitat in the project area, making it unsuitable for the least bittern to	Nesting: May to August

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
exilis)		Colorado River in dense emergent wetlands near sources of freshwater and in desert riparian habitat. This species nests in emergent wetlands and is relatively rare in deserts but breeds locally in the Owens Valley and Mojave Desert. Diet consists mainly of small fish, aquatic and terrestrial insects, and crayfish. It also feeds on amphibians, small mammals, and miscellaneous invertebrates.	use for nesting and foraging. The nearest suitable nesting habitat for the least bittern is in Baker and at Zzyzx. The species may migrate over the project area.	Resident: April to September Migration: Winter
Loggerhead shrike (*Lanius ludovivianus*)	CDFW: SSC	The loggerhead shrike is a common resident and winter visitor in lowlands and foothills throughout California. It prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches and frequently uses shrubs or small trees for cover. It eats mostly large insects, but also takes small birds, mammals, amphibians, reptiles, fish, carrion, and various other invertebrates. It searches for prey from a perch at least 2 feet above ground. The loggerhead shrike builds nests on stable branches in densely foliaged shrub or tree, up to 50 feet above ground.	**Present:** Mojave creosote bush scrub and Mojave wash scrub cover most of the project area and provide suitable foraging habitat for the loggerhead shrike. Fence posts and shrubs provide perches within the project area. Mesquite (*Prosopis* spp.), burrobush (*Ambrosia dumosa*), and cheesebush (*Ambrosia salsola*) are found in the project area and vicinity and can provide nesting habitat for the loggerhead shrike. Four individuals were identified in the spring and three individuals were identified in the fall 2009 avian point count survey (URS 2010).	Nesting: February to July Resident: Year-round
Lucy's warbler (*Oreothlypis luciae*)	CDFW: SSC	Lucy's warblers nest in cavities in trees or cactus in riparian mesquite woodlands at 3 to 20 feet above the ground. It prefers dense mid-story and somewhat sparse understory vegetation. Habitat is always close to water. The cavities can be behind loose bark, in natural cavities such as knots, in holes made by other animals in trees, or in bank crevices. Foraging takes place in the top of mesquite trees and at branch ends. It forages nearly exclusively on insects from vegetation at low	**Low:** The project area does not provide sufficient nesting habitat due to the absence of water and riparian mesquite woodlands. There are small local breeding populations in Afton Canyon and near Baker in San Bernardino County. The species is listed on the Desert Research Center's bird list as having occurred at Zzyzx. The species may migrate over the project area. It was not observed in the project area during avian surveys in 2009 (URS 2010).	Nesting: April to July Resident: Mid-March to mid-July or September at the latest Migration: Winter

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area				
Species	**Status**	**Habitat**	**Potential to Occur/Presence in Project Area**	**Activity Season/ Seasonal Restrictions**
		to middle heights.		
Summer tanager (*Piranga rubra*)	CDFW: SSC	The summer tanager in California breeds mostly in mature riparian woodland that has an extensive Fremont cottonwood canopy. The few exceptions to riparian forest habitat contain other types of tall trees that provide shade. Tanagers forage as they move through the tree canopy. They survive on a diet of insects. Summer tanagers also forage for fruit during the late breeding season, migration, and winter.	**Low:** There is no suitable nesting or foraging habitat in the project area. The summer tanager has been spotted at various locations in San Bernardino County, including locations along the Mojave River. The Desert Studies Center at Zzyzx lists the summer tanager on its bird list. The species may migrate over the project area. It was not observed in the project area during avian surveys in 2009 (URS 2010).	Nesting: May to August Resident: Mid-April to early October Migration: Spring and Fall
Vermilion flycatcher (*Pyrocephal-us rubinus*)	CDFW: SSC	Vermilion flycatchers occupy arid scrub, agricultural areas, savanna, and riparian woodland, and frequently require surface water. Flycatchers prefer open habitat over dense vegetation. Nests occur in native and nonnative trees. They forage for insects, and usually hunt by sitting on an open perch and watching for prey.	**Low:** There is no suitable nesting or foraging habitat for vermillion flycatchers in the project area. The nearest recorded observance is near Baker, approximately 6 miles northeast of the project area. The Desert Studies Center at Zzyzx, approximately 4 miles away, lists the vermilion flycatcher on its bird list. The species may migrate over the project area. It was not observed in the project area during avian surveys in 2009 (URS 2010).	Nesting: March to July Resident: Mid-March to late August Migration: Winter
Yellow warbler (*Setophagap etechial*)	CDFW: SSC	The yellow warbler typically inhabits and nests in riparian vegetation located near streams and wet meadows. It forages on insects that it gleans from foliage of trees or bushes or on short flights.	**Low:** There is no suitable nesting habitat in the project area. Breeding yellow warblers have been documented along the Mojave River near Victorville. The species is listed on the Desert Research Center's bird list as having occurred at Zzyzx. The species may migrate over the project area. It was not observed in the project area during avian surveys in 2009 (URS 2010).	Nesting: Mid-April to early August Resident: Late March to early October Migration: Mid-Summer and Spring

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area				
Species	**Status**	**Habitat**	**Potential to Occur/Presence in Project Area**	**Activity Season/ Seasonal Restrictions**
Yellow-headed blackbird (*Xantho-cephalus xanthoceph-alus*)	CDFW: SSC	Yellow-headed blackbirds breed in marshes vegetated by tall riparian vegetation. Nests are usually located in areas over water that is 2 to 4 feet deep, and receding water can lead to nest abandonment. The yellow-headed blackbird feeds on seed and sometimes insects; the adults feed their young almost only aquatic insects during the nesting season. Foraging takes place within the breeding territory unless there is a low abundance of food, in which case it will forage in uplands.	**Low:** The project area does not contain suitable breeding habitat because there are no marshes or riparian areas in the project area. Yellow-headed blackbirds would not forage in the area because foraging is done near breeding habitat. The yellow-headed blackbird could, however, pass through the project area during its seasonal migration. Breeding yellow-headed blackbird are found scattered in the Mojave Desert. The species is listed on the Desert Research Center's bird list as having occurred in Zzyzx.	Nesting: Mid-April to late July Resident: April to early October Migration: Late Summer and Spring
Mammals				
Pallid bat *(Antrozous pallidus)*	BLM: S CDFW: SSC	The pallid bat occurs throughout the Mojave Desert. Pallid bats prefer cliffs, crevices, and rock outcrops adjacent to open foraging habitat to roost, but have also been spotted large distances from these preferred habitats. They also roost in structures such as mines, barns, and bridges and have been found roosting on the ground under stones and baseboards. Desert roost sites are typically located near water, but this habitat characteristic is not always present. Foraging habitat varies widely, and includes grasslands, open pine forests, talus slopes, and riparian areas. Pallid bats move mostly close to their roosting sites, but commonly travel more than 1.2 miles from their roosting area, and have been recorded up to 18.6 miles from roosts.	**High:** The project area contains suitable foraging habitat for pallid bats because they forage in a wide array of habitats, and insects such as grasshoppers are present in the project area. The project area contains suitable roosting habitat for pallid bats. Individual pallid bats could potentially roost in burrows in creosote bushes. The project site does not contain suitable roosting habitat for colonies of pallid bats. The pallid bat was detected at surveys of the Otto Mine near Baker, approximately 5 miles northwest of the project area. The species was not observed during acoustic surveys of the project area (Brown-Berry Biological Consulting 2012).	Hibernacula roosts during winter (October to February) Maternity roosts during summer
Townsend's big-eared bat	BLM: S	Townsend's big-eared bats occur in and around mines and caves throughout the	**High:** The project area does not contain suitable roosting habitat for Townsend's big-eared bat	Hibernacula roosts winter

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
(Corynorhinus townsendii)	CDFW: SSC	Western Mojave Planning Area, in which the project site is located. Most roosts are in mines, with the largest observed roosts at China Lake Naval Air Weapons Station. Roosts in caves and mines are generally at least 100 feet long and 4 feet high. Maternity colonies are usually located within 2 miles of a water source. Seasonal movement has been documented at 20 miles. They forage on insects near trees and shrubs.	because there are no mines or caves in the project area. The project area provides suitable foraging habitat because it contains shrubs that provide cover for insects. The Townsend's big-eared bat was detected at Blue Bell Mine, approximately 2 miles north of the project during surveys in 2012 (Brown-Berry Biological Consulting 2012). No Townsend's big-eared bats were detected in the project area during acoustic studies (Brown-Berry Biological Consulting 2012).	(October to February) Maternity roosts in summer
Nelson's bighorn sheep *(Ovis canadensis nelsoni)*	BLM: S CA: FP	Nelson's bighorn sheep occupies the southwestern desert region of California. It prefers steep slopes (40 to 80 percent) at high elevations (4,900–5,600 feet amsl). It prefers to stay in mountainous areas that provide views of the surrounding area and will travel to flat land for food and water. The species can travel long distances.	**Present:** The gently sloping project area provides suitable foraging habitat for bighorn sheep. There is no lambing habitat (steep rocky terrain) in the project area. The project area does not contain mountain or intermountain habitat for bighorn sheep (CEC 2012a). No bighorn sheep, sign, or trails were identified in the project area during biological surveys in 2009, 2011, and 2012, indicating that use of the area for foraging is likely intermittent. The nearest documented occurrence of bighorn sheep is approximately 0.5 mile east of the project site (Kiva Biological 2012a). A population of bighorn sheep has been observed in the south Soda Mountains near Zzyzx Spring (Abella 2012a). Five bighorn sheep and sign were observed on the western side of the south Soda Mountains east and south of the project site (Kiva Biological 2012a). Bighorn sign was observed in the mountains to the south of the project area (ibid). There are anecdotal reports of several bighorn sheep sightings in the Soda Mountain valley	More sensitive to disturbance during lambing season (December to June). Lambing would not occur in or near the project area due to lack of steep rocky terrain and protection from predators.

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
			(Burke 2012); however, these observations have not been documented in a formal survey or report.	
American badger (*Taxidea taxus*)	CDFW: SSC	American badgers inhabit shrub, forest, and herbaceous habitats with friable soils for burrows. They need open, uncultivated ground. They prey on fossorial mammals.	**Present.** One burrow with sign of digging was observed within the project area during botanical surveys in 2012 (CSESA 2012).	No relocation allowed during pupping (March to June)
Desert kit fox (*Vulpes macrotis* ssp. *arsipus*)	CA: FBM	The desert kit fox occupies arid and semi-arid locations at 1,300 to 6,250 feet amsl, and typically will avoid areas of rugged, sloped terrain. Vegetation communities in kit fox habitat include desert scrub, chaparral, halophytic (plants growing in salty conditions), and grassland. They live in dens and thus prefer loose-textured soils that are conducive to burrowing. They primarily subsist on kangaroo rats, prairie dogs, black-tailed jackrabbits, cottontails, birds, reptiles, and carrion. They do not need to live near a water source because they can get sufficient water from their food if they consume a sufficient quantity.	**Present:** Kit fox were observed on the site during surveys in 2009. Fifty-seven desert kit fox dens were observed on the project site during botanical surveys in 2012 (CSESA 2012).	No relocation allowed during pupping (January to July)
Fish				
Saratoga Springs pupfish *(Cyprinodon nevadensis nevadensis)*	CDFW: SSC	Natural populations of the Saratoga Springs pupfish are only known from Saratoga Springs and adjacent lakes in Death Valley National Park. It has also been introduced to and currently exists in manmade Lake Tuendae at Zzyzx.	**Absent:** There is no potential for the Saratoga Springs pupfish to occur in the project area because there are no permanent water bodies in the project area. The population closest to the project area is approximately 4 miles to the east of the project area in Lake Tuendae.	N/A

Table 3.3-1 (*Continued*): Special-status Wildlife, Potential to Occur, and Documented Presence in the Project Area

Species	Status	Habitat	Potential to Occur/Presence in Project Area	Activity Season/ Seasonal Restrictions
Mohave tui chub *(Gila bicolor mohavensis)*	FED: FE CDFW: SE CA: FP	The fish requires freshwater flow into a pond or pool of a minimum depth of 4 feet. They use aquatic plants for fish egg attachment and a minimal amount of riparian or wetland vegetation for shade. Too much vegetation, such as cattails, can clog waterways. Arroyo chubs and other nonnative, aquatic animal species can act as competitors or predators of the tui chub. Mohave tui chub historically existed in the Mojave River. Today, there are only four known populations: China Lake NAWS, Zzyzx, CDFW Camp Cady Wildlife Area, and Deppe Pond.	**Absent:** There is no potential for the tui chub to occur in the project area because there are no permanent water bodies in the project area. The population closest to the project area is approximately 4 miles east of the eastern portion of the project area in Soda Spring at Zzyzx.	N/A

Federal: U.S. Fish and Wildlife Service (USFWS) Status (ESA) FE: Federally listed as Endangered FT: Federally listed as Threatened BCC: Bird of Conservation Concern *Federal: Bureau of Land Management (BLM) Status* S: Sensitive *Federal: Bald and Golden Eagle Protection Act (BGEPA)*	*State: California Department of Fish and Wildlife (CDFW) Status (CESA)* SE: State listed as endangered ST: State listed as threatened SSC: Species of Special Concern *State: California Fish and Game Code* FP: Fully Protected PFM: Protected Fur-bearing Mammal

Sources: URS 2009b; Kiva Biological 2012a; Brown-Berry Biological Consulting 2012; CSESA 2012; BRC 2011; BLM 1999; BLM 2012a; BLM 2012b; BLM 2012c; URS 2009a; URS 2009d; CDFW 2012a; Fulton 2012; CEC 2012a; Lewis Center 2008; NPS 2004; USFWS 2009a; Nussear et al. 2009; Pierson et al. 1999; Caithness 2010a; Caithness 2010b; Caithness 2010d; Caithness 2010e

Threats to desert tortoise populations identified in the Desert Tortoise Recovery Plan (USFWS 2011) are numerous and include:

- Human contact and mortality, including vehicle collisions and collection of tortoises
- Predation, primarily from raven, but also from feral dogs, coyotes, mountain lions, and kit fox
- Disease
- Habitat destruction, degradation, and fragmentation resulting from grazing, land development, solar development, OHVs, wildfire, landfills, and road construction
- Climate change and drought

Survey Results. No live desert tortoises were identified within the project area or adjacent areas in the following focused surveys:

- 2001 protocol desert tortoise surveys of the Opah Ditch (located approximately 0.25 miles (0.6 km) west of the project area) (AMEC 2001)
- 2009 protocol desert tortoise surveys of the project area and zone of influence (URS 2009a and Caithness 2010a)
- 2012 supplemental protocol desert tortoise surveys of the 220 acres of additional SMS ROW project area and zone of influence (Kiva Biological 2012a)
- 2012 protocol desert tortoise surveys of geotechnical sites and access roads (Kiva Biological 2012b)
- 2012 fall rare plant survey and incidental wildlife observations (CSESA 2012)

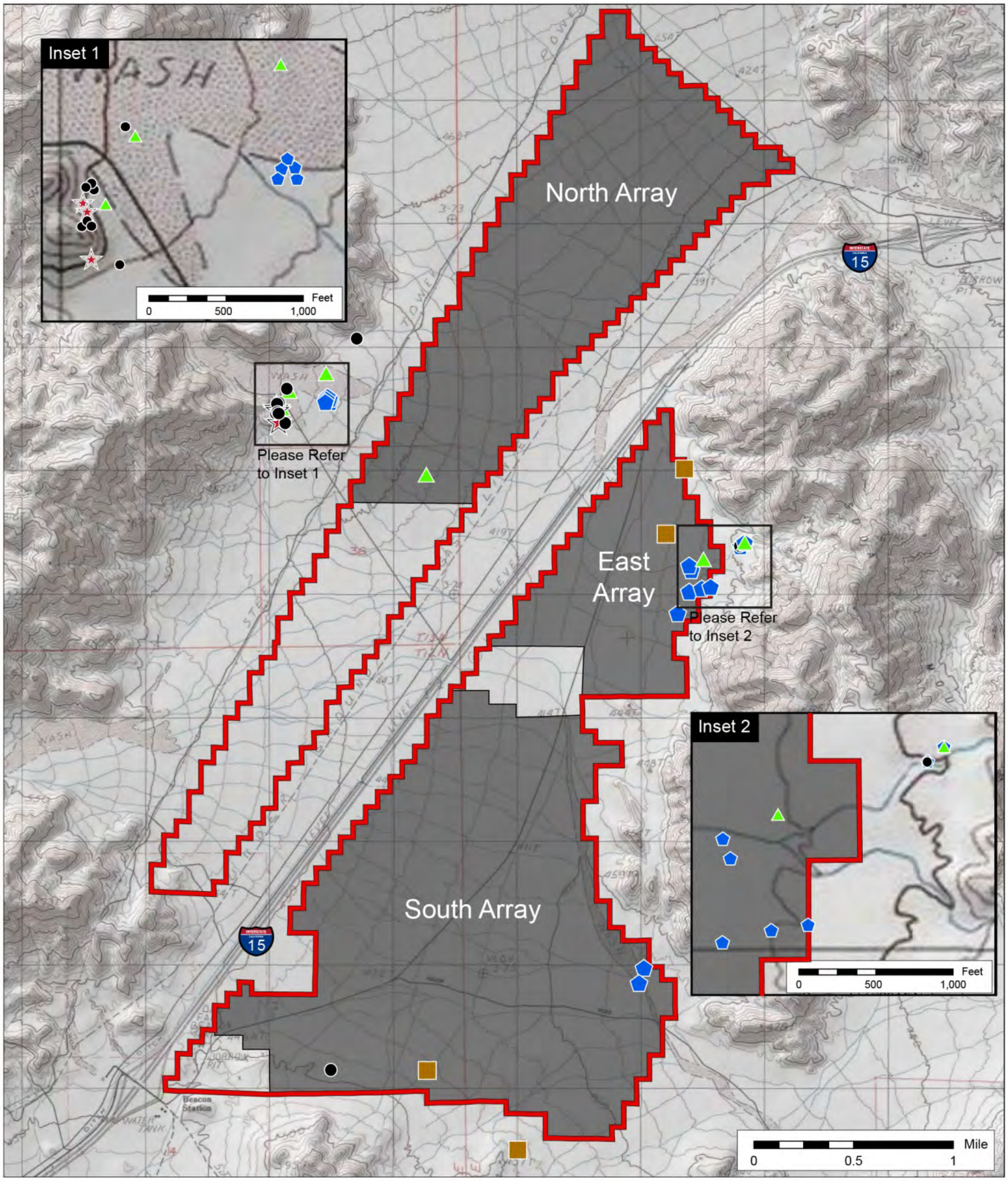
Survey results are summarized on Figure 3.3-1 and in Table 3.3-2. Sign were found outside of the project area in 2001 and 2009. Sign were found in the eastern and southern portion of the project area in 2012 during supplemental desert tortoise surveys and rare plant surveys. A desert tortoise was seen on Opah Ditch Road near the western edge of the ROW area in 2001 (Jones 2013). This sighting was never formally recorded and was not part of a formal survey.

The limited sign of desert tortoise, combined with no identification of live tortoises in any of the project area surveys, indicate that there are likely a low number of desert tortoises inhabiting the project site (Kiva Biological 2012a). The data also indicate those tortoises are likely concentrated near the toes of hill slopes surrounding the project.

Habitat Suitability. The Soda Mountain Solar project area has several characteristics that indicate the habitat is not suitable to support a high-density population of tortoises. These characteristics include:

- No tortoises observed during surveys
- Lower elevation (i.e., below 1,970 feet amsl [600 meters] in the Mojave Desert)
- Low shrub species diversity
- Habitat fragmentation and tortoise mortality due to vehicles on I-15
- OHV activity in the South Array area resulting in increased risk of desert tortoise mortality and burrow destruction
- Abundant rocks and cobbles

Figure 3.3-1: Results of Desert Tortoise Surveys



SOURCE: ESRI 2012, AMEC 2001, C.S. Ecological Surveys and Assessmnets 2012, URS 2009, and Panorama Environmental, Inc. 2012

Scale: 1:50,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Desert Tortoise Carcass
- Desert Tortoise Scat
- Desert Tortoise Shelter
- Possible Desert Tortoise Burrow
- Desert Tortoise Burrow

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Table 3.3-2: Desert Tortoise Sign from Desert Tortoise and Other Surveys Results

Survey	Live Tortoises	Scat	Burrows	Carcasses	Rock Shelters
2001 Desert Tortoise Survey at Opah Ditch (outside SMS)	0	9	5	3	3
2009 SMS Desert Tortoise Survey (including QA/QC surveys at 10-foot [3-meter] spacing)	0	1 (ZOI)	0	0	0
2012 SMS Desert Tortoise Supplemental 220-acre Survey	0	20 (ZOI)	8 (SMS) 2 (ZOI)	1 (SMS) 1 (ZOI)	0
2012 Geotechnical Study Desert Tortoise Survey	0	0	0	0	0
Fall 2012 Botanical Survey	0	1	3 (SMS)	1 (ZOI)	0

Notes:

SMS: Soda Mountain Solar ROW Area ZOI: zone of influence

Sources: AMEC 2001; URS 2009a; Kiva Biological 2012a; CSESA 2012

Tortoise sign has been identified along the margins of the Soda Mountain valley, which has more friable soils than the interior of the valley. The project area to the west of I-15 and within the interior of the valley has abundant rocks and cobbles. The low abundance of desert tortoise in the interior of the valley may be attributed to an increased rate of mortality along I-15, which traverses the valley center. It is possible that there may have been a larger population of tortoise in the valley before I-15 was constructed in the 1970s. The population would have experienced increased mortality from vehicles along the highway and from attempts to cross the highway. Studies of tortoise presence along highways reveal that tortoise densities (and sign) increase farther from the highway and high-volume highways can result in decreases in tortoise sign up to 13,000 feet (4,000 meters) from highways (Hoff and Marlow 2002). The entire project area is located within 10,000 feet of the I-15 highway, which experiences near-continuous traffic.

The U.S. Geological Survey (USGS) has modeled habitat suitability for desert tortoises in the Mojave and Sonoran Deserts (Nussear et al. 2009). Areas with habitat suitability values of less than 0.6 are generally considered unsuitable habitat for desert tortoise in the West Mojave. The USGS model was used to determine suitable habitat for the Solar PEIS and DRECP Baseline Biology Report (EERE et al. 2012; CEC 2012a). The DRECP Science Advisors noted the following regarding the use of models:

> *"[T]he species models we reviewed likely over-predict habitat suitability and species distribution for most species while providing a false sense of confidence in the results. This has potentially serious consequences for reserve design, because modeled species distributions are a key input to the reserve-selection and design process. If models that over-predict species distribution are used in reserve design, areas included in the reserve may be credited with conserving habitat for a given species even if it doesn't occur there."*

The model does not predict species abundance or habitat quality and does not take into account human disturbance of habitat (SMS 2012a; SMS 2012b). The habitat modeling identified the SMS project area as having moderately suitable habitat for desert tortoise (0.6 to 0.9 on a scale of 0 to 1) (Figure 3.3-2). The presence of limited sign and no observed desert tortoise during multiple surveys of the project site indicate that the habitat suitability for desert tortoise is likely over-predicted in the project area due to prior human disturbance (e.g., highway I-15 and OHV use). Refer to Appendix C for additional information on model limitations in predicting habitat suitability.

Connectivity. The following section provides an analysis of the SMS project regarding the potential for connectivity of desert tortoise across the project site. It may not reflect the ongoing analyses being conducted by BLM and other permitting agencies. BLM will be providing its analysis, in conjunction with other agency consultation, regarding potential connectivity across the project site in the EIS that will be prepared for this project.

Information on desert tortoise habitat connectivity in the project area is provided in:

1. *A Linkage Network for the California Deserts* (Penrod et al. 2012)
2. *Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise* (Hagerty et al. 2010)
3. DRECP *Updated Expert Species Model Results* (CEC 2012b)
4. Solar PEIS (EERE et al. 2012)
5. *Revised Recovery Plan for the Mojave Population of the Desert Tortoise* (USFWS 2011)

The differences between these connectivity maps are explained by the different methods that are employed and different goals for the mapping efforts. Surveys of the project area did not identify live tortoise and found sign only around the base of the mountains; the limited tortoise and sign indicate that the area is not heavily used (Woodman 2012).

The Desert Connectivity Project is a regional-scale mapping effort that identified connectivity corridors for desert tortoise in the Mojave Desert. The results of the Desert Connectivity Project are presented in *A Linkage Network for the California Deserts* (Penrod et al. 2012). The Desert Connectivity Project included 11 Landscape Blocks[4] that were linked through least-cost corridors.[5] The least-cost corridors (linkages) are largely defined by the landscape blocks that are being connected. A corridor approximately 6 miles north of the project area links the

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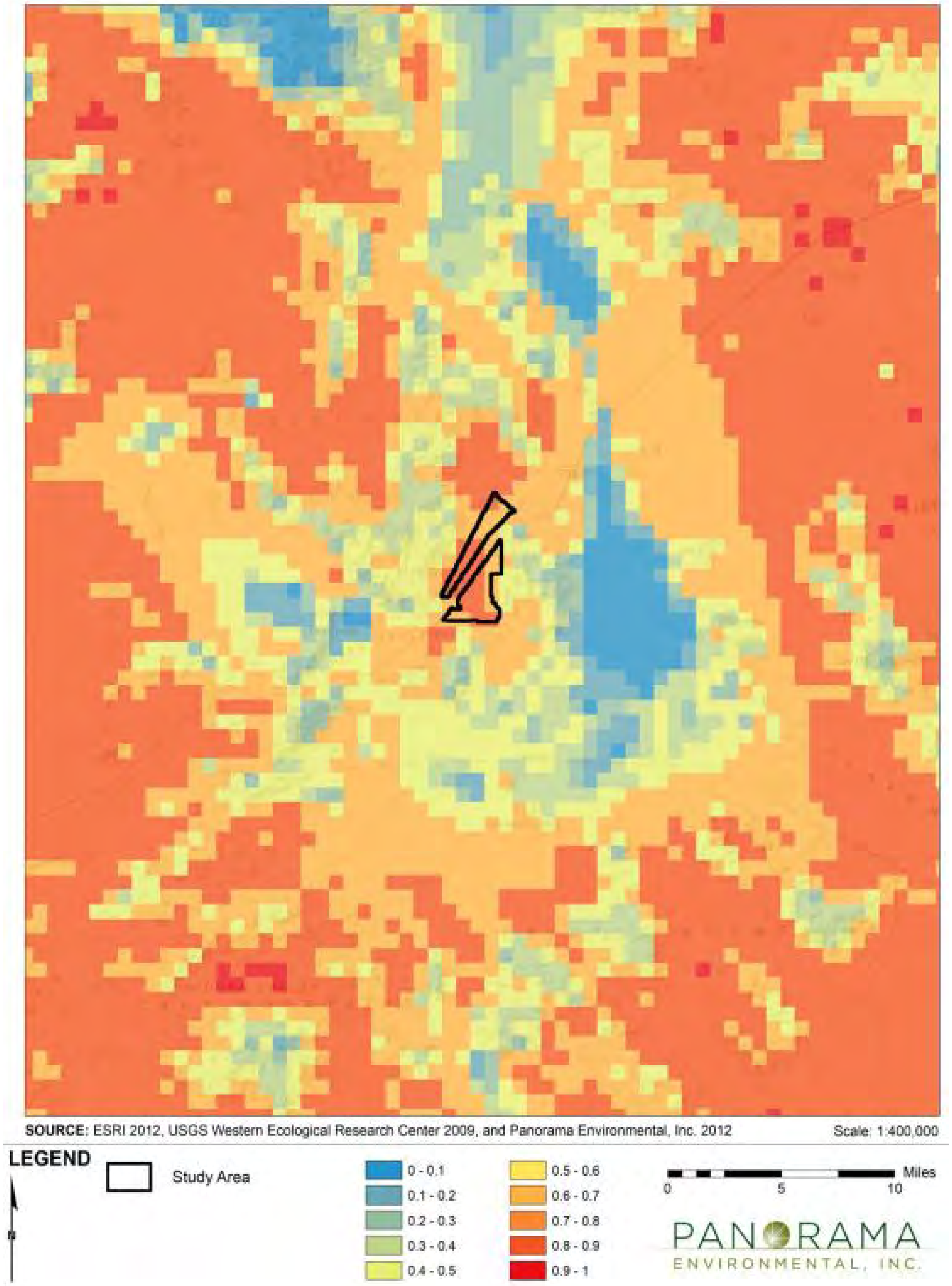
[4] Landscape Blocks are the units of analysis in a least-cost corridor model. They are the areas that are being connected and should be preserved.

[5] Least-cost corridor modeling involves calculating the "cost" of movement from one cell in a model to the next cell using a resistance surface. The cost of movement is aggregated over the distance between the start and end points. The path with the lowest aggregate cost between the two points is the least-cost path. A least-cost corridor includes multiple paths with the least aggregate cost of movement between start and end points.

Figure 3.3-2: Desert Tortoise Habitat Suitability Model (Nussear et al. 2009)



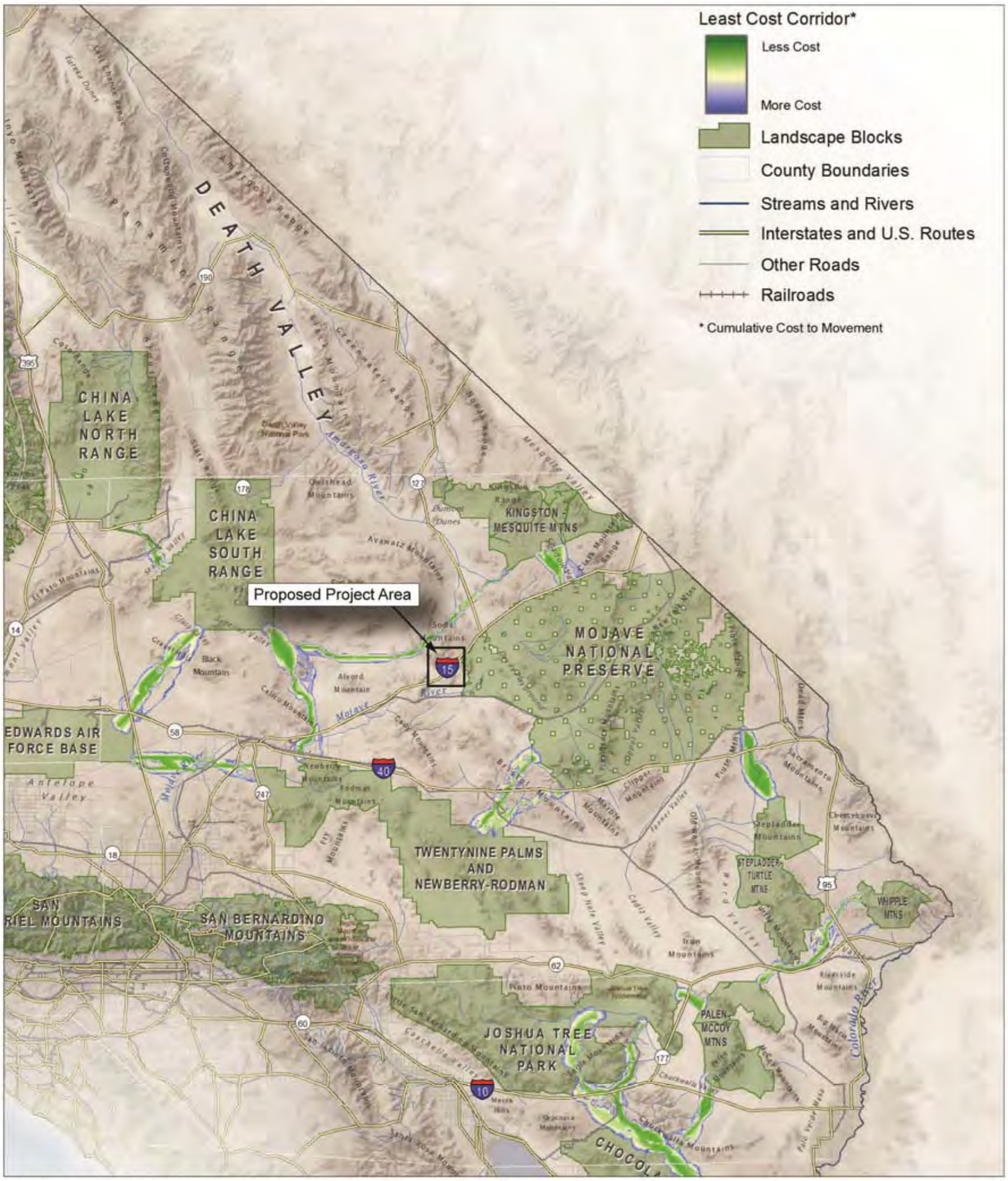
SOURCE: ESRI 2012, USGS Western Ecological Research Center 2009, and Panorama Environmental, Inc. 2012 Scale: 1:400,000

Kingston-Mesquite Mountains to the China Lake South Range. The Mojave National Preserve is linked to Twentynine Palms through the Bristol Mountains approximately 20 miles south of the project area. The project area was not included within a desert tortoise linkage corridor (Figure 3.3-3) in *A Linkage Network for the California Deserts* (Penrod et al. 2012).

Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise presents an evaluation of the impact of landscape barriers on desert tortoise gene flow (Hagerty et al. 2010). Connectivity modeling and genetic analysis are used in this study to evaluate gene flow between tortoise populations in the Mojave and Sonoran Deserts. Hagerty et al. identified barriers to tortoise movement using a habitat suitability model for the Mojave and Sonoran Deserts. Habitat suitability ranged from 0 to 1. No connectivity was assigned to areas with a habitat suitability rating of 0.3 or less. The model assumes that these areas are barriers to tortoise movement and gene flow , as shown on Figure 3.3-4. Barriers and geographic distance were significantly correlated with genetic difference (Hagerty et al. 2010), suggesting that the barriers used in the model and geographic distance influence population connectivity. Barriers to desert tortoise connectivity (red areas on Figure 3.3-4) include the Baker Sink, Soda Lake, and Mojave wash to the east and south of the project area. The Baker Sink is a low-elevation Pleistocene-era waterway that consists of a strip of arid land extending from Death Valley to Bristol Lake and may serve as a barrier to tortoise movement between populations east and west of the project area (Hagerty et al. 2010). Baker Sink is inhospitable to tortoise because it has a low elevation and lacks vegetation for cover. However, desert tortoise sign and a live tortoise has been documented in the Baker Sink area just north of the town of Baker, indicating that this is not a complete barrier.

The DRECP *Updated Expert Species Model Results* (CEC 2012b) includes *Draft Species Habitat Model Results for Desert Tortoise (USFWS Least Cost Corridors)*. This map identifies a least-cost corridor for desert tortoise through the project area (Figure 3.3-5). This connectivity map is very similar to the connectivity corridor map for desert tortoise presented in the Solar PEIS (EERE et al. 2012). The DRECP and Solar PEIS connectivity models were both developed by USFWS using habitat suitability mapping developed by USGS (Nussear et al. 2009). Both models use least-cost corridors to link critical habitat areas. The project area is part of a connectivity corridor in both maps that appears to link the Ivanpah Valley critical habitat unit with the Superior-Cronese critical habitat unit (Figures 3.3-5 and 3.3-6). The primary difference between the DRECP and Solar PEIS connectivity maps is that the Priority 1 Connectivity Corridors in the Solar PEIS are narrower than the least-cost corridors presented in the DRECP. While the Solar PEIS Priority 1 connectivity corridor (that spans the project area) includes a break in connectivity at the Baker Sink, the least-cost corridor presented in the DRECP shows substantial areas of connectivity across the Baker Sink. SMS has discussed the USFWS least-cost corridors with both BLM and USFWS. In talking to the USFWS individuals responsible for developing the models, the BLM State Biologist has concluded that there was an error in the DRECP data layers that resulted in incorrect designation of a least-cost corridor within the project area (Fesnock 2013).

Figure 3.3-3: Desert Tortoise Linkage Corridor (Penrod et al. 2012)



SOURCE: ESRI 2012, Penrod, K. et al. 2012, and Panorama Environmental, Inc. 2012

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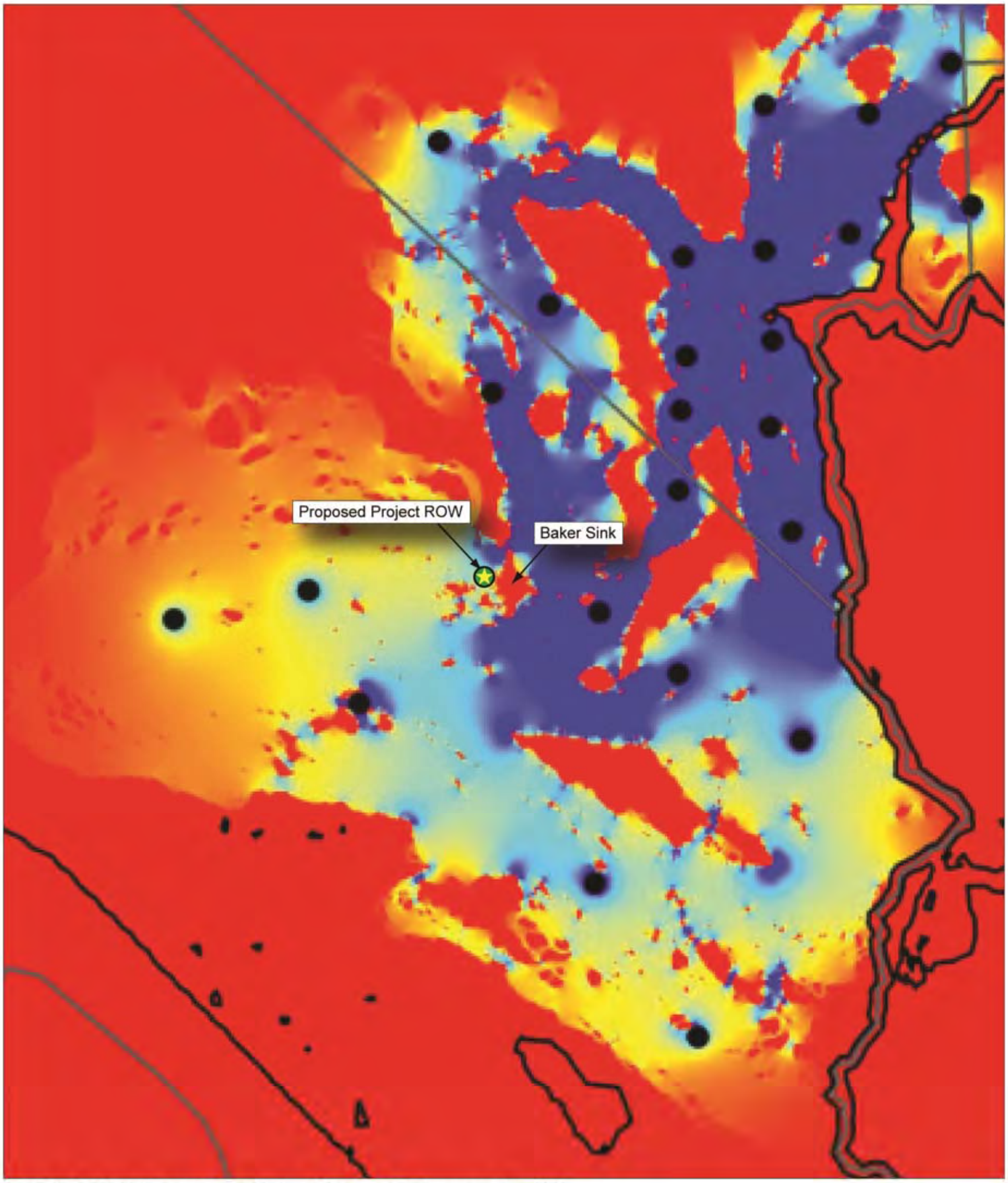
Figure 3.3-4: Desert Tortoise Connectivity Barriers (Hagerty et al. 2010)



SOURCE: ESRI 2012, Hagerty et al 2010, and Panorama Environmental, Inc. 2012

LEGEND

- Proposed Project ROW
- Population Centroid
- Low Probability of Tortoise Movement
- Tortoise Movement Area

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Figure 3.3-5: DRECP Modeled Desert Tortoise Connectivity Corridor

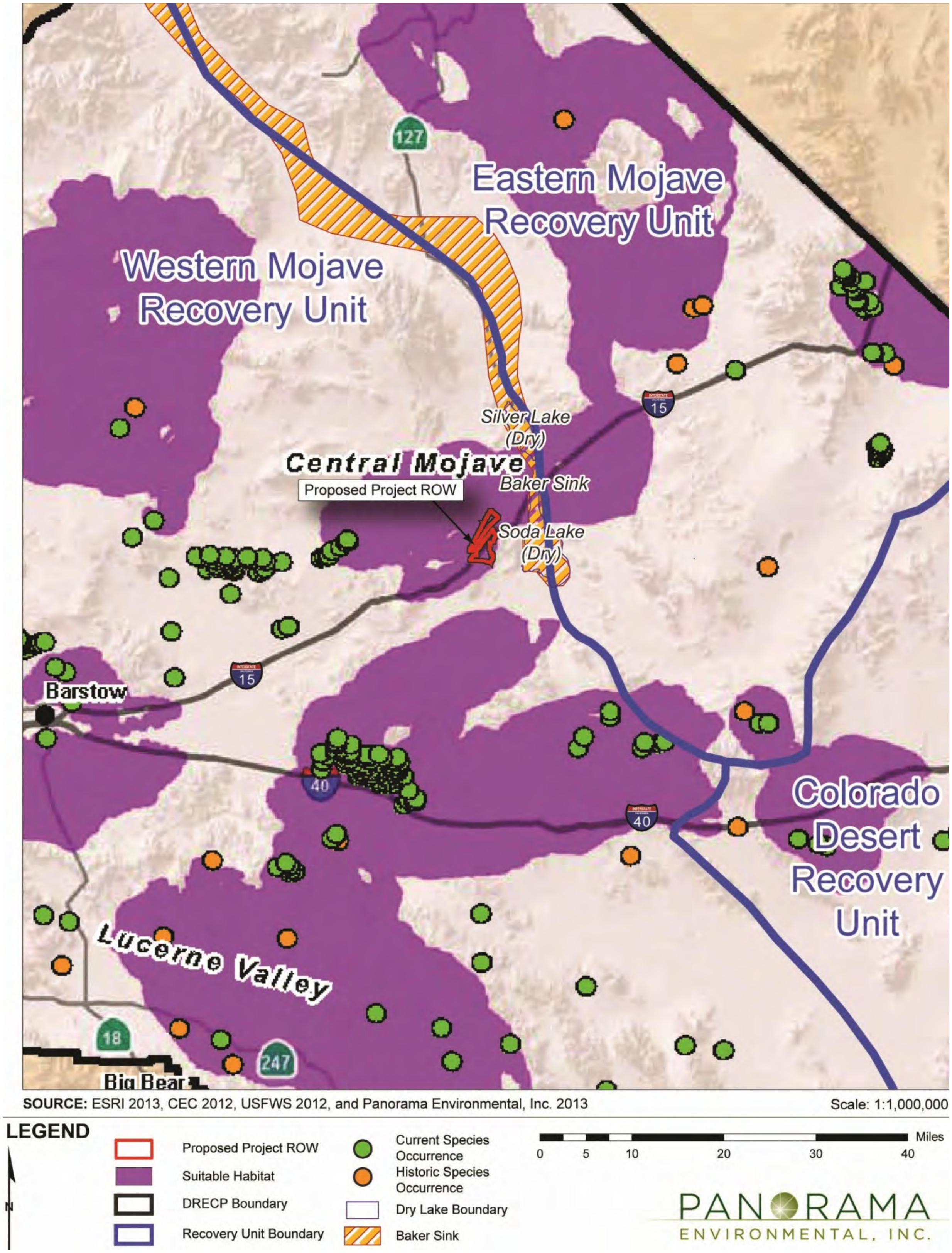
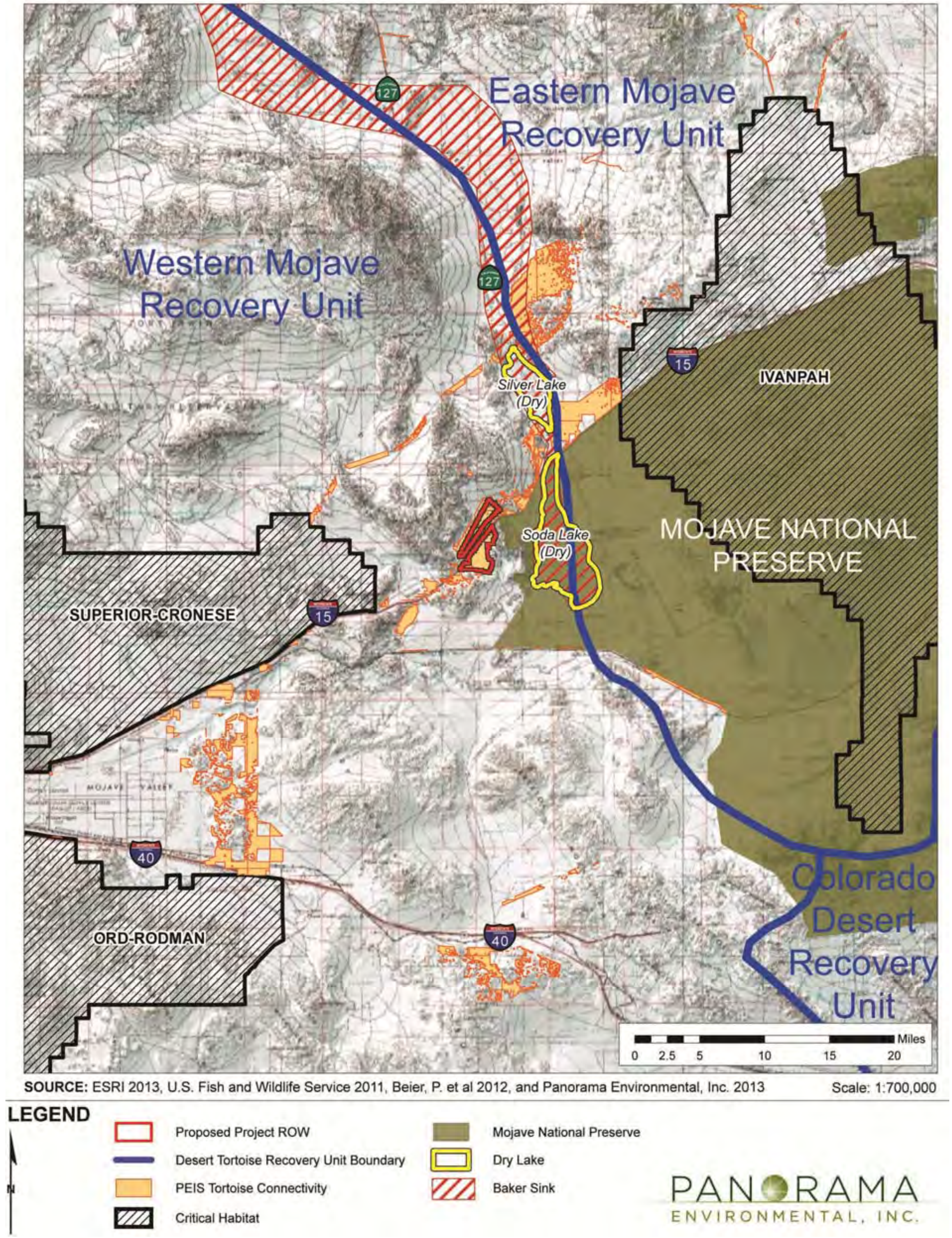


Figure 3.3-6: Solar PEIS Priority 1 Connectivity Corridor with Recovery Units



SOURCE: ESRI 2013, U.S. Fish and Wildlife Service 2011, Beier, P. et al 2012, and Panorama Environmental, Inc. 2013 Scale: 1:700,000

The Mojave population of desert tortoise is divided into five recovery units in the Revised Recovery Plan (USFWS 2011). The recovery objectives identified in the Revised Recovery Plan revolve around the concept of the recovery unit. The recovery objectives include:

- Maintain self-sustaining populations of desert tortoises within each recovery unit into the future
- Maintain well-distributed populations of desert tortoise throughout each recovery unit
- Ensure that habitat within each recovery unit is protected and managed to support long-term viability of desert tortoise populations

Recovery units were defined on the basis of geographic barriers that coincide with observed variation among tortoise populations (Ibid). The project area is located on the eastern edge of the Western Mojave recovery unit (Figure 3.3-6). The Ivanpah critical habitat unit is located in the Eastern Mojave recovery unit.

The DRECP and Solar PEIS identify a least-cost corridor that extends through the SMS project area and crosses between these recovery units (Figure 3.3-6). This least-cost corridor differs from the Revised Recovery Plan, which indicates that desert tortoise population connectivity between the Eastern Mojave and Western Mojave recovery units is unlikely. The Recovery Plan states that the population within the Eastern Mojave recovery unit is recognized as relatively isolated from other recovery units on the basis of genetic analysis (USFWS 2011). The Recovery Plan suggests that Baker Sink through Soda Dry Lake may be a movement barrier between the Eastern Mojave recovery unit and the Western Mojave recovery unit because the Baker Sink barrier forms the dividing line between these two recovery units:

> "*Although gene flow likely occurred intermittently during favorable conditions across this western edge of the recovery unit, this area contains a portion of the Baker Sink, a low-elevation, extremely hot and arid strip that extends from Death Valley to Bristol Dry Lake. This area is generally inhospitable for desert tortoises*." (Ibid)

The study conducted by Hagerty et al. (2010) supported this conclusion from a genetic standpoint by finding that the Baker Sink was significantly correlated with genetic difference. The USGS model of habitat suitability (Nussear et al. 2009) identifies the Baker Sink as having suitability in the range of 0 to 0.5 (considered unsuitable habitat for desert tortoise in the Western Mojave). Recent observations of tortoise sign and an individual desert tortoise in the Baker Sink just north of the town of Baker indicate that the Baker Sink may not be a complete barrier to tortoise connectivity (Otahal 2013). The Baker Sink just north of the proposed project area also becomes very narrow (0.1 to 0.2 miles), which could be traversed by tortoise even if it is found not to be suitable live-in habitat. The modeled low habitat suitability and genetic study suggest that there would be a low frequency of tortoise and movement across Baker Sink and the area is unlikely to be a primary corridor for tortoise population connectivity.

The presence of I-15 hinders connectivity in the area. The Solar PEIS provides a set of criteria for connectivity corridors including the "need to be free of large-scale impediments from anthropogenic activity" (EERE et al. 2012). The Priority 1 connectivity corridor in the project area straddles a portion of I-15 that is unfenced. I-15 is a large-scale anthropogenic impediment but has several undercrossings, spaced approximately 1 mile apart, which can be used by desert tortoise (Figure 3.3-14). The presence of I-15 has likely reduced habitat suitability and increased habitat fragmentation adjacent to the highway relative to natural conditions, though it likely does not preclude movement of tortoise away from the highway.

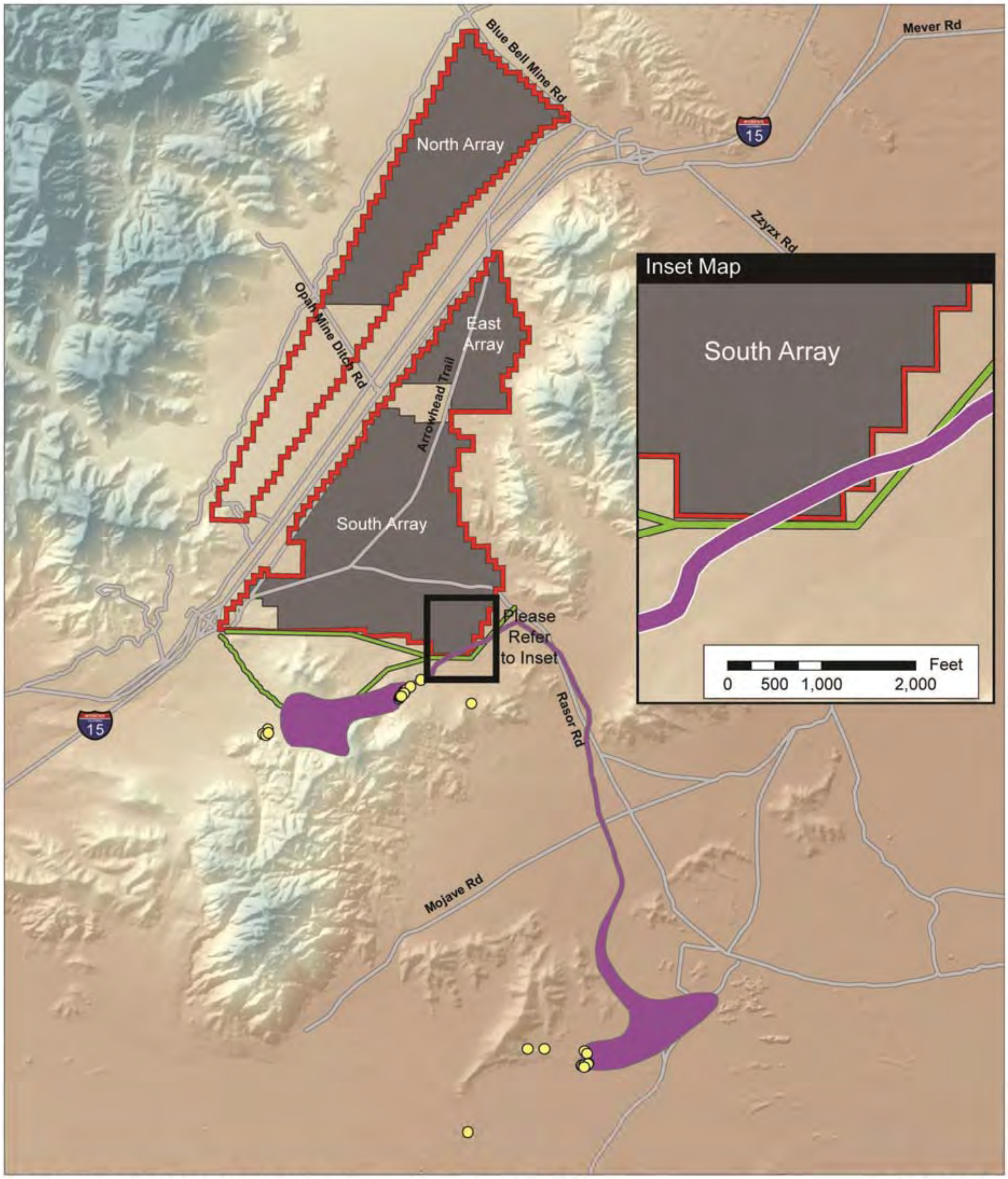
Mojave Fringe-toed Lizard. The Mojave fringe-toed lizard is listed as a BLM sensitive species and a California species of special concern. Mojave fringe-toed lizard habitat is characterized as fine, aeolian sand dunes and ramps on the margins of lakebeds and washes. Some populations are restricted to isolated pockets of wind-blown sand on the sides of hills. Widely distributed plants provide shade for thermoregulatory behavior and burrowing cover to escape heat and predators (Presch 2007). The Mojave fringe-toed lizard distribution extends from southern Inyo County through most of eastern San Bernardino County, south and east through the eastern portion of Riverside County to the area of Blythe (Presch 2007).

MFTL in the Study Area. Twenty-six Mojave fringe-toed lizards were observed south and southwest of the project area during surveys conducted in 2009 and 2012 (URS 2009c; Kiva Biological 2012a) (Figure 3.3-7). No Mojave fringe-toed lizards were observed within the project ROW. A Mojave fringe-toed lizard was observed within the southern alternative Rasor Road realignment corridor. The closest observance of a Mojave fringe-toed lizard was approximately 1,000 feet southwest (uphill) of the project ROW boundary.

Suitable Habitat. During the Mojave fringe-toed lizard survey, washes within the project area were investigated to determine whether they could provide suitable habitat. There is no suitable habitat for the Mojave fringe-toed lizard on the northwest side of I-15 in the ROW area (URS 2009c). Sands encountered within the alluvial fans within the majority of the ROW are coarse-grained. No aeolian sand deposits that could provide suitable habitat for Mojave fringe-toed lizard were observed within the project area, with the exception of the habitat corridor defined on Figure 3.3-7 (URS 2009c). There is approximately 5.56 acres of suitable habitat for Mojave fringe-toed lizards in the southeastern portion of the South Array. There are an additional 0.26 acres of suitable Mojave fringe-toed lizard habitat in the alternative Rasor Road realignment route. The wash that flows through the southeastern edge of the ROW contains suitable habitat and could connect the two fringe-toed lizard populations south and southwest of the project area (see Figure 3.3-7).

Potential Sand Sources. The project area is not likely a source of aeolian sand for Mojave fringe-toed lizard habitat, with the exception of the habitat corridor identified on Figure 3.3-7. Clarke et al. (1995) assert that the aeolian sand source for the habitat south of the project site (Figure 3.3-7) originates in the Mojave River Sink from Afton Canyon to Kelso Dunes. The source of aeolian sand for the project site could also include Cronese Lake located southwest of the project area.

Figure 3.3-7: Mojave Fringe-toed Lizard Locations in SMS Region



SOURCE: ESRI 2013, URS 2009, Kiva 2012, and Panorama Environmental, Inc. 2013

Scale: 1:90,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Potential Rasor Road Re-alignment
- Mojave Fringe-Toed Lizard Study Area
- Mojave Fringe-Toed Lizard Observation

Miles: 0 1 2

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Aeolian Sand Transport. The dominant wind direction in the area is from the west and south (Urban 2013), such that wind would move aeolian deposits in the project area in the opposite direction from the Mojave fringe-toed lizard habitat that is south of the project area.

It is unlikely that aeolian sand from the suitable habitat would be transported across the project site by wind. The habitat areas are located upwind of the project area; however, there are hills that separate the two habitat areas (north and south) from the project area (Figure 3.3-7). There is a hill just north of the northern habitat area that would block wind transport (Figure 3.3-8). Sand transported by wind from the northern habitat area can be observed at the foot of the hill. There are a number of hills that would likely block aeolian sand transport between the southern habitat and the project area.

Fluvial Sand Transport. There are two drainage channels in the South Array that could support fluvial transport of sand across the project site from Mojave fringe-toed lizard habitat, as shown on Figures 3.3-7 and 3.3-8. Both drainages terminate in the wash east of the project area and drain to the southeast toward the southern habitat area, which is 3.6 to 4.7 miles southeast of the project boundary.

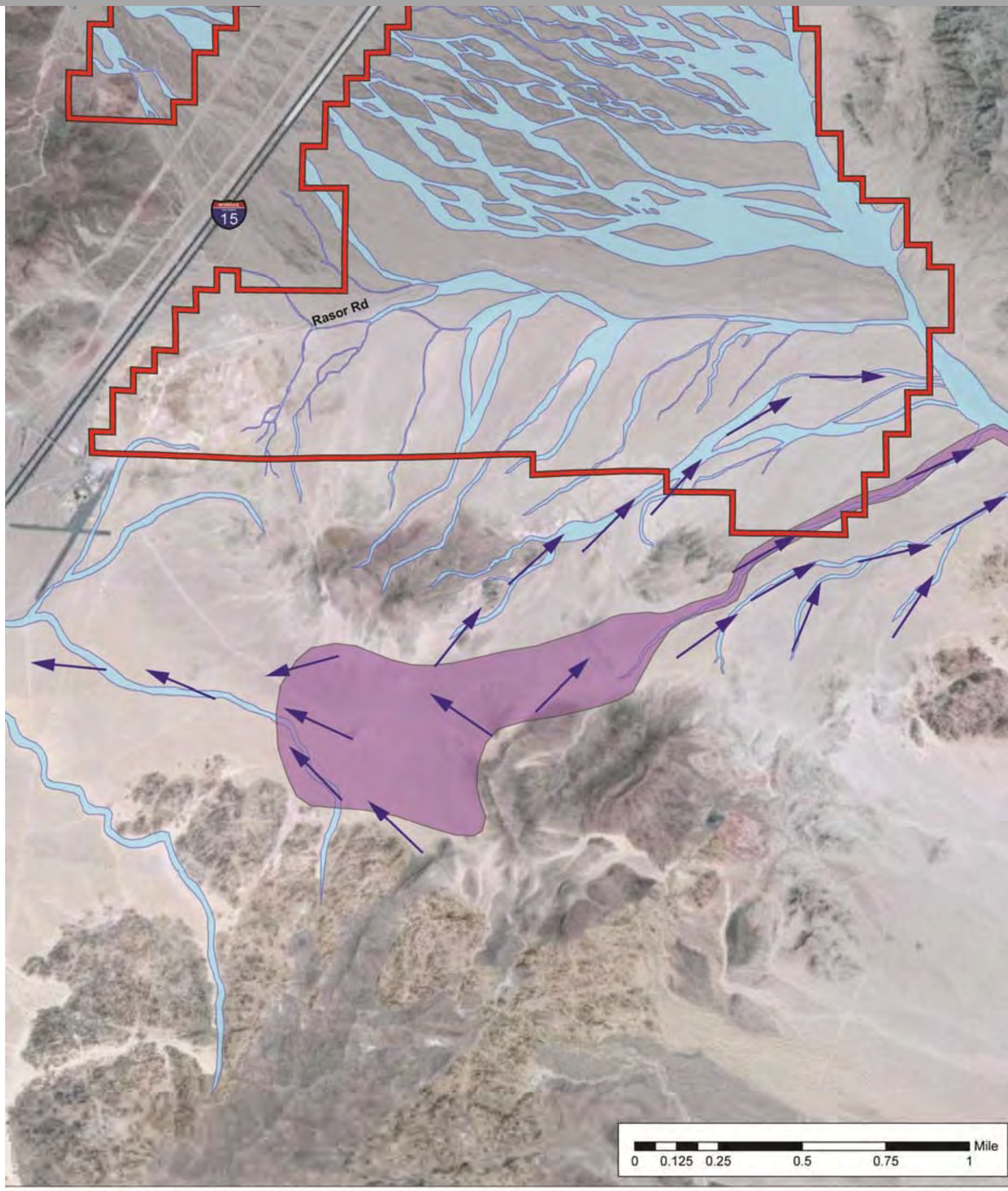
Birds

Burrowing Owl. Burrowing owls are listed by CDFW as a species of special concern and by BLM as a sensitive species. The burrowing owl inhabits burrows in a variety of habitats, including deserts and scrublands characterized by low-growing vegetation. Burrowing owls exhibit high site fidelity, reusing burrows year after year (CBOC 1993).

The project area provides suitable nesting, foraging, and wintering habitat for burrowing owls. Burrowing owls and burrowing owl sign, including burrows, pellets, feathers, and whitewash, were observed in multiple locations within the project ROW during fall botanical surveys and desert tortoise surveys in 2012 (Figure 3.3-9) (CSESA 2012; Kiva Biological 2012a). The project area appeared to support between 9 and 24 burrowing owls at the time of the surveys (late October to early November). Twenty-four burrows with recent sign of use by burrowing owls were mapped during the botanical surveys (Figure 3.3-9). Live owls were observed using 8 of the 24 active burrows; 1 additional live owl was also observed in the project ROW. Many of the burrowing owls were observed foraging on grasshoppers, which were abundant during fall 2012 surveys (Schnurrenberger 2012). Burrowing owls that are observed during fall migration will commonly move on to other over-wintering or nesting habitat (Schnurrenberger 2012). It is likely that a number of the burrowing owls observed in the fall were using the project area for forage during migration. Only a portion of the owls observed on the site would be expected to over-winter in the area; other owls were likely migrating (Schnurrenberger 2012). SMS will conduct a burrowing owl survey prior to construction.

Golden Eagle. The golden eagle is protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c) and is a fully protected species under California Fish and Game Code. Golden eagles nest in large sturdy trees and on cliffs and forage widely over grasslands and scrublands for rodents and other prey. They build large nests of sticks, and nest from early spring through summer.

Figure 3.3-8: Mojave Fringe-toed Lizard Habitat Drainage



SOURCE: ESRI 2013, URS 2009, and Panorama Environmental, Inc. 2013

Scale: 1:30,000

LEGEND

Mojave Fringe-Toed Lizard Study Area

State Jurisdictional Waters

Flowline Direction

N

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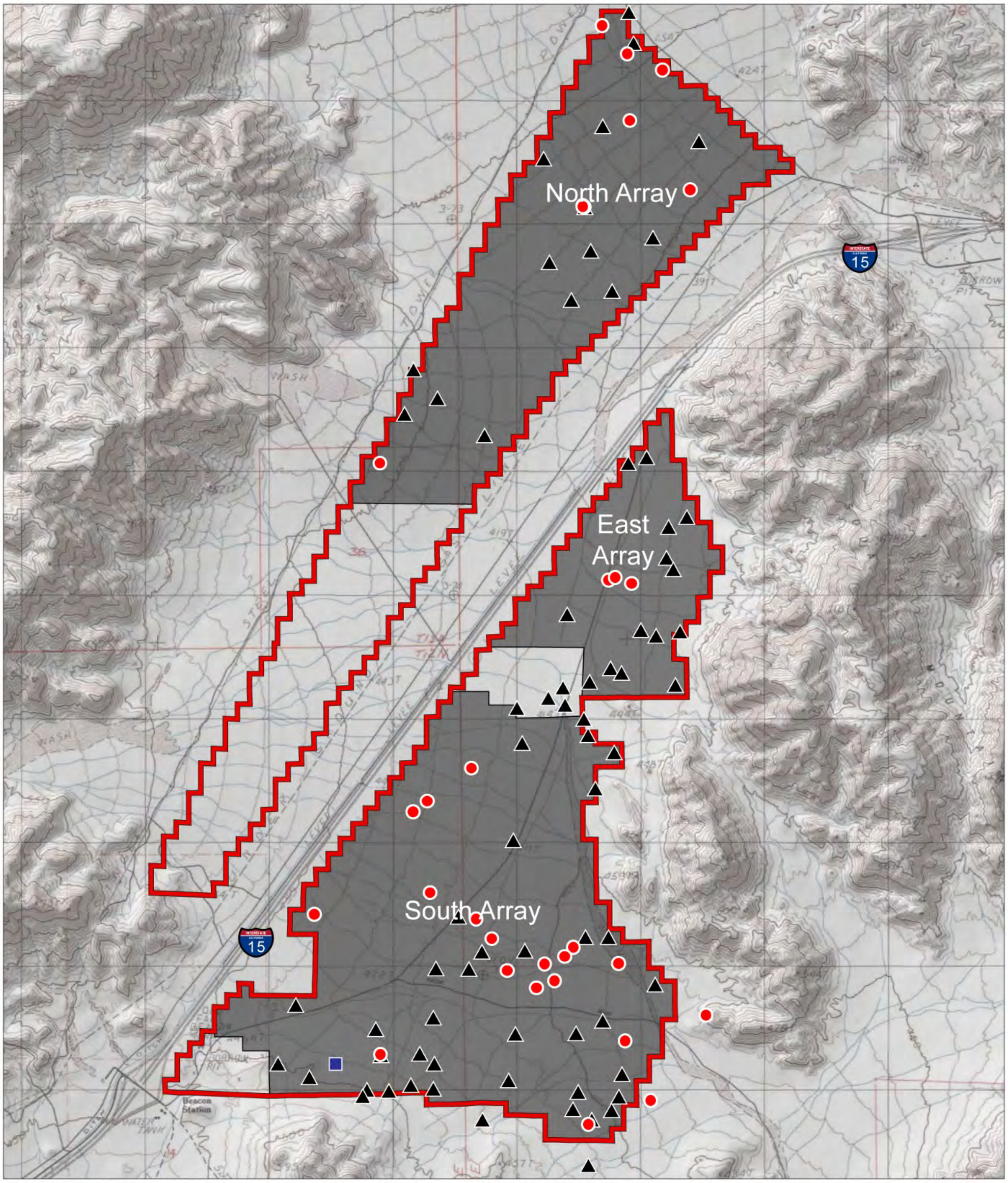
Figure 3.3-9: Burrowing Owl, Kit Fox, and American Badger Locations in Survey Area



SOURCE: ESRI 2012, C.S. Ecological Surveys and Assessmnets 2012, Kiva 2012, and Panorama Environmental, Inc. 2012

Scale: 1:50,000

LEGEND

Proposed Project ROW

Potential Solar Array Area

Kit Fox Den

American Badger

Burrowing Owl

0 0.5 1 1.5 2 Miles

N

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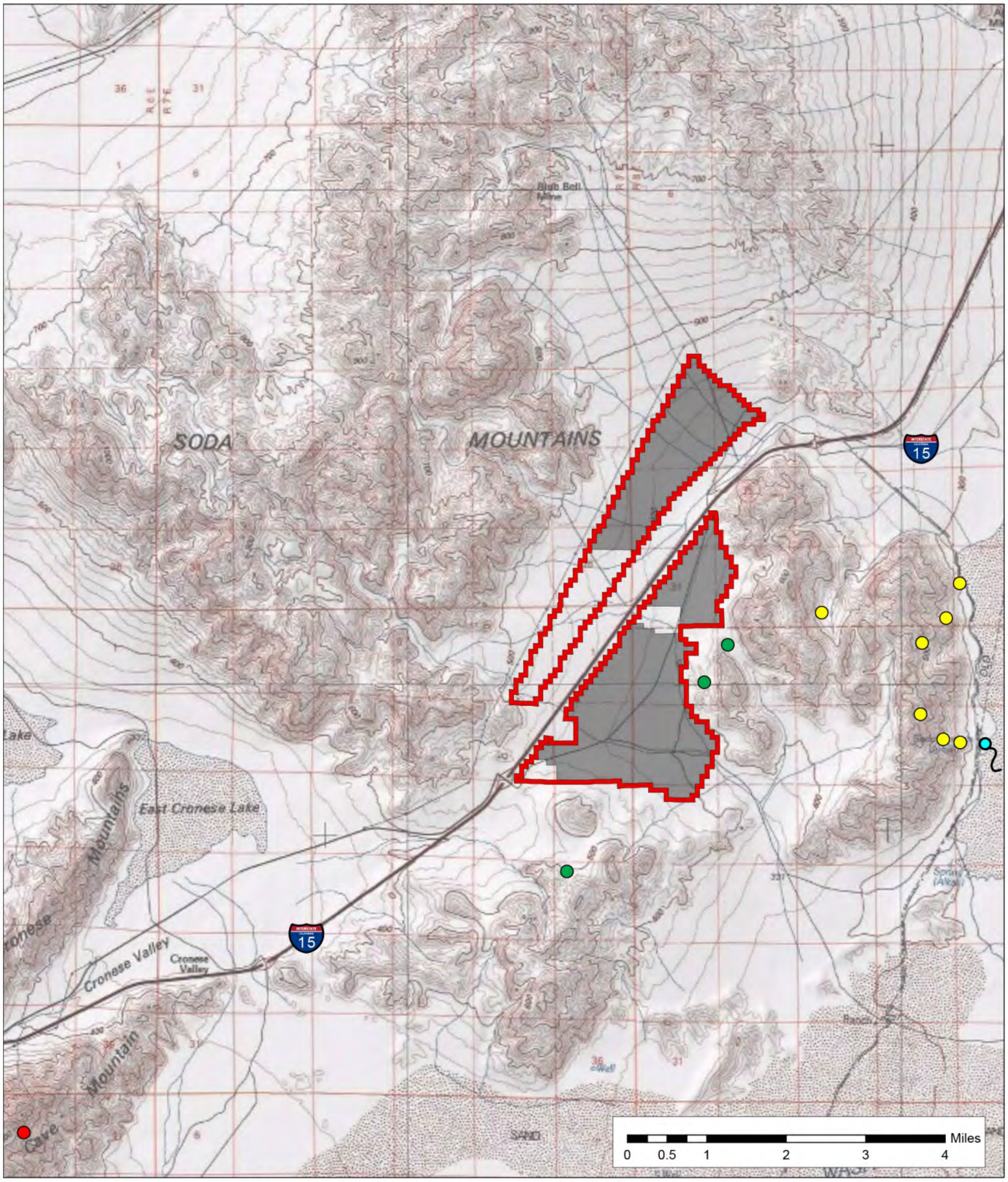
The project is located within an open valley and there is no suitable nesting habitat for golden eagles within the project area. The project area provides suitable foraging habitat and could be used by golden eagles nesting outside of the project area, as the home range of the species in southern California is estimated to be approximately 36 square miles. Golden eagles may forage up to 10 miles from a nest in xeric habitat. Golden eagles may hunt jackrabbits, squirrels, woodrats, or other small animals that occur within the project area. They may also scavenge for carrion along I-15.

The 2009 avian surveys did not record sightings of golden eagle within the project area (URS 2010). No golden eagles were identified during surveys of the project area in either 2009 or 2012. Biologists identified two golden eagle nests in one active territory (outside the ROW) during the March helicopter and ground surveys (BRC 2011) (Figure 3.3-10). The nests were located on the south face of Cave Mountain approximately 8 miles southwest of the southwestern boundary of the project area, such that the project area is within the outer estimated range of these eagles. One nest was active, with a pair of eagles taking turns incubating an unknown number of eggs. A second, alternate nest was located in a larger overhanging cave directly below the active nest. Biologists observed an additional sub-adult golden eagle interacting with the adult male, perching and soaring around the summit of Cave Mountain. During the May 10, 2011, follow-up survey, biologists determined that two golden eagle nestlings were in the active nest, and aged them to be approximately 3 weeks old.

Loggerhead Shrike. The loggerhead shrike is listed by USFWS as a bird of conservation concern and by CDFW as a species of special concern. The loggerhead shrike is distributed throughout much of California, except in higher-elevation and heavily-forested areas (Humple 2008). Loggerhead shrikes establish breeding territories in open habitats with relatively short vegetation that allows for visibility of prey; they can be found in grasslands, scrub habitats, riparian areas, other open woodlands, ruderal habitats, and developed areas including golf courses and agricultural fields (Yosef 1996). They often use structures for impaling their prey; the structures most often take the form of thorny or sharp-stemmed shrubs, or barbed wire (Humple 2008). Shrikes nest earlier than most other passerines, especially in the west where populations are resident. The breeding season can begin as early as late February and lasts through July (Yosef 1996). Nests are typically established in shrubs and low trees, such as sagebrush (*Artemisia* spp.), willow (*Salix* spp.), and mesquite.

Suitable nesting and foraging habitat for loggerhead shrike exists on and adjacent to the project area. Seven loggerhead shrike were observed during spring and fall avian surveys in 2009 (URS 2010). A wing of a logger-head shrike was identified in the project area during fall 2012 surveys (CSESA 2012). The species was observed during both spring and fall surveys indicating that loggerhead shrike may use the project area year-round.

Figure 3.3-10: Golden Eagle and Bighorn Sheep Locations in Survey Area



SOURCE: ESRI 2012, BRC 2011, CDFG 2012, Kiva 2012, and Panorama Environmental, Inc. 2012

Scale: 1:140,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- Zzyzx Spring
- BRC Bighorn Sheep and Golden Eagle Location
- CDFG Bighorn Sheep Location
- Kiva Bighorn Sheep or Sign

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Mammals

Pallid Bat. The pallid bat is a CDFW species of special concern and a BLM sensitive species. Pallid bats select roosts on the basis of temperature and proximity to foraging habitat. Pallid bats roost in crevices in granite boulders, between rocks in loosely cemented conglomerate, mud solution tubes, historic buildings, mines, and burrows (Brown pers. obs.). The bats often spend the day in rock crevices and congregate for socialization at night (Lewis 1994), often in boulder caves and mines. Pallid bats prey upon scorpions, solpugids, beetles, grasshoppers, cicadas, katydids, and sphinx moths captured on or near the ground (Barbour and Davis 1969; Hermanson and O'Shea 1983). Radio telemetry and the known behavior of favored prey items suggest pallid bats fly close to the ground and land on the ground to capture prey (Brown and Grinnell 1980; P. Brown pers. obs.). Between foraging bouts, pallid bats congregate in night roosts in mines, buildings, and under bridges where they leave guano and the remains of their insect and arachnid prey. Pallid bats have been documented traveling up to 5 miles for forage (Brown 2012).

Suitable roosting habitat occurs outside of the project area at Blue Bell Mine and in rock crevices in nearby mountains. Individual pallid bats may also be able to use burrows within the creosote scrub habitat for roosting. Pallid bat guano and insect prey remains were discovered in three tunnels of the Otto Mountain Mine (or Aga Prospect Mine) north of Baker, within 10 miles of the project (Brown-Berry Biological Consulting 2012). No acoustic signals of pallid bats were detected during surveys of the project area in 2012 (Brown-Berry Biological Consulting 2012). With sufficient moonlight, pallid bats can navigate visually, use prey-produced sounds to hunt (Bell 1982), and may not emit echolocation signals. It is difficult to estimate the relative abundance of this species in the project area vicinity by acoustic methods (Brown-Berry Biological Consulting 2012). Therefore, it is assumed that pallid bats would use the project area for foraging because the project is within the foraging range of the bats observed at Otto Mine.

Townsend's Big-eared Bat. The Townsend's big-eared bat is a CDFW species of special concern and a BLM sensitive species. The determining factor in the distribution of this species in the western United States tends to be the availability of cave-like roosting habitat (Pierson 1998). Population concentrations occur in areas with substantial surface exposures of cavity-forming rock (e.g., limestone, sandstone, gypsum, or volcanic rock) and in old mining districts (Genter 1986; Graham 1966; Perkins et al. 1994; Perkins and Levesque 1987). Townsend's bats have been documented traveling up to 5 miles for forage (Brown 2012).

This sensitive species has declined in numbers across the western United States (Pierson et al. 1999). The Western Bat Working Group rates Townsend's big-eared bat at high risk of imperilment across its range. The species has been recently proposed for listing in California by the Center for Biological Diversity. Roost disturbance or destruction appears to be the most important reason for the decline. The tendency for this species to roost in highly visible clusters on open surfaces near roost entrances makes them particularly vulnerable to disturbance. Roost loss in California in 36 of 38 documented cases was directly linked to human activity (e.g., demolition, renewed mining, entrance closure, human-induced fire, renovation, or roost disturbance) (Pierson and Rainey 1996).

Townsend's big-eared bats were not detected during acoustic surveys of the project area. Townsend's big-eared bats and/or their guano were observed approximately 2 miles from the project area in several of the Blue Bell Mine features and the Otto Mountain Mine in 2012 (Brown-Berry Biological Consulting 2012). Acoustic studies are not a good method to determine the presence of this species because the bats often emit faint calls, usually detectable only within 10 feet. While no bats were observed, it is assumed that bats roosting in the Blue Bell Mine could forage over the project area for several reasons. The project area provides suitable foraging habitat for Townsend's big-eared bat and is within the foraging range of bats at Blue Bell Mine and Otto Mountain Mine. Townsend's bats are known to travel up to 5 miles for forage (Brown-Berry Biological Consulting 2012). Suitable roosting habitat is not present within the project area, as there is no cave-like roosting habitat.

Nelson's Bighorn Sheep. Nelson's bighorn sheep is a California fully-protected species and a BLM sensitive species. Bighorn sheep populations in the desert are generally found above the desert floor, near or in steep, rocky mountainous areas, and often on slopes of 10 percent or greater (Wehausen 2006; URS 2009a). Bighorn sheep prefer visually open areas without dense vegetation (USFWS 2000). Mountainous terrain and open views allow them to detect predators from a great enough distance to seek refuge (Wehausen 2006; Turner 2010).

Bighorn sheep can feed on a wide variety of plants. Their diet changes with season and geography due to natural changes in forage quantity and quality (Miller and Gaud 1989; Shackleton 1985 as cited in CEC 2012a). Bighorn sheep prefer to feed on green, succulent grasses and forbs located in areas close to steep, open topography (e.g., rocky barren areas, meadows, and brushlands with low vegetation density) (Zeiner et al. 1990). Rolling terrain and washes act as a vital source of forage that becomes even more important in summer and other times when forage is otherwise limited (USFWS 2000). Sheep will use a variety of habitat types as long as the terrain and visual characteristics of the area meet their requirements (visually open areas) (Penrod et al. 2012).

A study in Arizona found that desert bighorn sheep resided within 1.2 miles of a perennial water source 95 percent of the time (Bristow et al. 1996); bighorn in the Mojave Desert may travel farther from water sources (Davenport 2013). The most important water sources are close to terrain that provides a suitable escape route (i.e., steep, rugged terrain with open visibility) (USFWS 2000). Bighorn sheep will live in areas with water during the summer and move away from water and expand their ranges in the winter (Zeiner et al. 1990). Males typically have an average home range size of approximately 9.8 square miles with ewes having an average home range size of approximately 7.8 square miles (USFWS 2000).

Survey Results. No desert bighorn sheep were observed on or adjacent to the project area during the 2009 surveys (desert tortoise, avian point count, vegetation, and cultural resources) or during the March and May 2011 bighorn surveys in the Soda Mountains north of I-15 (BRC 2011). The March and May 2011 surveys avoided the existing population in the south Soda Mountains in accordance with the request of CDFW. Two bighorn sheep were located in the

Cave Mountains approximately 8 miles southwest of the project area in March 2011. No bighorn sheep were observed during surveys in May 2011.

Surveys conducted in 2012 by CDFW identified a population of 51 to 100 bighorn sheep on the east side of the south Soda Mountains near Zzyzx Spring (Abella 2012a). This population on the east side of the south Soda Mountains is located in close proximity to Zzyzx Spring and limestone outcrops, which provide suitable lamb-rearing habitat. There are frequent sightings of bighorn sheep near the Desert Research Center at Zzyzx. The population is thought to be acclimated to humans (Abella 2012a).

During the fall 2012 desert tortoise survey, five bighorn sheep and bighorn sheep bedding sites were identified on the west side of the south Soda Mountains, east and south of the project ROW (Kiva Biological 2012a). Locations where bighorn sheep were identified during surveys are shown on Figure 3.3-10.

There is anecdotal evidence of bighorn sheep sightings in the Soda Mountain valley. Bighorn sheep have been sighted:

- Between Basin Road and Zzyzx Road approximately 300 feet east of I-15 and within the project area (Burke 2012)
- Near the Rasor Road gas station and to the east of I-15 near Rasor Road (Burke 2012)
- West of I-15 near the Zzyzx Road interchange
- On the ridge above the Zzyzx Road interchange (Weasma 2012)

Habitat Suitability. The project area is relatively flat with sparse vegetation. The area is suitable foraging habitat for sheep and it may be used intermittently by the population in the south Soda Mountains. There is no water source in the project area or in the Soda Mountains to the north or west that would attract bighorn to the area. The closest water source to the project area is 3 miles east of the East Array at Soda Spring on the west shore of Soda Lake. The spring provides a year-round water source for the bighorn sheep population in the south Soda Mountains.

The project area has several characteristics that make it unsuitable bighorn sheep mountain or lamb-rearing habitat, including:

- Flat terrain (2 to 4 percent slope)
- No steep rocky slopes
- Open area, vulnerable to predators
- No water source within 3 miles
- No limestone outcrops

No bighorn trails or sign were located in the project area during surveys in 2009 and 2012. The lack of trails or sign in the project area indicates that bighorn foraging in the area may be intermittent and may involve a low number of sheep.

The DRECP *Updated Expert Species Models* provides the results of modeling for bighorn sheep habitat (CEC 2012b). Figures 3.3-11 and 3.3-12 show the model results for intermountain and mountain habitat, respectively. The project area (a valley between mountains) is not identified as intermountain or mountain habitat.

Habitat Suitability of Adjacent Mountains. The south Soda Mountains are occupied habitat for bighorn sheep. Bighorn sheep sign and trails were identified within mountain habitat areas during surveys in 2012 (Abella 2012a; Kiva Biological 2012a). The slopes of the north and west Soda Mountains are relatively gentle with small rock outcrops and few vertical cliff faces of any height. The west Soda Mountains are not as steep or as rocky as the Cronese and Cave Mountains (where sheep occur), and have few sheer cliffs and rock-strewn gullies (BRC 2011).

Bighorn sheep mountain habitat was modeled in the DRECP *Updated Expert Species Models* (CEC 2012b; Figure 3.3-12). Bighorn sheep mountain and intermountain habitat areas were defined by CDFW and John Wehausen using habitat suitability modeling and expert opinion (CEC 2012b). The DRECP model of mountain habitat shows bighorn sheep mountain habitat to the south and east of the project area; no mountain habitat is shown within the project area. No mountain habitat was identified in the north or west Soda Mountains located north and west of the project area. The mountains north and west of the project area lack a year-round water source and no bighorn sheep use has been documented in formal surveys (BRC 2011; Epps et al. 2003). However, they may be used by bighorn because they historically supported a population of bighorn sheep (Davenport 2013).

CDFW identifies the range of the Soda Mountain population of bighorn sheep to include the Soda Mountains both north and south of the project area, as well as the entire Soda Mountain valley. The range identified by CDFW includes the full species range and does not appear to be adjusted for anthropogenic disturbance that may have fragmented or reduced the historic range size. In the case of the Soda Mountains, the range size has been reduced substantially due to the I-15 highway, which has significantly altered and impaired historic habitat use.

Connectivity in the Project Area. The Mojave population of Nelson's bighorn sheep is divided into three meta-populations: north, central, and south. The meta-populations are bounded by the I-15 and I-40 highways (Wehausen 2006). These highways (Figure 3.3-11) have interfered with the natural intermountain movement and gene flow within the species.

Bighorn sheep connectivity mapping in *A Linkage Network for the California Deserts* (Penrod et al. 2012) and the DRECP "*Updated Expert Species Model Results*" (CEC 2012b) were reviewed to evaluate the suitability of the project area as a potential connectivity corridor. The Soda Mountain valley is not mapped as part of a linkage corridor for bighorn sheep in *A Linkage Network for the California Deserts* (Figure 3.3-13) (Penrod et al. 2012). Penrod et al. define a linkage corridor that runs east-west through the Avawatz Mountains, approximately 20 miles north of the project area, and another linkage about 20 miles south. The linkage corridor mapping developed by Penrod et al. used a least-cost corridor model to determine potential

Figure 3.3-11: Bighorn Sheep Intermountain Habitat (CEC 2012b)

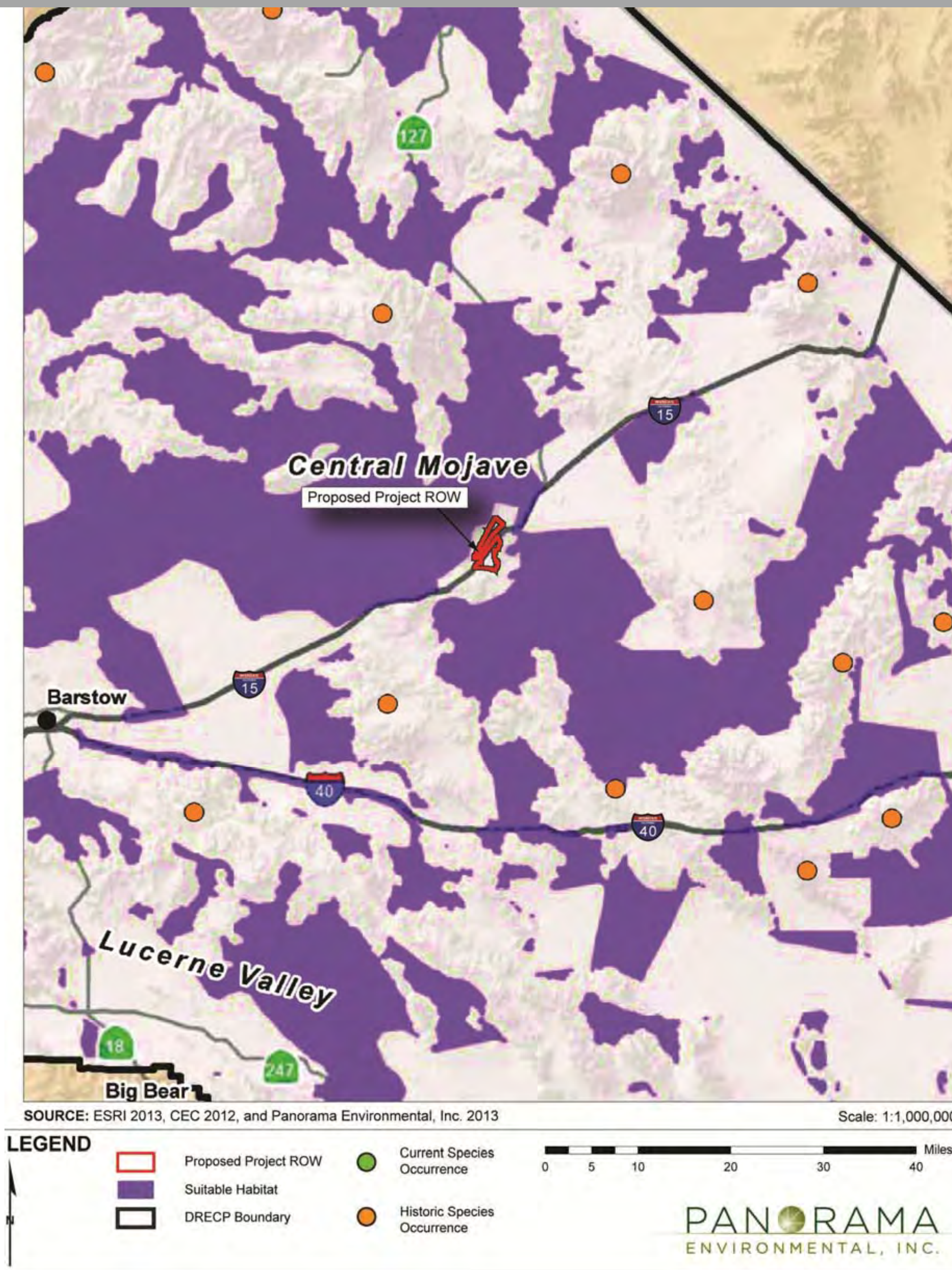


Figure 3.3-12: Bighorn Sheep Mountain Habitat (CEC 2012b)

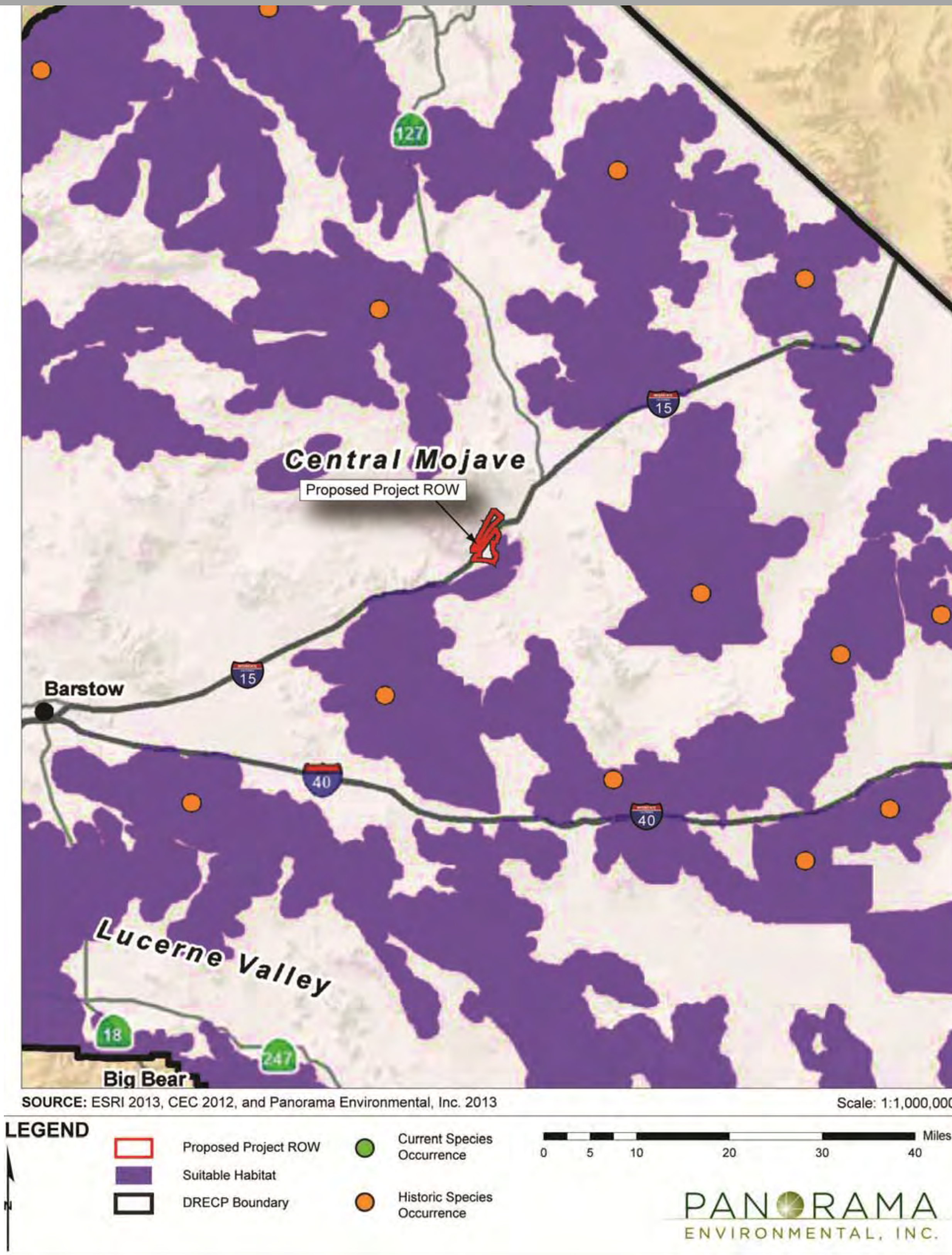


Figure 3.3-13: Bighorn Sheep Connectivity (Penrod et al. 2012)

SOURCE: ESRI 2012, Penrod et al 2012, Mojave Desert Ecosystem Program 2012, and Panorama Environmental, Inc. 2012 Scale: 1:700,000

LEGEND

N

Study Area

China Lake South - Mesquite Wilderness Area Bighorn Sheep Linkage

Mojave National Preserve - Twentynine Palms and Newberry Rodman ACEC Bighorn Sheep Linkage

Mojave National Preserve - Stepladder Turtle mountains Wilderness Area Bighorn Sheep Linkage

Kingston Mesquite Wilderness Area - Mojave National Preserve Bighorn Sheep Linkage

linkage areas. As discussed previously, least-cost corridor model results are dependent on which landscape blocks are being connected. The linkages may therefore over-attribute connectivity to some areas while missing others, depending on which landscape units are proposed for connection.

The DRECP *Updated Expert Species Models* document does not show the project area as intermountain or mountain habitat (Figures 3.3-11 and 3.3-12, respectively) (CEC 2012b). Mountain and intermountain habitats are the areas that are presumed to be most likely used by bighorn sheep when migrating between populations.

The DRECP identifies critical linkage areas at potential highway crossing locations along I-15 and I-40 using the expert opinion of John Wehausen (CEC 2012b). The entire Soda Mountain valley, including the project site and the surrounding mountains, is designated as a critical linkage in the DRECP (Figure 3.3-14), although the modeling did not classify the project area as either intermountain or mountain habitat (Figures 3.3-11 and 3.3-12, respectively).

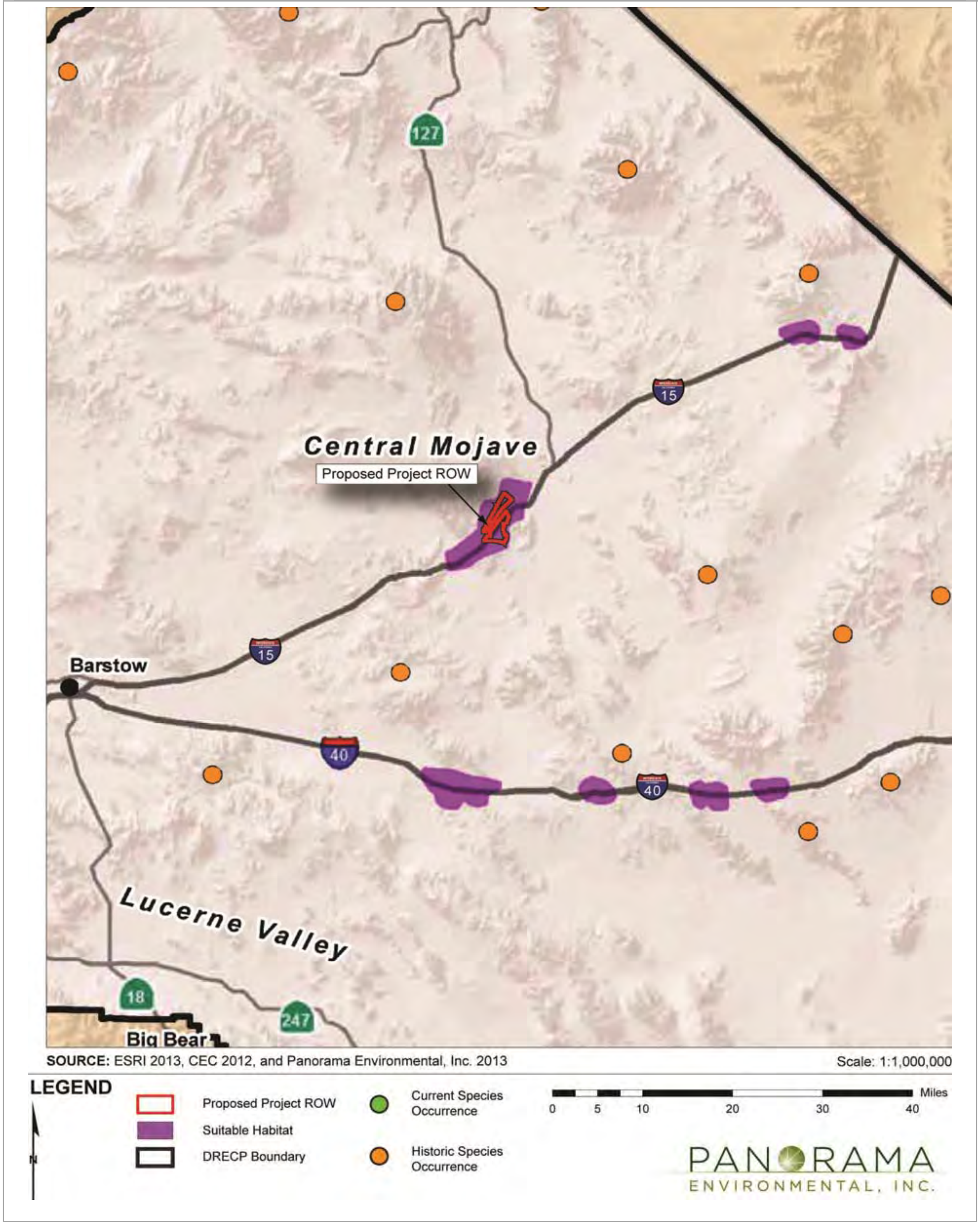
Bighorn sheep are not expected to use the project area (which is neither mountain nor intermountain habitat) for migration between populations because the sheep are more likely to cross the highway at areas where the mountains are close on both sides of the highway, as is the case at both Rasor Road and Zzyzx Road (Davenport 2013; see *Mountain Connectivity* below). The DRECP *Updated Expert Species Models* intermountain map (Figure 3.3-11) supports this conclusion with regard to Zzyzx Road.

Regular sheep migration routes often exhibit trails and sign. The sheep use trails to define routes of frequent travel. They migrate during the breeding season and use the same route to return at the end of the breeding season. There were no bighorn sheep sign or trails observed on the project site during area surveys in 2009 and 2012 (URS 2009b; CSESA 2012; Kiva Biological 2012).

Mountain Connectivity. Bighorn sheep within the south Soda Mountains recently recolonized the area in 2004. It is hypothesized that this population was recolonized from a population in the Cady Mountains (Hughson 2013). The presence of bighorn trails along the mountains to the east and south of the project area (observed by Kiva Biological in fall 2012) indicate that there is likely existing movement through these mountains. These trails indicate sheep could be moving between the population in the south Soda Mountains and the population in the Cady/Cave Mountains.

The modeled mountain habitat in the DRECP shows continuous mountain habitat between the south Soda Mountains and the Cady Mountains. This modeling provides support for a bighorn sheep connectivity corridor between the south Soda Mountains and the Cady Mountains outside of the project area (Figures 3.3-11 and 3.3-12).

Figure 3.3-14: Bighorn Sheep Critical Linkages (CEC 2012b)



The mountains immediately adjacent to the I-15 crossing at Zzyzx Road north of the project area are modeled as intermountain habitat (CEC 2012b). This area has been considered one of the most likely places for intermountain movement because the mountains are close to the highway, and there is both an overpass and an underpass that could be used by sheep (see discussion of culverts, below).

There is no known existing migration or connectivity between populations of bighorn sheep in the south Soda Mountains and the Avawatz Mountains, approximately 15 miles north of the project area. CDFW and the Society for the Conservation of Bighorn Sheep have expressed interest in reconnecting the population in the south Soda Mountains with the population in the Avawatz Mountains. This potential connection to the Avawatz Mountains would improve genetic diversity by connecting the central meta-population with the northern meta-population. The Desert Bighorn Sheep Management Plan, currently being drafted by CDFW, identifies the Soda Mountain area as a location where connectivity across I-15 could be reestablished due to the presence of oversized culverts (essentially underpasses) and bighorn sheep in the area (Wehausen 2012). The critical linkage map in the DRECP reflects this goal of reestablishing connectivity across I-15 in areas where it could potentially exist in the future. While the DRECP map shows the entire Soda Mountain valley as a critical linkage, the only areas where bighorn sheep would be able to safely cross I-15 are at highway underpasses or overpasses.

Highway Crossings. Bighorn sheep occasionally use underpasses to cross highways. One study in Arizona monitored wildlife use at three highway underpasses for 10 months and recorded 25 times when bighorn sheep crossed under the highway (AZDOT 2008). Most (88 percent) of the crossings occurred at the culvert located in the most rugged terrain at the narrowest highway span (AZDOT 2008). The study concludes that higher intensity of culvert use was most associated with their proximity to traditional trails of bighorn sheep, while other factors, such as proximity to steep terrain, underpass structure, lines of sight, and other animals' presence may also be important influences (AZDOT 2008). Underpasses must be a minimum of 14 feet high and 26.3 feet wide to be used by bighorn (Penrod et al. 2008).

Box culverts and bridges in the vicinity of the project were analyzed for potential bighorn sheep use to determine if the culverts are being used by sheep to move between the south Soda Mountains and the Avawatz Mountains or between the south Soda Mountains and the Cady Mountains. There are four box culverts (2, 3, 5, and 6 on Figure 3.3-15) and two bridges (underpasses 1 and 4 on Figures 3.3-16 and 3.3-17) under the I-15 highway near the project area. These box culverts and bridges were evaluated for potential bighorn sheep use using the criteria in the Arizona study (Table 3.3-3). The four box culverts (underpasses 2, 3, 5, and 6) are not likely to be used by bighorn sheep because they are dark and smaller than the minimum width identified for underpass use by bighorn sheep (Burke 2012; Penrod et al. 2008).

Figure 3.3-15: Box Culverts 2, 3, 5, and 6

SOURCE: TerraMetrics 2012, GeoEye 2012, USDA Farm Service Agency 2012, DigitalGlobe 2012, Google Earth Pro 2012, and Panorama Environmental, Inc. 2012

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Figure 3.3-16: Underpass 1, North of Zzyzx Road

SOURCE: ESRI 2012, TerraMetrics 2012, GeoEye 2012, USDA Farm Service Agency 2012, DigitalGlobe 2012, Google Earth Pro 2012, and Panorama Environmental, Inc. 2012

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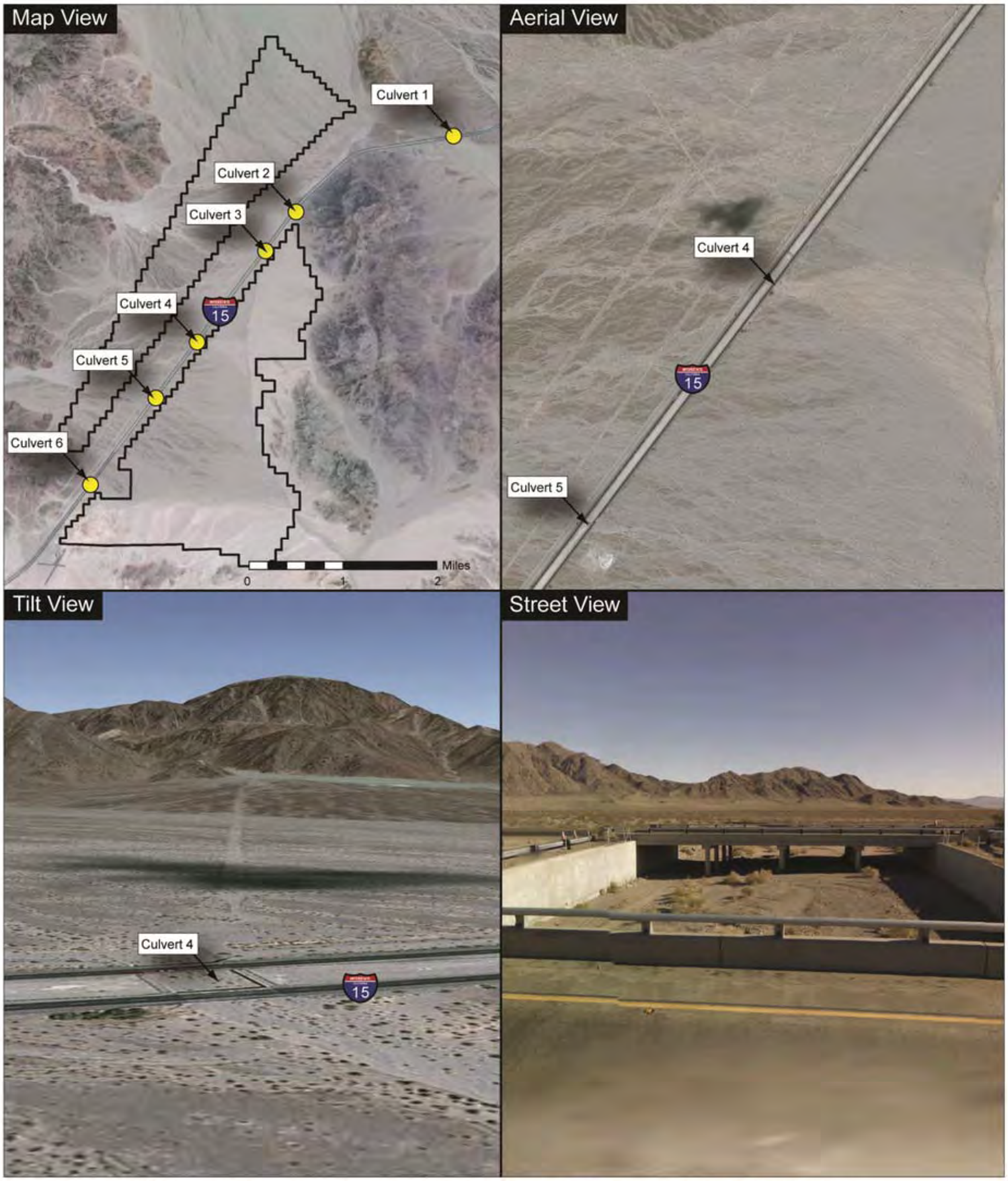
Figure 3.3-17: Underpass 4, Opah Ditch



SOURCE: ESRI 2012, TerraMetrics 2012, GeoEye 2012, USDA Farm Service Agency 2012, DigitalGlobe 2012, Google Earth Pro 2012, and Panorama Environmental, Inc. 2012

LEGEND

N

Proposed Project ROW

Existing Culvert

PANORAMA ENVIRONMENTAL, INC.

Table 3.3-3: Likelihood of Bighorn Sheep Use of Box Culverts/Bridges for Undercrossing

#	Underpass	Dimensions (width by length in feet)	Distance to Nearest Mountainous Terrain (miles)	Proximity to Nearest Known Bighorn Sheep Occurrence	Probability of Use
1	Zzyzx Road bridge	100 by 15	0.15 north	2.2	**Moderate.** Of adequate size, close to steep terrain, near known location, no bighorn sheep trail, approximately 2.5 miles from mapped occurrence
2	Box culvert	25 by 15	0.16 east	1.6	**Low.** Less than minimum width of 26.3 feet (Penrod et al. 2008)
3	Box culvert	25 by 15	0.49 east	1.3	**Low.** Less than minimum width of 26.3 feet (Penrod et al. 2008), far from steep terrain
4	Opah Ditch bridge	80 by 15	1.14 east	1.3	**Low.** Of adequate size, far from steep terrain, no bighorn sheep trail
5	Box culvert	25 by 15	1.5 east	1.7	**Low.** Less than minimum width of 26.3 feet (Penrod et al. 2008), far from steep terrain
6	Box culvert	25 by 15	0.12 west	2.7	**Low.** Less than minimum width of 26.3 feet (Penrod et al. 2008), far from known occurrences

Evaluation of the criteria identified in the Arizona study discussed above indicates the bridge at Opah Ditch (underpass 4; Figure 3.3-17) is not likely to be used by bighorn sheep. Even though this underpass is of sufficient size, it is far from steep terrain and the Zzyzx and Rasor Road areas are better locations for movement due to the relatively short intermountain distance at Zzyzx Road and Rasor Road. The underpass at Zzyzx Road (underpass 1; Figure 3.3-16) has a higher likelihood of bighorn sheep use because the underpass is wider and is closest to steep terrain where sheep are known to occur. There is sign of bighorn sheep use of the ridge south of the Zzyzx Road overpass (Weasma 2012). Game cameras installed by CDFW at the underpasses at Opah Ditch and Zzyzx Road in August 2012 have not detected any bighorn sheep use to date (Abella 2013). There are also no bighorn sheep trails or sign at the Opah Ditch underpass. However, given the limited duration of these photographic studies and the time of year at which they were conducted, these studies cannot be considered conclusive.

Bighorn may use the existing overpasses at Zzyzx Road and Rasor Road to cross I-15. These overpasses are both located at pinch-points in the mountains where there is suitable habitat and escape terrain in close proximity to the crossing. As discussed previously, bighorn sheep have been observed north of I-15 near Zzyzx Road and near Rasor Road (Weasma 2012; Burke 2012). The overpass at Zzyzx Road is approximately 1.25 miles from the project area and the overpass at Rasor Road is located south of the project area, immediately adjacent to the Rasor Road service station, which is currently disturbed and characterized by high levels of human activity.

Connectivity Summary. The DRECP modeled intermountain habitat identifies areas that bighorn sheep would be most likely to use for intermountain movement. The area near Zzyzx Road is identified as intermountain habitat and is a more likely location for intermountain movement than the project area. The Soda Mountain valley and the hills by Rasor Road are not identified as intermountain habitat (Figure 3.3-11).

There have been sightings of bighorn sheep near I-15 between Basin Road and Zzyzx Road and there are anecdotal observations of bighorn sheep just west and north of the I-15 highway at Zzyzx Road (Weasma 2012; Burke 2012; Abella 2012b). There is no documented existing connectivity between the population in the south Soda Mountains and the population in the Avawatz Mountains. Sheep may, however, be moving to the north Soda Mountains at the "pinch points" at Zzyzx Road because they are located near mountain habitat and rugged terrain. Sheep are less likely to use the open valley for movement or crossing the highway when there are mountainous areas nearby (Davenport 2013).

American Badger. American badgers are stocky, burrowing mammals that occur in grassland and scrubland habitats throughout the western United States. Badgers can have large territories up to 21,000 acres in size, but territory size varies by sex and season. Badgers are strong diggers, and feed primarily on other burrowing mammals, such as ground squirrels. Burrows are used for dens, escape, and predation. Badgers are primarily nocturnal, but are often active during the day. They breed during late summer to early autumn, and females give birth to a litter of young the following spring in March to early April. Coyotes and golden eagles have been known to depredate badgers, but the primary known sources of mortality are automobiles and hunting. American badgers prefer open habitat with friable soils (suitable for digging) and abundant prey.

The fall 2012 survey of the project area identified one burrow with sign of digging by an American badger (Figure 3.3-9) (CSESA 2012). The project area provides suitable denning and foraging habitat.

Desert Kit Fox. The desert kit fox is a protected fur-bearing mammal under California Fish and Game Code. The desert kit fox occupies arid and semi-arid locations at 1,300 to 6,250 feet amsl and typically will avoid areas of rugged, sloped terrain. Vegetation communities in kit fox habitat includes desert scrub, chaparral, halophytic (plants growing in salty conditions), and grassland. Kit fox live in dens and thus prefer loose-textured soils that are conducive to burrowing. They primarily subsist on kangaroo rats, prairie dogs, black-tailed jackrabbits, cottontails, birds, reptiles, and carrion. Kit fox do not need to live near a water source because they can get sufficient water from their food if they consume a sufficient quantity.

The project area is relatively flat and contains poorly graded gravels, silty gravels, and silty sands, which could be conducive to den creation. Prey species, such as black-tailed jackrabbits and ground squirrels, are present on the site. The project area contains suitable habitat for desert kit fox.

Kit fox were identified on the project site during surveys conducted in 2009 (URS 2009b). In addition, 57 recently active, occasional use, and inactive natal dens were found in the project area during botanical surveys in fall 2012 (Figure 3.3-9) (CSESA 2012). Numerous sign of desert kit fox were recorded during the botanical surveys, including 2 active dens, 26 inactive occasional use dens, 14 possibly active dens, 10 dens that were potentially used by kit fox, and 5 inactive natal dens. No live kit fox were observed. Numerous desert kit fox scat were also observed; the majority of the scat was associated with a den. SMS will conduct a desert kit fox survey prior to construction.

Species Absent from the Project Area that Could be Indirectly Impacted by the Project
Fish
Mohave Tui Chub. The Mohave tui chub is a fully protected, state endangered, and federal endangered species. The Mohave tui chub's range is limited to four locales:

1. Lark Seep at China Lake Naval Air Weapons Station (North Channel, George Channel, and G1 Channel)
2. Camp Cady Wildlife Area
3. Desert Studies Center at Zzyzx (Lake Tuendae and MC Spring)
4. Deppe Pond at the Lewis Center for Educational Research, Mojave Rivers Campus (USFWS 2009a)

Suitable Mohave tui chub habitat includes specific requirements for pool configuration, food sources, water quality, and water temperature. Pools must be at least 4 feet deep to resist cattails and to stabilize temperature and dissolved oxygen content. Temperature tolerance ranges from 37 to 97 degrees Fahrenheit (3 to 36 degrees Celsius). The tui chub cannot tolerate high salt content and thus there must be a flow of freshwater into the pool to counteract high evaporation rates in the desert. Insufficient water supply to existing populations is a threat to the viability of Mohave tui chub populations. Mohave tui chub feed on aquatic invertebrates. Aquatic plants are needed for attachment of eggs and to prevent anoxic conditions in the water. Vegetation (aquatic and riparian) also provides shade to protect the fish from extreme temperatures (USFWS 2009a).

The population of Mohave tui chub closest to the project area is located in Lake Tuendae and MC Spring in the Mojave National Preserve near the Desert Studies Center at Zzyzx, approximately 4 miles east of the project area (Figure 3.3-18). The habitat in Lake Tuendae is managed to provide adequate habitat for the Mohave tui chub through activities such as periodic dredging of sediment and cattail removal (NPS 2001). The population of tui chub at the Desert Studies Center was 1,318 fish in Lake Tuendae (where the population tends to vary by approximately 50 percent) in 2007, and 255 fish in MC Spring (where the population is stable) in 2008. Lake Tuendae is filled with water pumped from the local aquifer, while MC Spring's pool is fed by a natural spring. The aquifer at the project site is not known to be hydrologically connected to the aquifer(s) that supplies MC Spring and is pumped to fill Lake Tuendae.

Figure 3.3-18: Soda Spring Location Relative to Project

SOURCE: ESRI 2012, USGS National Water Information System 2012, and Panorama Environmental, Inc. 2012

Scale: 1:100,000

LEGEND

Proposed Project ROW

Well

Soda Spring

0 0.5 1 2 3 4 Miles

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Saratoga Springs Pupfish. The Saratoga Springs pupfish is a state-listed species of special concern; this pupfish has no special federal status. The pupfish are found in two locations—Saratoga Springs in Death Valley National Park and Lake Tuendae at Zzyzx, where they were introduced over 30 years ago.

Saratoga Springs is the native habitat of the pupfish and is thus used here as a proxy for habitat requirements, although the conditions of Lake Tuendae also provide adequate habitat. Generally, the pupfish is able to tolerate great temperature extremes during non-reproductive life stages (35.6 to 111.2 degrees Fahrenheit) but has a lower tolerance during reproduction (75.2 to 86 degrees Fahrenheit). Its eggs are sticky, aiding adhesion to the substrate. The chief food of the pupfish is blue-green cyanobacteria, though they also consume small invertebrates seasonally. The Saratoga Springs location is up to 6.6 feet deep, with algae and detritus on the bottom. Water temperature ranges from 82.4 to 84.2 degrees Fahrenheit at most times. The springs drain to several lakes, which have grassy, muddy/sandy bottoms. Water temperatures vary more in the lakes than the springs, particularly from season to season, ranging from 50 to 120.2 degrees Fahrenheit. It is suspected that the spring itself is not used for spawning because juveniles are only found in the lakes (CDFW 1995). The main threat to the species is the destruction of its native habitat at Saratoga Springs, including groundwater pumping (CDFW 1995).

The closest population to the project area is in Lake Tuendae, at the Mojave National Preserve at the Desert Studies Center at Zzyzx, approximately 4 miles east of the project area.

3.3.2 Avian Species

Migratory birds are protected under the federal Migratory Bird Treaty Act (MBTA) and California Fish and Game Code Sections 3503, 3503.5, 3505, and 3513. Avian species that are protected under the MBTA and Fish and Game Code were identified during spring and fall point count surveys in 2009 (URS 2010). A total of 629 birds (22 species) were recorded within the study area during the spring point count surveys for the project area (URS 2010). The fall point count surveys recorded a total of 210 birds (23 species) within the study area. Loggerhead shrike, a CDFW species of special concern, was identified during both spring and fall avian point counts. No other special-status birds were identified during either spring or fall avian point counts. Birds identified within the project area are identified in Table 3.3-4. The number of each species observed during the fall and spring point counts under the column for project area sightings for each respective avian point count (APC).

Foraging Habitat

A variety of forage is available within the project area. Table 3.3-4 identifies the types of foraging habitat available for each species recorded during the avian point count surveys. Birds of prey may use the project area as foraging grounds to hunt small animals such as snakes, mice, kangaroo rats, ground squirrels, woodrats, and jackrabbits, or may scavenge for carrion along I-15. Insects, seeds, fruits, and berries are also available forage for birds.

Table 3.3-4: Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
American crow (*Corvus brachyrhynchos*)	Nests are constructed in trees 10 to 25 feet above ground using large sticks, mud, and fine vegetation. Occasionally nests in shrubs, on the ground, or on utility poles.	Adult American crows are omnivorous. Insects are fed to young.	There is nesting habitat (shrubs) available in the project area and foraging habitat (insects, foliage, reptiles, and carrion from I-15 and other animals in area).	Nesting: March to August Resident: Uncommon in desert habitats but live year-round in areas of California where humans are present. Migrant: Spring and Fall	Fall 2009 APC: 1
American robin (*Turdus migratorius*)	N/A—winter resident or migrant.	Eats beetles and other small arthropods, as well as fruits, berries, seeds, and sprouts.	There is no nesting habitat. There is foraging habitat (insects, foliage, and cactus berries).	Resident: September to March Migrant: Spring and Fall	Fall 2012 BS
Bewick's wren (*Thryomanes bewickii*)	Nests are constructed in natural cavities or rock crevices.	Feeds on insects, spiders, and small invertebrates. Rarely eats seeds. Mostly forages on small trees and shrubs.	There is no nesting habitat on the project site. The species could nest in the Soda Mountains (rock outcroppings provide crevices for nests) and foraging habitat (insects and foliage).	Nesting: February to August Resident: Year-round	Fall 2012 BS
Black-chinned sparrow (*Spizella atrogularis*)	Shrubs, with the species likely irrelevant. Usually on gentle to steep slopes in somewhat dense vegetation.	Gleans insects from vegetation and ground during summer and rarely captures insects from air; obtains water from food. Feeds on grass seeds while perched on shrubs in winter; will travel far distances for water.	There is no nesting habitat (vegetation not dense, project area not sloped; not sighted during nesting season). There is migration habitat (fall survey occurred in September-October) and foraging habitat (insects from ground and vegetation).	Nesting: April to July Resident: March to September Migration: Spring and Fall	Fall 2009 APC: 1

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Black-tailed gnatcatcher (*Polioptila melanura*)	Mojave Desert populations prefer to nest in arroyos and washes densely and primarily vegetated with creosote bush and salt bush, with smaller populations of other plants. Nests are usually found in trees and are rarely found in creosote bush.	Mojave Desert populations prefer to forage in arroyos and washes densely and primarily vegetated with creosote bush and salt bush, with smaller populations of other plants.	There is nesting habitat (one mesquite bush) present in project area, which is dominated by creosote scrub; sighted during nesting season. Project area may be used during migration.	Nesting: April to June Resident: Year-round Migrant: Spring and Fall	Spring 2009 APC: 2 Fall 2009 APC: 2
Black-throated sparrow (*Amphispiza bilineata*)	Occupies a variety of chaparral and desert scrub habitats with sparse or open stands of shrubs, especially cholla, ocotillo, creosote bush, and saltbush. Uses a variety of shrubs, cacti, and small trees for cover. Nests are built 6 to 18 inches above ground in dense, often thorny shrubs or among cactus joints.	Eats insects, spiders, seeds, and green shoots of grasses and forbs. Diet consists of mostly seeds in winter. Insects are more important in breeding season. Feeds primarily by gleaning and scratching on ground; also gleans from shrubs and herbs, and occasionally hawks aerial insects.	There is nesting and foraging habitat present in the project area.	Nesting: March to June Resident: Year-round Migrant: Spring and Fall	Spring 2009 APC: 89 Fall 2009 APC: 10

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Blue-gray gnatcatcher (*Polioptila caerulea*)	Shrubs and low trees, usually in arid habitats. Most common where there is open woodland or trees scattered among chaparral, sagebrush, and other brush. Dominant shrub in desert habitat is antelope brush. Common in pinyon-juniper habitat.	Feeds on insects, spiders, and small invertebrates by gleaning from foliage. Also captures prey from the air.	There is possibly nesting habitat (sightings in fall only) and foraging habitat (hawking and gleaning from vegetation).	Nesting: April to July Resident: Late March to late August Migrant: Spring and Fall	Fall 2009 APC: 3
Cactus wren (*Campylorhynchus brunneicapillus*)	Frequents desert succulent shrub, Joshua tree, and desert wash habitats. Nests in cholla or other large, branching cactus, in yucca, or in thorny shrubs or trees.	Forages on ground and in low vegetation for insects, spiders, and other small invertebrates. Fruits, such as cactus fruits, make up 15 to 20 percent of its annual diet.	There is nesting habitat (cactus present) and foraging habitat (low vegetation, cactus present). An inactive cactus wren nest was observed in fall 2012 in the project area (CSESA 2012).	Nesting: April to July Resident: Year-round	Spring 2009 APC: 1
Cassin's kingbird (*Tyrannus vociferans*)	Uses water sources in deserts. Nests in tall trees in open woodlands or other open areas; also nests in utility poles. Occasionally breeds in desert shrublands.	Hawks insects from shrub and tree perches and forages over grassland.	There is nesting and foraging habitat in the project area and this species was sighted during the nesting season in the project area.	Nesting: Late April to early June Resident: March to October Migrant: Spring and Fall	Spring 2009 APC: 3
Chipping sparrow (*Spizella passerina*)	N/A—winter resident.	Eats mostly grass and seeds during winter months. Gleans from the ground and low plants.	No nesting habitat. There is foraging habitat present for this species.	Resident: September to April	Fall 2012 BS

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Common poorwill (*Phalaenoptilus nuttallii*)	Nest in a scrape on the ground, on rock, gravel or litter of forest floor. Builds nests near logs, rocky outcrop, shrub, or herbage for shade.	Feeds on insects caught in the air in cleared areas or on roads in brush and open woodlands.	There is nesting habitat and foraging habitat on the project site.	Nesting: March to August Resident: Year-round	Fall 2012 BS
Common raven (*Corvus corax*)	Nest is a mass of twigs and sticks bound with earth and moss and well-lined with soft vegetation and hair. Nest usually placed on cliff or bluff, but also in a tall tree or human-made structure.	Eats carrion, small vertebrates (including mice and rabbits), bird eggs and young, insects, seeds and grains, nuts, and berries and other fruits. Gleans from the ground, searches for food in flight, and pursues prey.	There is no nesting habitat (no tall trees, cliffs, or bluffs in the project area). The species could nest on transmission towers and poles adjacent to the project. There is foraging habitat (carrion from interstate, rodents, and insects).	Nesting: February to May Resident: Year-round	Spring 2009 APC: 24 Fall 2009 APC: 31
Costa's hummingbird (*Calypte costae*)	Primary habitats are desert wash, edges of desert riparian and valley foothill riparian, coastal scrub, desert scrub, desert succulent shrub, lower-elevation chaparral, and palm oasis. Builds nest approximately 5 feet above ground in trees, cacti, shrubs, or woody forbs.	Feeds on flower nectar and small insects.	There is nesting habitat and foraging habitat present.	Nesting: February to June Resident: January to May	Spring 2009 APC: 1

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
European starling (*Sturnus vulgaris*)	In southern California deserts, this species is restricted to urban, cropland, pasture, agricultural, desert riparian, and oasis habitats. Nests in cavities and crevices, or on ground if no crevice available; probably needs drinking water. Avoids desert.	On the ground in open habitats, or takes fruits and nuts from trees and shrubs. Common foraging locales include residential areas, agricultural areas, and dumps.	There is no nesting habitat (no suitable habitat type; avoids desert). There is foraging habitat.	Nesting: Late February to June Resident: Year-round	Spring 2009 APC: 17 Fall 2009 APC: 10
Gray-headed junco (*Junco hyemalis caniceps*)	N/A—winter resident.	Feeds principally on the ground and also gleans from shrubs and small trees.	There is no nesting habitat (winter resident). There is foraging habitat and migration habitat (sighted at beginning of wintering season).	Nesting: April to August Resident: Late September to mid-April	Fall 2009 APC: 7
Greater roadrunner (*Geococcyx californianus*)	Nests in low trees, shrubs, or cactus clumps in open, semiarid areas with scattered brush. Unclear whether water is required; can get water from food but will also drink water if it is available.	Hunts reptiles, rodents, and large invertebrates by chasing them on the ground.	There is nesting and foraging habitat in the project area.	Nesting: Peaks in April and early May Resident: Year-round	2009 DT

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Hooded oriole (*Icterus cucullatus*)	Utilizes tall trees, preferably fan palm.	Eats insects and fruits; forages in tree and shrub foliage and also consumes flower nectar.	There is marginal nesting habitat (no tall trees) in the project area and foraging habitat.	Nesting: Early April to July Resident: March to mid-September Migrant: Spring and Fall	Spring 2009 APC: 1
Horned lark (*Eremophila alpestris*)	Nests on the ground in the open. Shrubs, grasses, and surface irregularities provide cover. Live in deserts, foothills, and dry grasslands around farming areas.	Searches for food while walking on ground. Eats insects, snails, and spiders during the nesting season and at other times also eats seeds and vegetation.	There is suitable nesting and foraging habitat for this species and it is known to nest in the project area (URS 2009a).	Nesting: March to July Resident: Year-round	Spring 2009 APC: 414 Fall 2009 APC: 53 2009 DT: (1 empty nest, 1 nest with eggs)
House finch (*Haemorhous mexicanus*)	Nests are usually built 6 to 20 feet above ground in trees or shrubs with dense foliage, or in a cliff crevice. Requires water daily, but is known to fly long distances to drink.	Seeds of grasses and forbs are principal foods but buds, berries, and other small fruits are also important. Only eats small amounts of insects.	There is limited nesting habitat in the project area and there is suitable foraging habitat.	Nesting: March to August Resident: Year-round	2009 DT

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
House sparrow (*Passer domesticus*)	Usually builds nest in a hole, crevice, or cranny in a building, nest box, or tree, or in old nest of other cavity nester. Sometimes nests in hole in cliff, or in dense branches of tree, shrub, or vine. Nest usually more than 10 feet above ground.	Primarily a seedeater but occasionally eats fruits, other plant materials, and some insects. Gleans most food from ground, but also gleans from foliage. Often feeds on grains in fields and at stables, and scavenges human food scraps.	There is limited nesting habitat and there is suitable foraging habitat in the project area.	Nesting: April to August Resident: Year-round	2009 DT
Ladder-backed woodpecker (*Picoides scalaris*)	Nests are usually 2 to 20 feet above ground in a cavity in cactus, mesquite, or Joshua tree.	Drills for wood-boring beetles and other insects in trees, shrubs, and cacti. Also gleans insects from trunks and foliage. Occasionally feeds on cactus fruits.	There is foraging and nesting habitat in the project area.	Nesting: March to August Resident: Year-round	Fall 2012 BS
Lesser goldfinch (*Spinus psaltria*)	In deserts, this species is mostly limited to the vicinity of riparian areas and human habitations. Drinking water is required daily and usually nests within 0.5 miles of water and 2 to 30 feet above ground in trees or shrubs. Nests are sheltered by dense outer foliage.	Diet consists mostly of seeds, with some buds, fruits, leaves, and insects.	There is foraging habitat in the project area; however, this species is unlikely to nest in the project area because there is no year-round water source.	Nesting: March to August Resident: Year-round	Fall 2009 APC: 1

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Lesser nighthawk (*Chordeiles acutipennis*)	Nests and roosts are bare sand and gravel surfaces or desert floor along washes.	Feeds on insects, which it hawks on long, low flights over open areas. Also forages over grasslands, desert riparian, and other habitats with high densities of flying insects.	There is nesting habitat (bare sand and gravel and desert wash habitat available in project area) and foraging habitat.	Nesting: April to July Resident: April to September Migrant: Spring and Fall	2009 DT
Mourning dove (*Zenaida macroura*)	Usually nests in dense tree foliage, but also nests on the ground in the western United States, and may also nest in structures. Requires water source nearby and must drink water frequently.	Eats seeds almost exclusively, foraging on the ground in the open and foraging low-profile plants.	There is foraging habitat but this species is unlikely to nest in the project area because there is no water source nearby.	Nesting: March to September Resident: Year-round Migrant: Spring and Fall	Fall 2009 APC: 2
Northern flicker (*Colaptes auratus*)	N/A—winter resident.	Eats mostly berries, fruits, and other plant matter in the fall and winter but also eats insects.	There is no nesting habitat (winter resident). There is foraging habitat (insects and plant matter).	Resident: September to March	Fall 2012 BS (sign)
Northern mockingbird (*Mimus polyglottos*)	Nests in shrubs, small trees, and vines, typically within 6 feet of the ground. Uses mesquite or ocotillo in the desert.	In breeding season eats insects; also eats berries and small fruits other times. Hawks prey in air, picks fruit from plants, gleans from foliage, and flies down from perch to take prey on the ground. Forages in open areas with high perches.	There is foraging habitat (insects and plants; high perches present) and nesting habitat (mesquite present).	Nesting: Mid-February to late September Resident: Year-round	Spring 2009 APC: 6

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Orange-crowned warbler (*Oreothlypis celata*)	Streamside thickets and groves in woodlands that have somewhat dense foliage. Winters in shrubs along streams, in forests, and in dense shrubs.	Forages by gleaning insects from vegetation. Occasionally hawks for insects. Forages in open to dense brush.	There is no nesting habitat (vegetation insufficiently dense; survey sighting not during nesting season). There is foraging habitat (brush) and migration habitat (fall survey done in September-October).	Nesting: Mid-April to mid-July Resident: Late March to mid-October; may also remain in winter	Fall 2009 APC: 2
Red-breasted sapsucker (*Sphyrapicus ruber*)	N/A—winter resident.	Preference for deciduous woodlands, orchards, and shade trees. Eats insects and feeds on tree sap. Also hawks insects over open meadows and other open habitats.	There is no nesting habitat (winter resident). There is foraging habitat (hawking over open habitat) and migration habitat (fall survey occurred in September-October).	Resident: October to April	Fall 2009 APC: 1
Red-tailed hawk (*Buteo jamaicensis*)	Nests 30 to 70 feet above ground in trees, near openings, in older, mature forests, especially riparian deciduous habitats. Nesting is higher on cliffs.	Eats small mammals up to hares in size, small birds, reptiles, amphibians, and some carrion. In winter, largely dependent upon mice, but also takes medium to fairly large birds on the ground. Searches by soaring; also perches and pounces, or pounces on prey from low, quartering flights, sometimes hovering on wind or air currents. Known to forage nearly 4 miles from nests.	Transmission towers or poles adjacent to the project area provide suitable nesting habitat. There is foraging habitat and prey (e.g., black-tailed jackrabbits, white-tailed antelope squirrels, and woodrats) present in project area.	Nesting: March to July Resident: Year-round	2011 GE/BHS: 7 nests, 19 individuals within 6 miles of project area Spring 2009 APC: 2 Fall 2009 APC: 2

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Rock wren (*Salpinctes obsoletus*)	Nests in cavities, among rocks, or in crevices. May also nest in areas with abundant piles of log and brush or where rodents have burrowed. Does not drink water and thus need not nest near water.	Consumes insects and arthropods gleaned from rocks, spider webs, and the air.	There is nesting habitat (burrows, other cavities, and piles of brush) and foraging habitat and this species was sighted during nesting season.	Nesting: Mid-March to late August Resident: Year-round Migrant: Spring and Fall	Spring 2009 APC: 12 Fall 2009 APC: 17
Ruby-crowned kinglet (*Regulus calendula*)	N/A—winter resident.	Diet consists of mostly insects, and other arthropods. Occasionally feeds on seeds. Hovers and gleans from foliage, twigs, and canopy branches.	There is foraging habitat, but this species does not breed in the Mojave Desert.	Resident: September to March Migrant: Spring and Fall	2012 Fall BS
Sage sparrow (*Artemisiospiza belli*)	N/A—winter resident.	Frequents low, fairly dense stands of shrubs. In transmontane California, occupies sagebrush, alkali desert scrub, desert scrub, and similar habitats. Feeds on mostly insects, spiders, and seeds while breeding, and consumes mostly seeds in winter.	There is foraging habitat present, but this species is not known to nest in the east Mojave Desert.	Resident: October to March	Fall 2009 APC: 6.

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Say's phoebe (*Sayornis saya*)	Prefers grasslands, desert scrub, alkali desert scrub, and desert wash. Needs ledges to provide support and needs shelter from the sun. Frequently found in dry, open habitat, at times near water. Most abundant where adequate nesting habitat borders sparsely vegetated desert or grassland habitat.	Hawks flying insects from perches, or occasionally feeds over water, taking insects from the surface.	There is foraging habitat and potential nesting habitat (desert scrub and desert wash). The species was not sighted during nesting season.	Nesting: Early April through July Resident: Year-round	Fall 2009 APC: 44
Savannah sparrow (*Passerculus sandwichensis*)	N/A—winter resident.	Diet consists of mostly grass, seeds, insects, snails, and spiders. Gleans on the ground and picks food directly from low plants.	There is foraging habitat present and this species could occur during migration, but it is not known to nest in the east Mojave Desert.	Resident: September to March Migrant: Spring and Fall	Fall 2012 BS
Sharp-shinned hawk (*Accipiter striatus*)	N/A—winter resident.	Diet consists of mostly avian prey, such as small songbirds, quail, and young domestic foul. Occasionally eats small mammals, insects, and reptiles.	There is foraging habitat and available prey; this species could occur during migration and winter, but is not known to nest in the Mojave Desert.	Resident: September to March Migration: Sharp-shinned hawks migrate to breeding grounds in September and return to wintering grounds in March	Fall 2009 APC: 4

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Townsend's warbler (*Setophaga townsendi*)	N/A—migratory.	Eats mostly insects and spiders gleaned from foliage and twigs of conifers and oaks; occasionally hawks in air, eats seeds, or plant galls.	No nesting habitat. This species may forage in the project area during migration.	Nesting: May to August Migration: Townsend's warbler migrates from Alaska, Canada, and the northern Pacific coast to winter in Mexico and coastal southern California in September; the warblers return to summer breeding grounds in April	Spring 2009 APC: 1
Turkey vulture (*Cathartes aura*)	The species occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Nests are built on cliffs, rock outcrops with rims, ledges, and cavities in trees or snags.	Turkey vultures eat primarily carrion and rarely feeds on live birds, eggs, or live mammals. Regularly forages 15 to 20 miles from roosts or nests.	There is no nesting habitat (no rock outcrops or tall trees) on site but available in nearby Soda Mountains. There is foraging habitat and potential nesting areas nearby.	Nesting: March to June Resident: March to October Migration: Large numbers known to migrate through Mojave Desert during spring and fall	2011 GE/BHS: 2 active nests, 8 individuals within 2 miles of project area

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Verdin (*Auriparus flaviceps*)	Inhabits desert riparian, desert wash, desert scrub, and alkali desert scrub habitats. Builds nests on the ends of shrub branches and are often used as a roost.	Gleans insects from foliage and twigs of shrubs, but also eats berries and seeds.	There is nesting habitat and foraging habitat.	Nesting: February to June Resident: Year-round	Spring 2009 APC: 1 Fall 2009 APC: 2
Warbling vireo (*Vireo gilvus*)	Nests frequently in riparian habitat, probably for the type of tree rather than the water; nests located in a limb of a shrub or tree, 4 to 12 feet above ground.	Gleans foliage; occasionally hawks insects.	There is no nesting habitat. There is foraging habitat and migration habitat (sighted in April-May).	Migrant: Spring and Fall	Spring 2009 APC: 1
Western kingbird (*Tyrannus verticalis*)	Habitat generally is open with trees, tall manmade structures, or shrubs, and includes desert shrub, pasture, grassland, savanna, and urban areas. Nests in trees or structures like utility poles and fence posts.	Hawking and ground foraging for insects.	There is nesting habitat (shrubs, utility poles, and desert scrub) and foraging habitat.	Nesting: April to Late July Resident: Mid-March to mid-September Migrant: Spring and Fall	Spring 2009 APC: 1

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Western meadowlark (*Sturnella neglecta*)	Nest is soil lined with grasses and sometimes containing a dome over the nest made out of grass and shrub. Located in dense vegetation in open grasslands (including desert grassland), prairies, meadows, and agricultural fields. Avoids heavy shrubs.	Forages on the ground. Eats grains from winter to early spring, insects in spring, and seeds in fall. Perches on high posts for singing.	There is no nesting habitat (no grassland). There is foraging habitat.	Nesting: February to late August Resident: Year-round	Spring 2009 APC: 10 Fall 2009 APC: 1
Western tanager (*Piranga ludoviciana*)	Trees and shrubs. Nest is usually 6 to 50 feet above ground in tree canopy.	Feeds mostly on insects, but also some fruit, by gleaning from foliage or from the air. Eats more fruit after breeding and during migration.	There is foraging habitat and this species was observed during migration, but this species is not known to breed in the eastern Mojave Desert.	Migration: April and September to October	Spring 2009 APC: 1
White-crowned sparrow (*Zonotrichia leucophrys*)	N/A—winter resident.	Forages bare ground or grassy areas near shrub cover. Eats seeds and insects from the ground or from low plants. Can hawk insects.	There is foraging habitat and this species may occur in winter but is not known to breed in the eastern Mojave Desert.	Resident: September to May	Spring 2009 APC: 31 Fall 2009 APC: 4
Wilson's warbler (*Cardellina pusilla*)	Absent from southern California deserts during breeding season. Prefers dense understory habitat.	Insects cleaned from foliage low in canopy; also eats seeds and berries.	There is no nesting habitat (does not nest in southern deserts) or foraging habitat (vegetation not dense enough). There is migration habitat (absent during breeding season from southern deserts; spotted during April-May survey; rush habitat).	Migration: Is a frequent spring migrant in lowlands; found drinking at a desert waterhole; brush habitat may be used in migration	Spring 2009 APC: 5

Table 3.3-4 (*Continued*): Soda Mountain Solar Avian Species Observed in the Project Area

Species	Nesting Habitat	Foraging Habitat	Habitat In the Project Area	Nesting/ Residence Periods	Project Area Sightings[1]
Yellow-rumped warbler (*Setophaga coronata*)	N/A – winter resident.	Eats mostly insects and spiders; also eats small fruits, seeds, and occasionally nectar. Forages by hawking insects from air, gleaning from foliage, twigs, and branches, and by searching for food on ground.	There is no nesting habitat. There is winter foraging habitat present.	Resident: October to April Migration: Yellow-rumped warblers migrate to mountain breeding grounds in late April and return in mid-October	Spring 2009 APC: 2 Fall 2009 APC: 3

Notes

[1]
Fall 2009 APC: Fall 2009 Avian Point Count Survey
Spring 2009 APC: Spring 2009 Avian Point Count Survey
Fall 2012 BS: Fall 2012 Botanical Survey (count not recorded)
2009 DT: May 2009 Desert Tortoise Survey (count not recorded)
2011 GE/BHS: 2011 Golden Eagle and Bighorn Sheep Survey

Sources: Benson & Arnold 2001; Birding Information undated; Birdzilla 2012; Chipper Woods Bird Observatory, Inc. 2009; Clark & Hygnstrom 1994; Cornell Lab of Ornithology 2012; Cornell University 2011; Farmer 2008; Humple 1999; Knight et al. 1999; Merola 1995; Mirror-pole.com 2011; National Geographic 2006; Porter 2012; PRBO Conservation Science undated; Rowe & Gallion 1995; Ryser, Jr. 1985; San Diego Natural History Museum 2004; Sierra Club undated; Virginia Department of Game and Inland Fisheries 2012; Wild Bird Watching 2012; Wilson 2012.

Nesting Habitat

The avian species potentially found in the project area require a variety of nesting habitats. Table 3.3-4 identifies the nesting available to the species recorded during the avian point count surveys. Some birds, such as the common poorwill (*Phalaenoptilus nuttallii*), nest in a scrape on the desert surface. Burrobush and cheesebush are commonly found in Mojave scrub communities and provide nesting habitat for birds that require more dense vegetation. A variety of cholla grows within the project area and provide additional nesting habitat. Cliffs, bluffs, and rock outcroppings are available to the north and south of the project area; however, this habitat is not located within the project footprint.

3.4 WATERS

3.4.1 Waters of the US

2009 Delineation

The 2009 delineation identified no WoUS within the project area (URS 2009e). None of the washes contain a prevalence of hydrophytic vegetation or have hydric soils. Several washes within the study area are mapped as blue line drainages on the West of Soda Lake USGS topographic map and contain well-defined OHWMs. However, none of these blue line features, or any of the other washes mapped, have relatively permanent flow, or flow to a TNW. All dry desert washes mapped within the study area contain ephemeral flows. Because none of the washes has relatively permanent flows or are directly or indirectly tributary to a traditionally navigable water, none is likely subject to USACE jurisdiction pursuant to Section 404 of the Clean Water Act. USACE will make be making a formal determination of jurisdiction for the project area.

2012 Update

The 2012 update of the waters delineation identified ephemeral drainages within the project area in accordance with federal guidance for definition of the OHWM. The ephemeral drainages were identified independent of a determination of federal jurisdiction. Ephemeral washes identified within the project area can be grouped by size and drainage area into North Array area, South Array area, East Array area, north wash, south wash, and east wash (Figure 3.4-1). There are 411 acres of ephemeral drainages located within the Soda Mountain Solar project area (Table 3.4-1). These waters are not likely subject to federal jurisdiction as discussed above.

The multiple ephemeral drainages within each of the array areas (North, South, and East) exhibited similar characteristics. The similarity of drainage size and characteristics within each array area is likely due to the location of each array area within the watershed, slope, and the size and soil materials of the portion of the drainage basin upstream from the array area.

The hydrology of the South Array area has been significantly altered due to the presence of I-15. Many of the channels that were identified within the South Array area are historical features that were formed by geomorphic processes prior to the construction of the divided I-15

Figure 3.4-1: Water Features

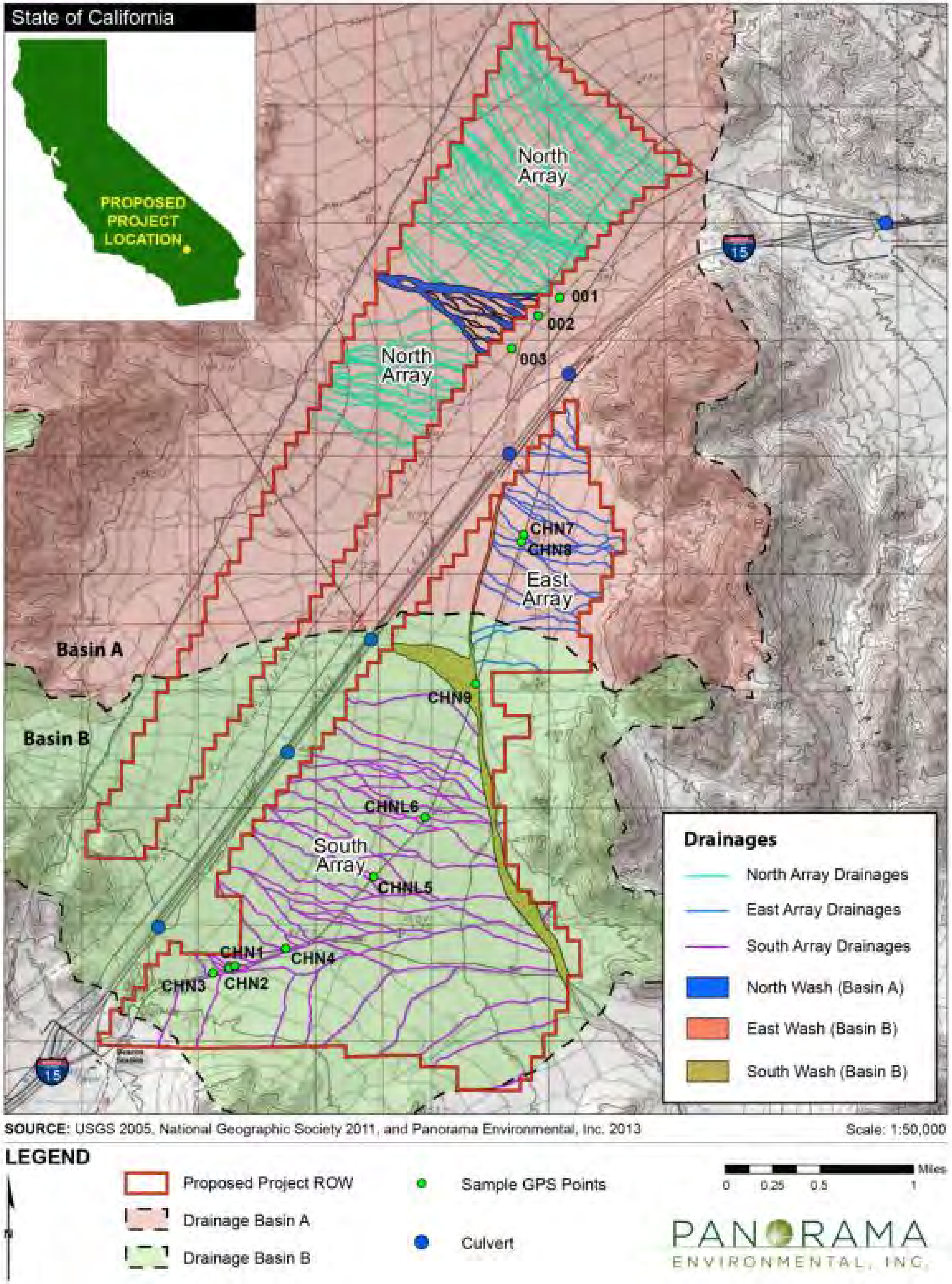


Table 3.4-1: Acreage of Ephemeral Drainages/Washes

Area	Linear Feet of Water Feature*	Average Width of Water Feature (Feet)*	Acres of Water Features
North Array	248,045	29	165
East Array	53,858	16	20
South Array	173,555	21	84
North Wash			47
East Wash			6
South Wash			89
Total 475,458			**411**

Notes:

* Linear feet and average width is not provided for the washes. These features are polygons. Acreage is calculated for these features using GIS.

Source: Panorama 2013

highway in the 1970s. The hydrology within the area is currently driven by the presence of two box culverts that allow flows from the upper watershed (north and west of I-15) to enter the area (Figure 3.4-1). It is unlikely that the relic channels that are not directly connected to a box culvert outlet convey substantial flows, except under infrequent storm events.

3.4.2 Waters of the State

2009 Delineation

In the 2009 wetland delineation (URS 2009e), 1,224 acres of desert washes were mapped within the study area (Figure 3.4-2). The washes within the study area are natural watercourses that are expected to be subject to state jurisdiction.

2012 Update

In 2012, 1,240 acres of WoS were remapped (Panorama 2013) within the proposed ROW (Figure 3.4-3). A number of these drainages, particularly in the South Array area, are no longer active due to significant alteration of area drainage patterns by I-15 (as described in Section 3.4.1). CDFW has indicated that the State will assume jurisdiction over these drainage features even though they are no longer active; state jurisdiction is based on channel form (Campbell 2012).

The assessment of lateral channel migration indicated that major drainages within the project area are geomorphically stable. Channels throughout the project area were incised with near vertical banks and calcium carbonate ($CaCO_3$) cement was observed in older alluvial deposits (RMT 2010). Historical aerial photographs (since 1953) indicate that the major drainage channels have not changed location in the last 60 years (RMT 2010). Some lateral erosion was noted on the downstream sides of box culverts. This downstream erosion can be attributed to the significant alteration of the area hydrology by I-15. The areas near the box culverts are likely subject to more frequent erosion and migration than the remainder of the site. Vyverberg (2010) defines the water body boundary on the basis that channels may migrate within the alluvial floodplain; however, the analysis of channel migration indicates that the channels within the project area are stable and not subject to regular migration.

Figure 3.4-2: Waters of the State (2009)

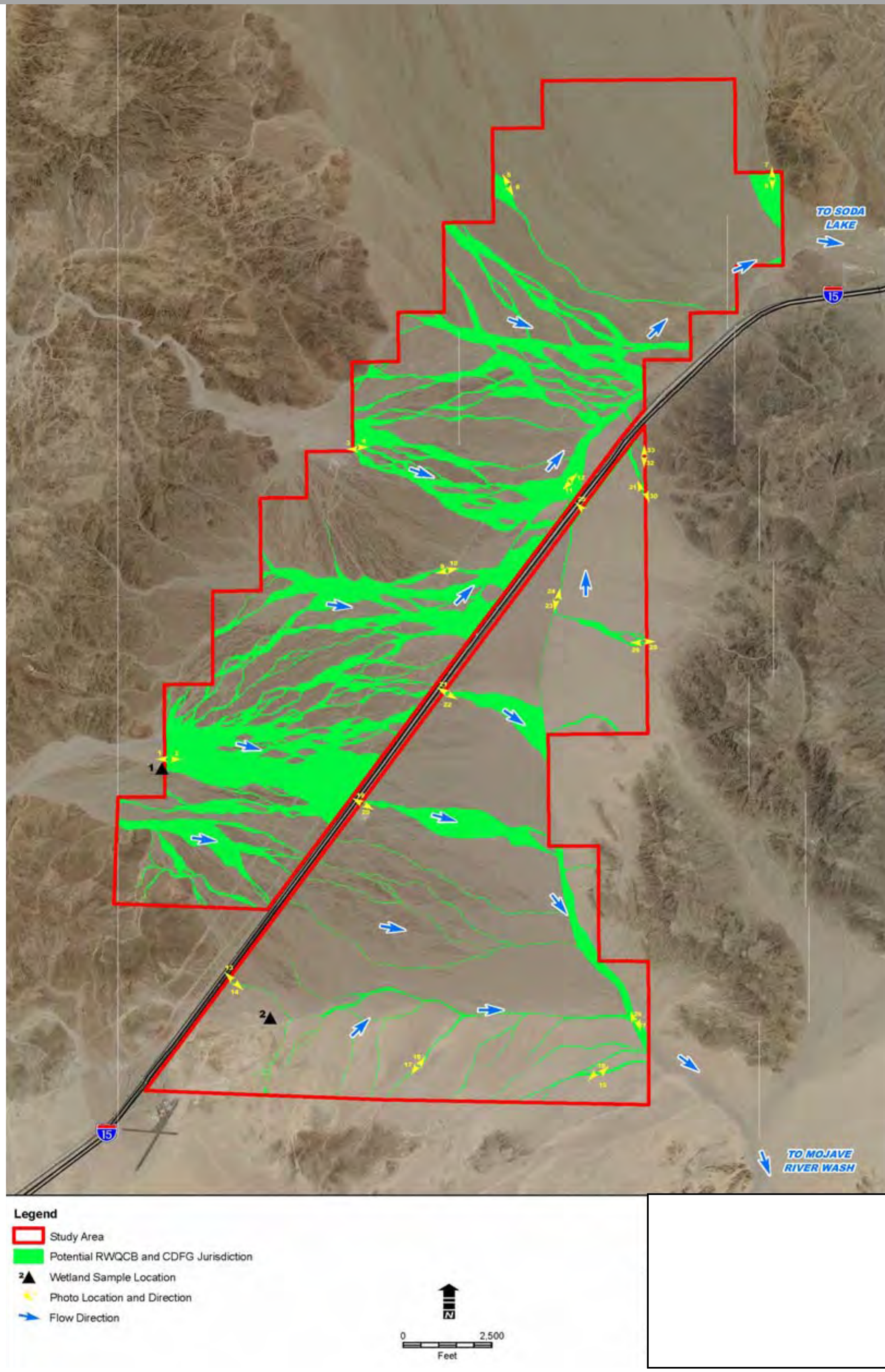
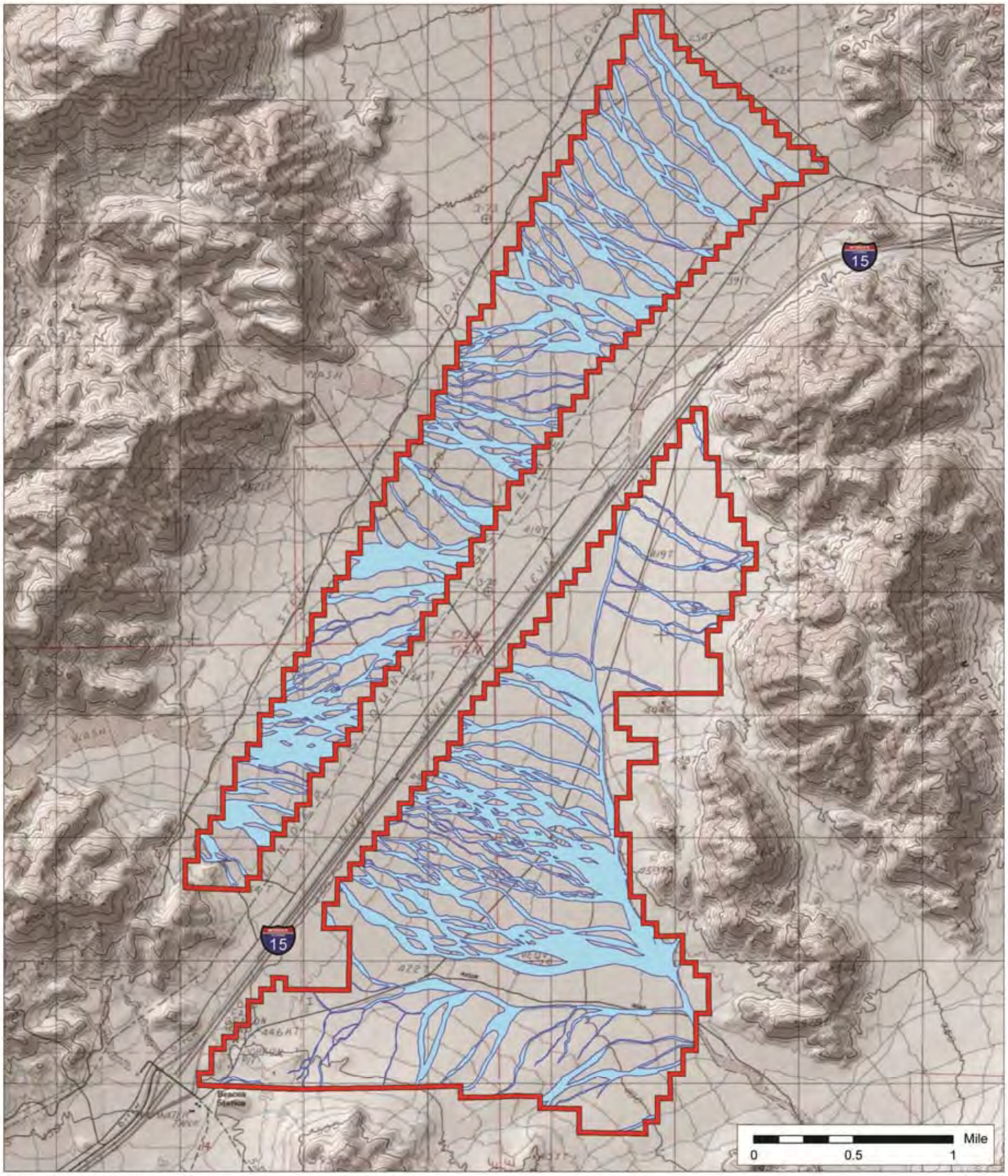


Figure 3.4-3: Waters of the State (2012)



SOURCE: ESRI 2013 and Panorama Environmental, Inc. 2013

Scale: 1:50,000

LEGEND

N

Proposed Project ROW

State Jurisdictional Drainage

PANORAMA
ENVIRONMENTAL, INC.

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APPENDIX A

VEGETATION SPECIES OBSERVED IN THE SODA MOUNTAIN PROJECT AREA

Appendix A: Vegetation Species Observed			
Scientific name	**Common name**	**Nativity[1]**	**Condition[2]**
Gymnosperms			
Ephedraceae (Mormon-tea family)			
Ephedra californica	California jointfir	Native	veg
Ephedra nevadensis	Mormon tea	Native	nd
Eudicots			
Aizoaceae (fig-marigold family)			
Mesembryanthemum crystallinum	common iceplant	Invasive	dry
Amaranthaceae (amaranth family)			
Amaranthus fimbriatus	fringed amaranth	Native	fl
Tidestromia suffruticosa var. *oblongifolia*	Arizona honeysweet	Native	veg
Apocynaceae (dogbane family)			
Asclepias erosa	desert milkweed	Native	veg/fl/fr
Asclepias subulata	rush milkweed	Native	veg/fl/fr
Funastrum cynanchoides var. *hartwegii*	climbing milkweed	Native	veg
Funastrum hirtellum	hairy milkweed	Native	veg/fl/fr
*Funastrum utahense**	Utah vine milkweed	Native	veg/fl/fr
Asteraceae (aster family)			
Ambrosia dumosa	white bursage/burro bush	Native	veg/fl
Ambrosia salsola	cheesebush	Native	veg
Ambrosia psilostachya	western ragweed	Native	nd
Baccharis brachyphylla	shortleaf baccharis	Native	veg
Baileya sp.	desert marigold	Native	veg
Bebbia juncea var. *aspera*	sweetbush	Native	veg/fl
Brickellia incana	woolly brickellbush	Native	veg
Chaenactis sp.	pincushion	Native	dry
Encelia farinosa	brittlebush	Native	veg
Encelia frutescens	button brittlebush	Native	veg/fl
Eriophyllum wallacei	Wallace's eriophyllum	Native	nd
Filago depressa	dwarf herbia impia	Native	nd
Geraea canescens	hairy desertsunflower	Native	veg

Appendix A (*Continued*): Vascular Plant Species Observed			
Scientific name	**Common name**	**Nativity[1]**	**Condition[2]**
Gutierrezia microcephala	threadleaf snakeweed	Native	fl
Malcothrix glabrata	desert dandelion	Native	nd
Monoptillon bellidforme	daisy desert star	Native	nd
Monoptilon belloides	desert star	Native	nd
Palafoxia arida var. *arida*	desert palafox	Native	veg/fl
Pectis papposa var. *papposa*	manybristle cinchweed	Native	veg/fl
Perityle emoryi	Emory's rock daisy	Native	nd
Peucephyllum schottii	Schott's pygmycedar	Native	veg
Porophyllum gracile	slender poreleaf	Native	veg
Prenanthella exigua	brightwhite	Native	nd
Psathyrotes ramosissima	velvet turtleback	Native	veg
Rafinesquia neomexicana	New Mexico plumeseed	Native	dry
Stephanomeria exigua	small wirelettuce	Native	veg
Stephanomeria pauciflora	wire-lettuce	Native	veg/fl
Bignoniaceae (bignonia family)			
Chilopsis linearis	desert willow	Native	nd
Boraginaceae (borage family)			
Amsinckia sp.	fiddleneck	Native	dry
Cryptantha angustifolia	Panamint cryptantha	Native	dry
Cryptantha barbigera	bearded forget-me-not	Native	nd
Cryptantha maritima	Guadalupe forget-me-not	Native	nd
Cryptantha micrantha	redroot cryptantha	Native	dry
Cryptantha nevadensis	Nevada cryptantha	Native	dry
Cryptantha pterocarya	wing-nut cryptantha	Native	nd
Nama demissum	desert mat	Native	nd
Pectocarya penicillata	peninsular pectocarya	Native	nd
Pectocarya platycarpa	broadfruit combseed	Native	dry
Pectocarya recurvata	curvenut combseed	Native	nd
Phacelia crenulata	dry phacelia	Native	dry
Phacelia crenulata var. minutiflora	Small-flowered purple phacelia	Native	nd

Appendix A (*Continued*): Vascular Plant Species Observed			
Scientific name	**Common name**	**Nativity[1]**	**Condition[2]**
Phacelia distans	wild heliotrope	Native	nd
Phacelia tanacetifolia	tansy phacelia	Native	dry
Tiquilia plicata	fanleaf crinklemat	Native	veg/fl
Brassicaceae (mustard family)			
Brassica tournefortii	Saharan mustard	Invasive	veg
Caulanthus lasiophyllus	California mustard	Native	dry
Descurainia pinnata	western tansymustard	Native	dry
Lepidium fremontii	desert peppergrass	Native	nd
Lepidium lasiocarpum	sand peppergrass	Native	nd
Sisymbrium sp.	mustard	Native	nd
Streptanthella longirostris	longbeak streptanthella	Native	dry
Cactaceae (cactus family)			
Cylindropuntia acanthocarpa var. *coloradensis*	buckhorn cholla	Native	veg
Cylindropuntia echinocarpa	silver cholla	Native	veg
Cylindropuntia ramosissima	pencil cholla	Native	veg
Echinocactus polycephalus var. *polycephalus*	cottontop cactus	Native	veg
Ferocactus cylindraceus	California barrel cactus	Native	nd
Mammillaria tetrancistra	common fishhook cactus	Native	veg
Opuntia basilaris var. *basilaris*	beavertail pricklypear	Native	veg
Campanulaceae (bellflower family)			
Nemacladus sp.	threadplant	Native	dry
Caryophyllaceae (pink family)			
Achyronychia cooperi	onyxflower	Native	fl
Chenopodiaceae (goosefoot family)			
Atriplex canescens ssp. *canescens*	four-wing saltbush	Native	nd
Atriplex hymenelytra	desertholly	Native	veg/fr
Atriplex polycarpa	cattle saltbush	Native	veg/fr
Convolvulaceae (morning-glory family)			
Cuscuta sp.	dodder	Native	dry

Appendix A (*Continued*): Vascular Plant Species Observed			
Scientific name	**Common name**	**Nativity[1]**	**Condition[2]**
Cucurbitaceae (cucumber family)			
Cucurbita palmata	coyote gourd	Native	veg/fl/fr
Euphorbiaceae (spurge family)			
Chamaesyce albomarginata	rattlesnake weed	Native	nd
Chamaesyce micromera	Sonoran sandmat	Native	veg/fl/fr
Chamaesyce polycarpa	smallseed sandmat	Native	veg/fl/fr
Chamaesyce setiloba	Yuma sandmat	Native	veg/fl/fr
Croton californicus	California croton	Native	veg
Eremocarpus setigerus	dove weed	Native	veg
Stillingia spinulosa	annual toothleaf	Native	veg
Fabaceae (pea family)			
Acacia greggii	cat claw acacia	Native	nd
Dalea mollis	hairy prairie clover	Native	veg
Dalea mollissima	hairy dalea	Native	veg/fl
Parkinsonia florida	blue palo verde	Native	veg/fr
Prosopis glandulosa var. *torreyana*	western honey mesquite	Native	veg/fr
Psorothamnus spinosus	smokebush	Native	nd
Senna armata	desert senna	Native	veg
Geraniaceae (geranium family)			
Erodium cicutarium	redstem stork's bill	Invasive	veg
Erodium texanum	Texas stork's bill	Native	veg
Krameriaceae (krameria family)			
Krameria erecta	leafy rattan	Native	veg/fl/fr
Lamiaceae (mint family)			
Salvia columbariae	chia	Native	dry
Loasaceae (loasa family)			
Eucnide urens	rock nettle	Native	nd
Mentzelia albicaulis	blazing star	Native	nd
Petalonyx thurberi ssp. *thurberi*	sandpaper plant	Native	fl
Malvaceae (mallow family)			
Eremalche rotundifolia	desert fivespot	Native	dry

Appendix A (*Continued*): Vascular Plant Species Observed			
Scientific name	**Common name**	**Nativity**[1]	**Condition**[2]
Sphaeralcea ambigua	desert mallow	Native	nd
Molluginaceae (carpet-weed family)			
Mollugo cerviana	threadstem carpetweed	Naturalized	fl/fr
Nyctaginaceae (four o'clock family)			
Abronia villosa var. *villosa*	desert sand verbena	Native	veg/fr
Allionia incarnata var. *incarnata*	trailing windmills	Native	veg/fl/fr
Boerhavia wrightii	largebract spiderling	Native	fl
Mirabilis laevis	desert wishbone-bush	Native	veg
Onagraceae (evening primrose family)			
Camissonia claviformis	brown-eyed evening primrose	Native	nd
Camissonia claviformis var. claviformis	brown-eyed evening primrose	Native	nd
Chylismia brevipes	yellow cups	Native	dry
Eremothera boothii	Booth's evening primrose	Native	dry/veg
Eremothera refracta	narrowleaf suncup	Native	dry
Oenothera deltoides	birdcage evening primrose	Native	dry
Oenothera primiveris	desert evening primrose	Native	dry/veg
Papaveraceae (poppy family)			
Argemone corymbosa	prickly poppy	Native	nd
Eschscholzia glyptosperma	California desert poppy	Native	nd
Eschscholzia minutiflora	pygmy goldenpoppy	Native	nd
Phymaceae (lopseed family)			
Mimulus bigelovii	Bigelow's monkey flower	Native	nd
Plantaginaceae (plantain family)			
Antirrhinum filipes	yellow twining snapdragon	Native	dry
Mohavea breviflora	golden desert snapdragon	Native	nd
Mohavea confertiflora	ghost flower	Native	nd
Plantago erecta	Western plantain	Native	nd
Plantago ovata	desert Indianwheat	Native	dry/veg
Polemoniaceae (phlox family)			
Aliciella latifolia	broad-leaved gilia	Native	nd
Allophyllum gilioides	false gilia	Native	nd

Appendix A (*Continued*): Vascular Plant Species Observed			
Scientific name	**Common name**	**Nativity[1]**	**Condition[2]**
Eriastrum sp.	woollystar	Native	dry
Gilia latiflora	hollyleaf gilia	Native	dry
Langloisia setosissima	langloisia	Native	nd
Langloisia setosissima ssp. *punctata*	lilac sunbonnet	Native	nd
Linanthus parryae	sandblossoms	Native	dry
Loeseliastrum sp.	calico	Native	dry
Polygonaceae (buckwheat family)			
Chorizanthe brevicornu	brittle spineflower	Native	dry
Chorizanthe rigida	Devil's spineflower	Native	dry
Eriogonum brachyanthum	shortflower buckwheat	Native	dry
Eriogonum inflatum	desert trumpet	Native	dry/veg
Eriogonum reniforme	buckwheat	Native	nd
Eriogonum trichopes	little deserttrumpet	Native	veg/fl
Resdaceae (mignonette family)			
Oligomeris linifolia	narrow-leaved oligomeris	Native	nd
Simaroubaceae (quassia family)			
*Castela emoryi**	Emory's crucifixion-thorn	Native	fl
Solanaceae (potato family)			
Nicotiana obtusifolia	desert tobacco	Native	nd
Physalis crassifolia	groundcherry	Native	fl/fr
Tamaricaceae (tamarix family)			
Tamarix chinensis	five-stamen tamarisk	Noxious	fl/fr
Zygophyllaceae (creosote-bush family)			
Larrea tridentata	creosote bush	Native	veg/fr
Monocots			
Agavaceae (century-plant family)			
Hesperocallis undulata	desert lily	Native	veg
Poaceae (grass family)			
Aristida adscensionis	sixweeks threeawn	Native	fl
Bouteloua aristidoides var. *aristidoides*	needle grama	Native	fl/fr
Bouteloua barbata var. *barbata*	sixweeks grama	Native	fl/fr

Appendix A (*Continued*): Vascular Plant Species Observed			
Scientific name	**Common name**	**Nativity[1]**	**Condition[2]**
Bromus sp.	brome	Naturalized	dry
Bromus madritensis	red brome	Naturalized or invasive	nd
Bromus tectorum	cheatgrass	Invasive	dry
Dasyochloa pulchella	fluff grass	Native	veg
Festuca myuros	fescue	Invasive	nd
Festuca octoflora	fescue	Native	nd
Hilaria rigida	big galleta	Native	veg/fr
Hordeum murinum	glaucous foxtail barley	Invasive	nd
Schismus barbatus	Mediterranean grass	Invasive	dry

NOTES:

* Special-status species

1 Native and Naturalized spp. after Baldwin (2012), Invasive and Noxious spp. after Cal-IPC (2012) and CDFA (2012)

2 dry = dry annual no longer living; fl = flowering; fr = fruiting; veg = vegetative, no flowers or fruits; nd = not documented

APPENDIX B

WILDLIFE SPECIES OBSERVED IN THE SODA MOUNTAIN PROJECT AREA

Appendix B: List of Wildlife Species Observed During Project Area Surveys			
Scientific Name	**Common Name**	**Observances**	**Notes**
Birds			
Accipiter striatus	Sharp shinned hawk	Fall 2009 APC: 4	
Amphispiza belli	Sage sparrow	Fall 2009 APC: 6	
Amphispiza bilineata	Black-throated sparrow	Spring 2009 APC: 89 Fall 2009 APC: 10	
Aruiparus flaviceps	Verdin	Spring 2009 APC: 1 Fall 2009 APC: 2	
Athene cunicularia	Burrowing owl	Fall 2012 BS Fall 2012 DT	Live owls, occupied burrows, and sign (pellets, feathers)
Bubo virginianus	Great horned owl	Fall 2012 BS	Sign (pellet)
Buteo jamaicensis	Red-tailed hawk	2011 GE/BHS Spring 2009 APC: 2 Fall 2009 APC: 2	7 nests with 19 individuals within 6 miles of the project
Calypte costae	Costa's hummingbird	Spring 2009 APC: 1	
Campylorhynchus brunneicapillus	Cactus wren	Spring 2009 APC: 1 Fall 2012 BS	Inactive nests observed in 2009. Active nest observed in 2012.
Cardellina pusilla	Wilson's warbler	Spring 2009 APC: 5	
Carpodacus mexicanus	House finch	2009 DT	
Cathartes aura	Turkey vulture	2011 GE/BHS	2 active nests with 8 individuals within 2 miles of the project area
Chordeiles acutipennis	Lesser nighthawk	2009 DT	
Colaptes auratus	Northern flicker	Fall 2012 BS	Wing of dead bird
Corvus brachyrhynchos	American crow	Fall 2009 APC: 1	
Corvus corax	Common raven	Spring 2009 APC: 24 Fall 2009 APC: 31	
Eremophila alpestris	Horned lark	Spring 2009 APC: 414 Fall 2009 APC: 53 Fall 2009 DT	1 empty nest and 1 nest with eggs were observed in 2009
Falco mexicanus	Prairie falcon	2011 GE/BHS	

Appendix B: List of Wildlife Species Observed During Project Area Surveys

Scientific Name	Common Name	Observances	Notes
Falco sparverius	American kestrel	2011 GE/BHS	
Geococcyx californianus	Greater roadrunner	2009 DT	
Icterus cucullatus	Hooded oriole	Spring 2009 APC: 1	
Junco hyemalis caniceps	Gray-headed junco	Fall 2009 APC: 7	
Lanius ludovicianus	Loggerhead shrike	Spring 2009 APC: 4 Fall 2009 APC: 3	
Mimus polyglottos	Northern mockingbird	Spring 2009 APC: 6	
Oreothlypis celata	Orange-crowned warbler	Fall 2009 APC: 2	
Passer domesticus	House sparrow	2009 DT	
Passerculus sandwichensis	Savannah sparrow	Fall 2012 BS	
Phalaenoptilus nuttallii	Common poorwill	Fall 2012 BS	
Picoides scalaris	Ladder-backed woodpecker	Fall 2012 BS	
Piranga ludoviciana	Western tanager	Spring 2009 APC: 1	
Polioptila caerulea	Blue-gray gnatcatcher	Fall 2009 APC: 3	
Polioptila melanura	Black-tailed gnatcatcher	Spring 2009 APC: 2 Fall 2009 APC: 2	
Regulus calendula	Ruby-crowned kinglet	2012 Fall BS	
Salpinctes obsoletus	Rock wren	Spring 2009 APC: 12 Fall 2009 APC: 17	
Sayornis saya	Say's phoebe	Fall 2009 APC: 44	
Setophaga coronata	Yellow-rumped warbler	Spring 2009 APC: 2 Fall 2009 APC: 3	
Setophaga townsendi	Townsend's warbler	Spring 2009 APC: 1	
Sphyrapicus ruber	Red-breasted sapsucker	Fall 2009 APC: 1	
Spinus psaltria	Lesser goldfinch	Fall 2009 APC: 1	
Spizella atrogularis	Black-chinned sparrow	Fall 2009 APC: 1	
Spizella passerina	Chipping sparrow	Fall 2012 BS	

Appendix B: List of Wildlife Species Observed During Project Area Surveys			
Scientific Name	**Common Name**	**Observances**	**Notes**
Sturnella neglecta	Western meadowlark	Spring 2009 APC: 10 Fall 2009 APC: 1	
Sturnus vulgaris	European starling	Spring 2009APC: 17 Fall 2990 APC: 10	
Thryomanes bewickii	Bewick's wren	Fall 2012 BS	
Turdus migratorius	American robin	Fall 2012 BS	
Tyrannus verticalis	Western kingbird	Spring 2009 APC: 1	
Tyrannus vociferans	Cassin's kingbird	Spring 2009 APC: 3	
Tyto alba	Barn owl	Fall 2012 BS	
Vireo gilvus	Warbling vireo	Spring 2009 APC: 1	
Zenaida macroura	Mourning dove	Fall 2009 APC: 2	
Zonotrichia leucophrys	White-crowned sparrow	Spring 2009 APC: 31 Fall 2009 APC: 4	
Reptiles			
Aspidoscelis tigris ssp. *tigris*	Great Basin whiptail	2009 DT Fall 2012 BS	
Callisaurus draconoides	Common zebra-tailed lizard	2009 DT Fall 2012 BS	
Crotalus cerastes ssp. *cerastes*	Mojave sidewinder	2009 DT	
Crotaphytus bicinctores	Great Basin collared lizard	2009 DT	
Dipsosaurus dorsalis	Desert iguana	Spring 2009 DT	
Gambelia wislizenii	Long-nosed leopard lizard	2009 DT Fall 2012 BS	
Gopherus agassizii	Desert tortoise	2009 DT Fall 2012 DT Fall 2012 BS	Sign (scat, carcasses, burrows) Observed onsite and within ZOI
Masticophis flagellum ssp. *flagellum*	Coachwhip (red racer)	2009 DT Fall 2012 BS	
Phrynosoma platyrhinos	Desert horned lizard	2009 DT Fall 2012 BS	
Salvadora hexalepis	Patch-nosed snake	Fall 2012 BS	

Appendix B: List of Wildlife Species Observed During Project Area Surveys			
Scientific Name	**Common Name**	**Observances**	**Notes**
Sauromalus obesus	common chuckwalla	2009 DT	
Uma scoparia	Mojave fringe-toed lizard	2009 MFTL Fall 2012 DT	Observed to the south and southwest of the project site.
Uta stansburiana	Common side-blotched lizard	2009 DT Fall 2012 BS	
Mammals			
Ammospermophilus leucurus	white-tailed antelope squirrel	2009 DT	
Canis latrans	Coyote	2009 DT Fall 2012 BS	Sign (scat and tracks)
Dipodomys sp.	Kangaroo rat	Fall 2012 BS	Burrows, likely *D. deserti*
Equus asinus	Feral donkey (burro)	Fall 2012 BS	Sign (scat)
Lasiurus cinereus	Hoary bat	Fall 2012 Bat	Echolocation signal
Lepus californicus	Black-tailed jackrabbit	2009 DT Fall 2012 BS	
Myotis californicus	California myotis	Fall 2012 Bat	
Neotoma lepida	Desert woodrat	2009 DT Fall 2012 BS	Sign (middens and scat)
Odocoileus hemionus	Mule deer (or possibly bighorn sheep)	Fall 2012 BS	Sign (scat and tracks), size suggests mule deer, but may be bighorn sheep
Ovis canadensis	Bighorn sheep	Fall 2012 DT	4 adults and 1 juvenile, tracks, scat, and bedding observed in mountainous areas east and south of the project
Parastrellus hesperus	Canyon bat	Fall 2012 Bat	Echolocation signals
Spermophilus tereticaudus	Round-tailed ground squirrel	Fall 2012 BS	Vocalizations, burrows
Tadarida brasiliensis	Mexican free-tailed bat	Fall 2012 Bat	Echolocation
Taxidea taxus	American badger	Fall 2012 BS	Sign (diggings)
Thomomys bottae	Botta's pocket gopher	Fall 2012 BS	Sign (burrows)

APPENDIX B

Appendix B: List of Wildlife Species Observed During Project Area Surveys			
Scientific Name	**Common Name**	**Observances**	**Notes**
Vulpes macrotis ssp. *arsipus*	Desert kit fox	2009 DT Fall 2012 BS	Sign (scat and dens)

APPENDIX C
COMMENTS ON THE DRECP

5275 Westview Drive
Frederick, MD 21703-830
(301) 228-8110

January 23, 2013

California Energy Commission
Dockets Office, MS-4
Docket No. 09-RENEW EO-01
1516 Ninth Street
Sacramento, CA 95814-5512
docket@energy.ca.gov

SUBJECT: Comments on Description and Comparative Evaluation of Draft DRECP Alternatives

Dear Sir/Madam:

Soda Mountain Solar, LLC is providing comments on the "Description and Comparative Evaluation of Draft DRECP Alternatives" (California Energy Commission [CEC] 2012). The document will be referenced in this letter as the Alternatives Analysis. Soda Mountain Solar, LLC is the applicant for the Soda Mountain Solar project. The Soda Mountain Solar project (SMS project) is a 350 megawatt solar electric generating facility located in San Bernardino County. The project has requested a right-of-way (ROW) grant from the U.S. Bureau of Land Management (BLM). The BLM case number for the project is CACA 49584. Soda Mountain Solar, LLC is providing comments on components of the "Description and Comparative Evaluation of Draft DRECP Alternatives" as they pertain to the Soda Mountain Solar Project.

SUMMARY OF COMMENTS

Soda Mountain Solar comments are summarized into key points:

1. The SMS lands and Soda Mountain valley do not meet the criteria for NLCS designation
2. SMS project variance lands are inaccurately screened from Alternative 1
3. Desert tortoise and bighorn sheep model results are inconsistent with habitat and genetic studies

4. The bighorn sheep critical linkage designation for Soda Mountain Valley is inaccurate and unsupported
5. The High Biological Sensitivity designation is inaccurate and inappropriate for Soda Mountain Valley
6. The Soda Mountain Valley should be designated a Development Focus Area
7. Appendix E is overly restrictive and contemplates excessive mitigation requirements
8. Appendix I criteria for pending projects need further refinement
9. Extend the comment period for the Alternatives Analysis materials

SMS LANDS DO NOT MEET CRITERIA FOR NATIONAL LANDSCAPE CONSERVATION SYSTEM (NLCS) DESIGNATION

Purpose of NLCS

The NLCS designation was established to

> *"conserve, protect and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations."*

Examples of lands within the NLCS include:

- Wilderness
- Wilderness Study Areas
- National Monuments
- National Conservation Areas
- Wild and Scenic Rivers
- National Scenic and Historic Trails.

Chapter 3.7 of the Description and Comparative Evaluation of Draft DRECP Alternatives states, "[u]nder the various plan alternatives, the DRECP will consider all lands within the CDCA boundary as identified in FLPMA for possible inclusion in the NLCS." Appendix D identifies the criteria that were applied to designate NLCS in the DRECP and how these lands were specified under each alternative.

Designation of Project Area in DRECP Alternatives

Alternatives 1 through 4 classify lands within the SMS project area and west of I-15 as NLCS. Alternative 5 classifies the entire SMS project area, both west and east of I-15, as NLCS. However, the SMS project area does <u>not</u> contain:

- Wilderness
- Wilderness Study Areas
- National Monuments

- National Conservation Areas
- Wild and Scenic Rivers
- National Scenic and Historic Trails
- Lands with Wilderness Characteristics

Most of the SMS project area is located within a designated utility corridor under Section 368 of the Energy Policy Act of 2005. The portion of the SMS project area northwest of the Interstate-15 Highway (I-15) is bounded by Blue Bell Mine Road, two transmission lines, mining areas, fuel pipelines, and fiber optic lines. The portion of the SMS project area southeast of I-15 is bounded by Rasor Road and a service station property, I-15, and the Rasor Off-Highway Vehicle (OHV) area. This portion of the project area is within close proximity to I-15, a four-lane divided highway and major transportation route between Los Angeles and Las Vegas. Highway I-15 experiences nearly continuous traffic. In short, the SMS project area's existing transportation and utility uses traversing the project area strongly suggest that the project area should not be included in the NLCS. Indeed, to do so would be entirely inconsistent with its current status as a Section 368 corridor under the Energy Policy Act of 2005.

The Soda Mountain Solar Site Does Not Have an Intact Landscape

The northwest portion of the SMS project area is identified as NLCS on Figures 2.3-1 and 2.3-4 of Chapter 2, Description of DRECP Alternatives. These figures present proposed land use categories for Alternative 1. Alternative 1 identifies NLCS lands in "highly scenic and intact landscapes".

The SMS project area includes an existing transmission corridor with multiple transmission lines, utilities, and the I-15 highway, which have altered the scenic landscape. The Visual Resource Inventory (VRI) index for the area is Class III as shown in Figure 3.4-4 of the document. Class III corresponds with moderate viewer sensitivity.

Appendix D states that Alternative 1 "excludes all existing transmission corridors" from areas identified as NLCS. The figure titled "Mojave and Silurian Valley Alt 1" in Appendix D does not include NLCS designated land in the northwest portion of the project area. It appears that Figure 2.3-1 and 2.3-4 incorrectly display SMS ROW lands northwest of I-15, which are within an existing Section 368 transmission corridor, as NLCS lands. This is most likely a GIS mapping error in Figures 2.3-1 and 2.3-4. The NLCS designations for Figures 2.3-1 and 2.3-4 in Chapter 2 should be revised to match the map in Appendix D. This area should not be designated as NLCS under Alternative 1 because it is in a transmission corridor, consistent with Appendix D.

The NLCS Designation is Not Appropriate for Transmission Corridors

The SMS project area northwest of I-15 is classified as NLCS in Alternatives 2 through 4. This designation corresponds with the presence of a Section 368 utility corridor within this area. As provided in Appendix D, NLCS identified in Alternatives 2 through 5 would include existing transmission corridors. The application of the NLCS designation to transmission corridors, particularly Section 368 corridors, is inconsistent with the purpose of the NLCS to

"…conserve, protect and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations."

Transmission corridors are typically located in areas that are near highways and existing development. In the absence of critical habitat, significant cultural sites, or major rivers, transmission corridors would not be expected to have outstanding ecological, cultural, or scientific value. Blanket application of the NLCS designation to transmission corridors is therefore inconsistent with the purpose of the designation.

The NLCS Designation is Not Appropriate for the Entire California Desert

The entire project site is designated as NLCS within Alternative 5. Alternative 5 is "based on the premise that all lands in the California Desert have been determined by Congress to be nationally significant and lands not focused on development or other intensive uses under the BLM's multiple use mandate should be included as national Conservation lands. This alternative would include existing transmission corridors." We are of the opinion that it would be extremely short-sighted - and inconsistent with BLM's multiple use mandate - to designate as national conservation lands all BLM lands other than those deemed ideal for solar and wind development under the DRECP. Doing so loses sight of the fact that the DRECP was originally intended to create a voluntary process for streamlining species permitting for renewable energy development, not to "rezone" away most multiple uses - renewable or otherwise - on BLM-administered lands located within the southern quarter of the state of California. It also runs the risk of creating what is in effect "Wilderness" by an act other than that of Congress.

ERROR IN SCREENING OF VARIANCE LANDS IN ALTERNATIVE 1

SMS project variance lands northwest of I-15 are incorrectly screened out of Alternative 1. Chapter 2 of the Alternatives Analysis defines screening criteria that were applied to variance lands in Alternative 1. The screening criteria and applicability to the SMS project site are provided in Table 1. As can be seen, the project does not trigger any of the variance screening criteria, with the exception of Criterion 13. However, the GIS mapping error in Figures 2.3-1 and 2.3-4 (discussed previously) that designated lands northwest of I-15 as NLCS consequently triggered variance land screening Criterion 13. Because the NLCS lands were incorrectly designated on the SMS project site as a result of a GIS error in Alternative 1, areas northwest of I-15 were inappropriately screened from Alternative 1. The NLCS designation should be removed from these areas and the variance lands northwest of the I-15 should be included in Alternative 1 because the project area does not qualify for screening under any of the 21 variance screening criteria.

Table 1: Variance Land Screening Criteria and Applicability to Project Area		
Screening Criteria for Variance Lands	Soda Mountain Contains	
	Yes	No
1. All designated and proposed critical habitat areas for species protected under the ESA of 1973 (as amended).		X
2. All areas where the BLM has made a commitment to state agency partners and other entities to manage sensitive species habitat; for example, the Desert Tortoise Research Natural Area, including the lands acquired by the Desert Tortoise Preserve Committee, Inc.		X
3. All desert tortoise translocation sites identified in applicable land use plans, project-level mitigation plans or Biological Opinions.		X
4. All wildlife migratory and movement corridors identified in applicable land use plans and recently mapped, through efforts such as South Coast Wildlands.		X
5. All Big Game Winter Ranges identified in applicable land use plans, such as mule deer area in the Bishop Resource Management Plan (RMP).		X
6. National Historic and Natural Landmarks identified in applicable land use plans and DRECP.		X
7. Lands within the boundaries of properties listed in the National Register of Historic Places (NRHP).		X
8. Segments of rivers determined to be eligible or suitable for Wild and Scenic River status identified in applicable land use plans, including associated 0.25 mile corridor.		X
9. Lands within a solar, wind or geothermal energy development ROW grant or application area found to be inappropriate for energy development through an environmental review process that occurred prior to finalization of the Draft DRECP EIS.		X
10. All lands within the proposed Mojave Trails National Monument.		X
11. All conservation lands acquired through donations or use of Land and Water Conservation Funds.		X
12. Wild Horse or Burro Herd Management Areas.		X
13. All ACECs, Research Natural Areas (RNA), and NLCS lands/units identified in DRECP Alternative 1.	X**	
14. All areas with BLM inventoried wilderness characteristics.		X
15. Developed recreational facilities, special-use permit recreation sites, all SRMAs, and all Long Term Vehicle Areas (LTVA) identified in Alternative 1.		X
16. Developed recreational facilities, special-use permit recreation sites, all SRMAs, and all Long Term Vehicle Areas (LTVA) identified in Alternative 1.		X
17. Variance land parcels smaller than 280 acres and/or not capable of being combined with other BLM variance parcels or non-BLM lands in Alternative 1		X

Table 1: Variance Land Screening Criteria and Applicability to Project Area		
Screening Criteria for Variance Lands	Soda Mountain Contains	
	Yes	No
Development Focus Areas to reach the 280-acre minimum size. (280 acres is the size of two small utility-scale solar projects [20 MW as per CEC] at approximately 7 acres per MW.)		
18. Narrow stringers on cherry stem roads between areas conserved or specially managed.		X
19. Areas within 1 mile of National Scenic and Historic Trail Corridors.		X
20. Designated off-highway vehicle (OHV) open areas.		X
21. All dunes, sand sources, and sand flow corridors.		X
22. All Microphyll woodlands, also known as semi-desert wash woodland/scrub.		X
23. Lands within 0.25 mile of any surface water source or riparian areas (e.g., seeps, springs, lakes, ponds, streams, rivers).		X
Notes: ** The area northwest of I-15 is designated as NLCS in DRECP Alternative 1 as a result of a GIS mapping error in Chapter 2. Alternative 1 presented in Appendix D does not include the NLCS designation northwest of I-15 in the project area.		

Source: CEC 2012 and Panorama Environmental, Inc.

DESERT TORTOISE AND BIGHORN SHEEP MODEL RESULTS ARE INCONSISTENT WITH HABITAT AND GENETIC STUDIES

Appendix C of the Alternatives Analysis provides updated species models and modeling methods. Comments are provided for two species models:

1. Draft species habitat model results for desert tortoise (USFWS least cost corridors) presented in Figure SM-R3B
2. Draft species habitat model results for bighorn sheep (critical linkage)

Analysis of Habitat Suitability and Connectivity in the Soda Mountain Area

SMS submitted an analysis of the habitat suitability and connectivity for desert tortoise and bighorn sheep in the Soda Mountain area (Panorama Environmental 2012; attached hereto as Exhibit 1). The analysis was based on site-specific field surveys of the project area and surroundings that identified no desert tortoise on the project site and limited sign outside project boundaries (URS 2009a). The habitat suitability analysis showed that characterization of the SMS project area based on model results (Nussear et al. 2009) was inconsistent with site-specific surveys of the project area. The model overstated the habitat value for desert tortoise.

The results of subsequent fall desert tortoise surveys (Kiva Biological) 2012), floristic survey (CSESA 2012), and general wildlife survey (CSESA 2012a) of the SMS project area have supported the conclusions of the habitat suitability and connectivity analysis for desert tortoise. No desert tortoise were found on the project site or in the zone of influence surveys. Limited sign was found on the eastern margins of the project area (Kiva Biological 2012).

The fall 2012 surveys found no evidence of bighorn use of the project area and CDFW photographic monitoring of the I-15 underpasses in the area found no evidence of bighorn use of the underpasses (Abella 2012a).

USFWS Desert Tortoise Least Cost Corridors are Inconsistent with Recent Connectivity Studies

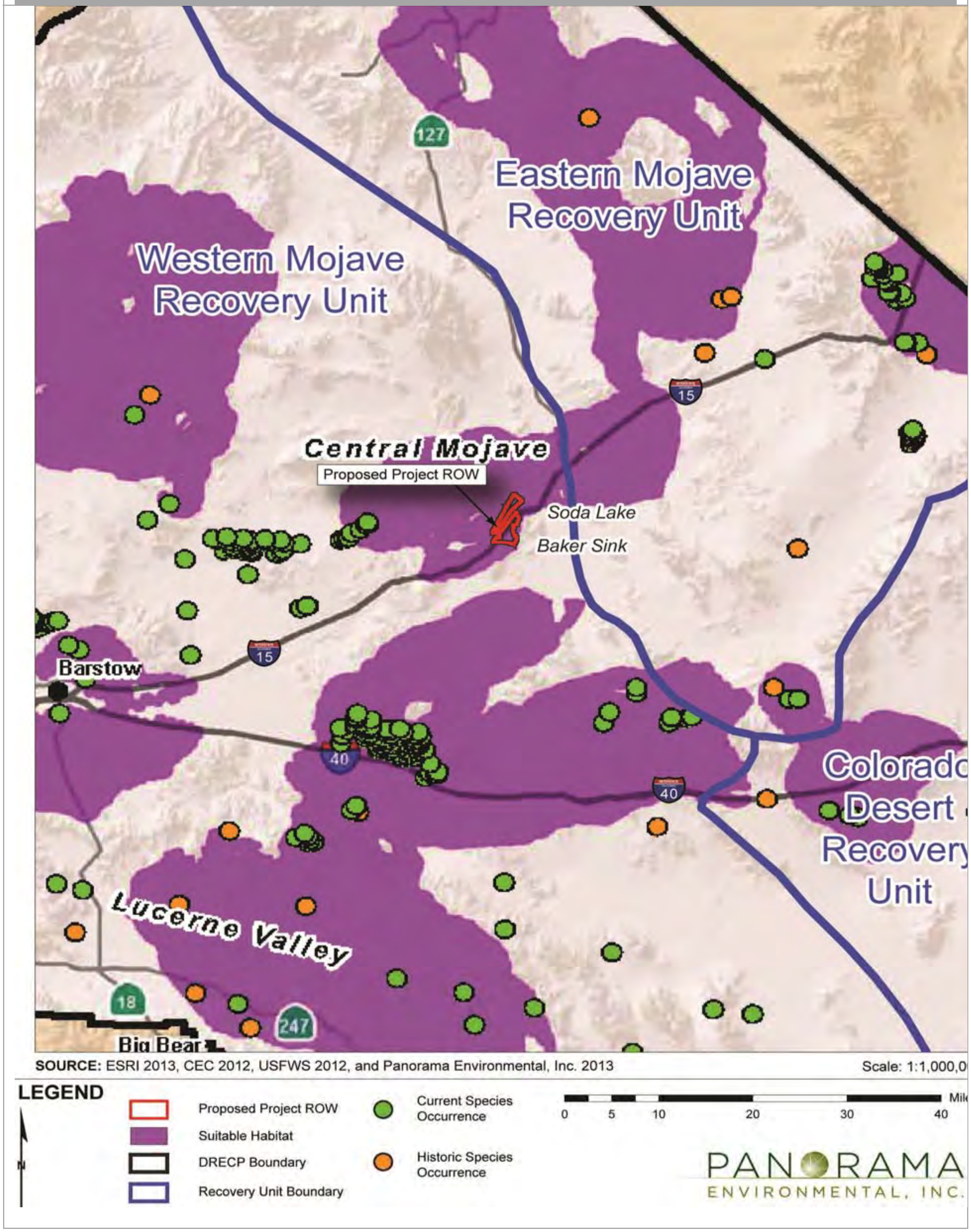
Figure SM-R3B, "Draft Species Habitat Model Results for Desert Tortoise (USFWS Least Cost Corridors)"shows the SMS project area as within a least-cost corridor for desert tortoise (Figure 1). This modeling was conducted by USFWS using the habitat suitability results of Nussear et al. (2009). SMS presented data in its DRECP comment letter dated July 23, 2012, that show the habitat suitability presented in Nussear et al. overstates the habitat value for the project area (Panorama 2012; attached hereto as Exhibit 1). This USFWS least-cost corridor (Figure 1) is inconsistent with Penrod et al. (2012), in which species-specific modeling was used to identify movement corridors (Figure 2).

Least Cost Corridors are Inconsistent with USFWS Recovery Plan and Genetic Studies

The least-cost corridor identified in Figure SM-R3B appears to connect suitable habitat areas to USFWS critical habitat areas. In the case of the SMS project area, the USFWS least-cost corridor attempts to connect the Ivanpah critical habitat unit to the Superior-Cronese critical habitat unit. This attempt is ill-founded.

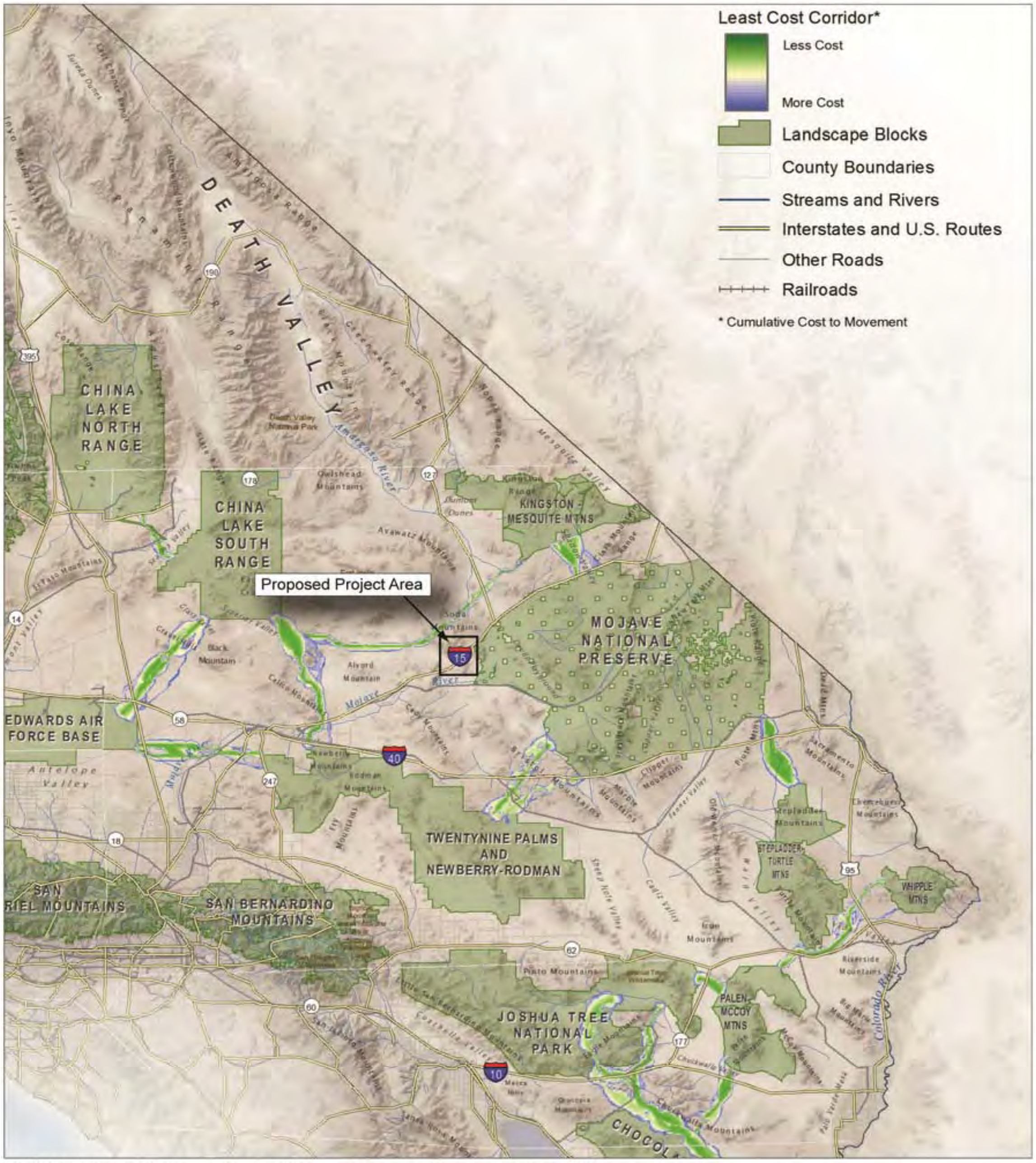
The designation of a least-cost corridor between the Ivanpah critical habitat unit and Superior-Cronese critical habitat unit is inconsistent with the *Revised Recovery Plan for the Mojave Population of the Desert Tortoise* (USFWS 2011), other studies, and the physical environment. The Mojave population of desert tortoise is divided into five recovery units in the Revised Recovery Plan (USFWS 2011). Recovery units were defined on the basis of geographic barriers that coincide with observed variation among tortoise populations (Ibid). The project area is located on the eastern edge of the Western Mojave recovery unit (Figure 1). The Ivanpah critical habitat unit is located in the Eastern Mojave recovery unit. A least-cost corridor in Figure SM-R3B extends through the SMS project area and crosses between these recovery units (Figure 1). This corridor contradicts the Revised Recovery Plan by asserting that there is existing, or possible, connectivity between the West Mojave recovery unit and the Eastern Mojave recovery unit even though their separate designation is premised on the basis of geographic barriers between them.

Figure 1: DRECP Desert Tortoise Least-Cost Corridors With USFWS Recovery Units



SOURCE: ESRI 2013, CEC 2012, USFWS 2012, and Panorama Environmental, Inc. 2013

Figure 2: Penrod et al. Desert Tortoise Least-Cost Corridors in SMS Area



SOURCE: ESRI 2012, Penrod, K. et al. 2012, and Panorama Environmental, Inc. 2012

PANORAMA ENVIRONMENTAL, INC.

The objectives identified in the Revised Recovery Plan revolve around the concept of the recovery unit. The recovery objectives include:

- Maintain self-sustaining populations of desert tortoises within each recovery unit into the future
- Maintain well-distributed populations of desert tortoise throughout each recovery unit
- Ensure that habitat within each recovery unit is protected and managed to support long-term viability of desert tortoise populations

Connectivity between recovery units is not necessary to achieve the recovery objectives. It is implicit in the concept of the recovery unit that there are natural barriers to movement between the recovery units that will not be overcome by management actions. The designation of a least-cost corridor linking the Ivanpah/Shadow Valley critical habitat unit to the Superior-Cronese critical habitat unit is inconsistent with the Revised Recovery Plan's definition of recovery units. It is also inconsistent with the Revised Recovery Plan's own assessment of the region surrounding the project area. Specifically, the Recovery Plan states that the population within the Eastern Mojave recovery unit is recognized as relatively isolated from other recovery units on the basis of genetic analysis (USFWS 2011). Baker Sink through Soda Dry Lake is a movement barrier between the Eastern Mojave recovery unit and the West Mojave recovery unit (Ibid). The Baker Sink barrier forms the dividing line between these two recovery units:

> "*Although gene flow likely occurred intermittently during favorable conditions across this western edge of the recovery unit, this area contains a portion of the Baker Sink, a low-elevation, extremely hot and arid strip that extends from Death Valley to Bristol Dry Lake. This area is generally inhospitable for desert tortoises*." (Ibid)

A study conducted by Hagerty et al. (2010) supported this conclusion from a genetic standpoint by finding that geographic barriers were significantly correlated with genetic differences and that,

> "*The Baker Sink is a low-elevation barrier that begins in Death Valley and separates these topographically different areas*."

Movement areas from Hagerty et al. are shown in Figure 3. The Baker Sink is shown in Figure 4. In short, substantial evidence –in the form of (i) site-specific survey results and habitat suitability analysis; (ii) USFWS' own Revised Recovery Plan; and (iii) genetic studies strongly indicate that tortoise populations are not crossing the Baker Sink and are not connecting between the West Mojave recovery unit and East Mojave recovery unit.

Figure 3: Hagerty et al. Desert Tortoise Movement Routes

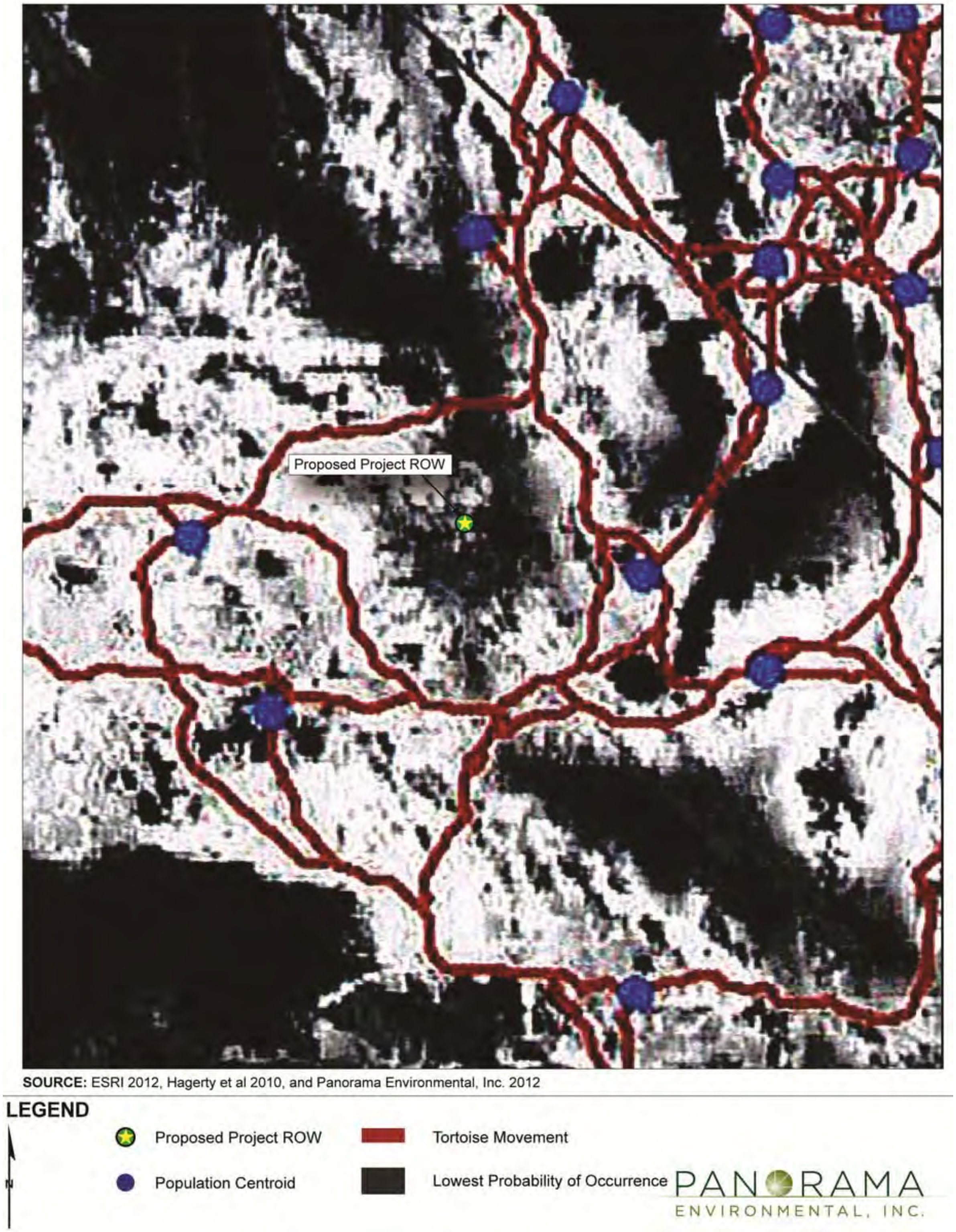
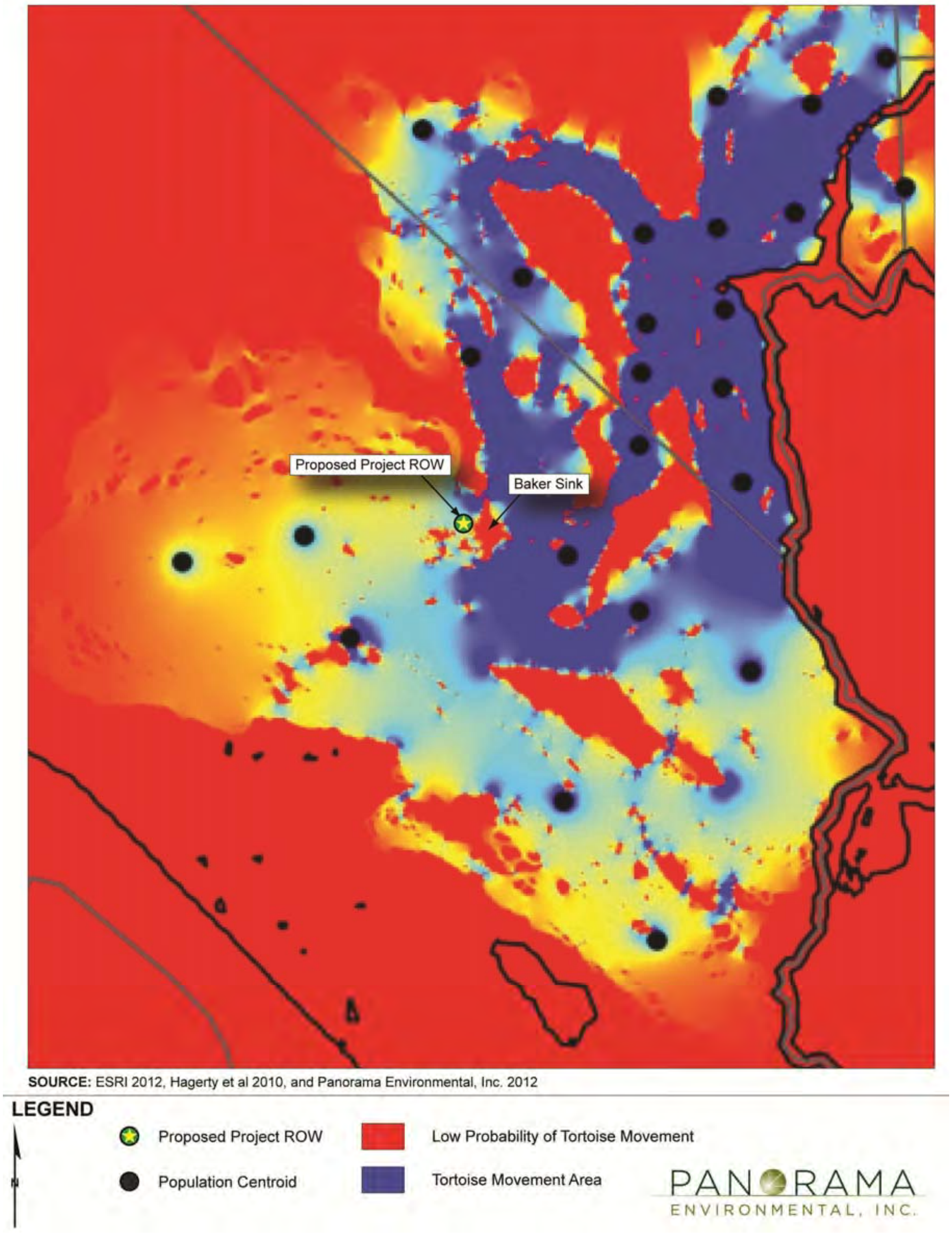


Figure 4: Baker Sink Barrier to Movement



BIGHORN SHEEP CRITICAL LINKAGE DESIGNATION FOR SODA MOUNTAIN VALLEY IS INACCURATE AND UNSUPPORTED

Figure SM-M1A, "Draft Species Habitat Model Results for Bighorn Sheep (Critical Linkage)" shows the SMS project area within a critical linkage for bighorn sheep (Figure 5 in this letter). The Alternatives Analysis does not include assumptions used in the model development, and does not specify the methods or criteria that were applied to determine the "critical linkages." Section 3.1 of the Alternatives Analysis indicates Mountain and Intermountain Habitat models were developed by CDFW and John Wehausen. Appendix C of the Alternatives Analysis states that a proxy model was used but provides no additional information. The bighorn sheep model assumptions and methodology must be provided so they can be analyzed. Additional time should be allowed to review and comment after the model information is provided to reviewers.

The "critical linkage" figure is inconsistent with field surveys of the SMS project area and investigations that have been undertaken by Soda Mountain Solar, LLC and CDFW regarding bighorn sheep use of the project area.

Bighorn Sheep Surveys

Soda Mountain Solar Surveys

SMS contracted with BioResource Consultants to conduct a helicopter survey of bighorn sheep (see survey results in Figure 6). The survey protocol was determined in consultation with CDFW. The surveys did not include the south Soda Mountains to the east of the project area in order to avoid effects to a known bighorn population during lambing season (see "CDFW 2012 Survey", below). Bighorn sheep were observed during surveys within 10 miles of the project area. Surveyors observed two desert bighorn sheep fleeing down a ravine approximately 8 miles southwest of the project area in the Cave Mountains (BRC 2011). No other individuals or groups were seen in the region during the remainder of the surveys conducted in March and May 2011 (BRC 2011). Five sheep and bedding sites were observed on the slope east of the project site in October 2012 (Kiva Biological 2012).

CDFW 2012 Survey

CDFW conducted a ground count for bighorn sheep on April 30 and May 1, 2012 in the south Soda Mountains, near Zzyzx Spring. Surveyors counted all sheep that could be located on the east side of the range in the vicinity of water. Habitat conditions in the south Soda Mountains are highly suitable for bighorn sheep because of the presence of a year-round water source at Zzyzx and the presence of limestone outcrops for lambing-rearing habitat. A total of 47 sheep in seven groups were identified within the south Soda Mountains during the CDFW 2012 survey (Abella 2012a).

Figure 5: DRECP Bighorn Sheep Critical Linkage and SMS Project Area

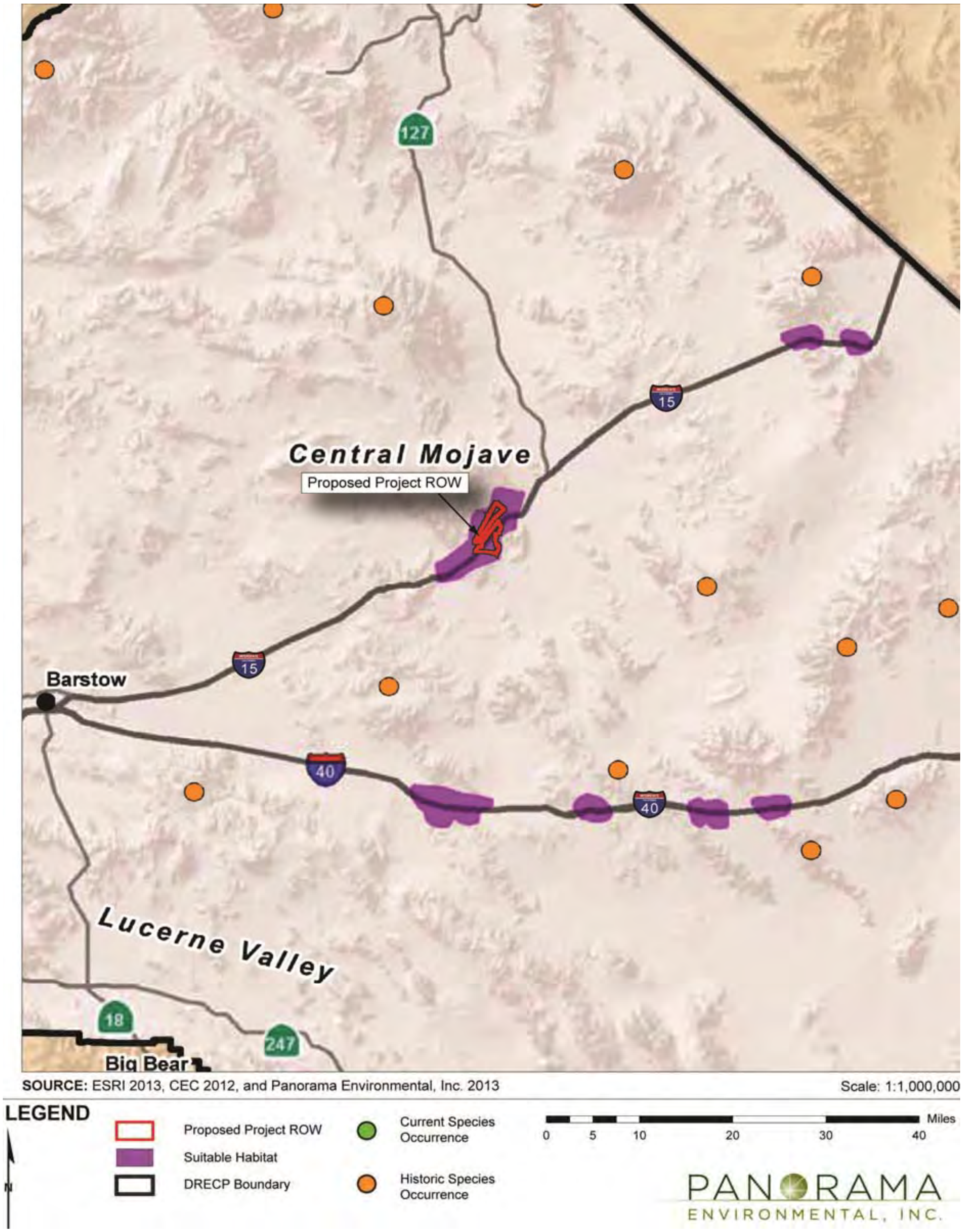


Figure 6: Bighorn Sheep Surveys and Populations in Soda Mountain Region

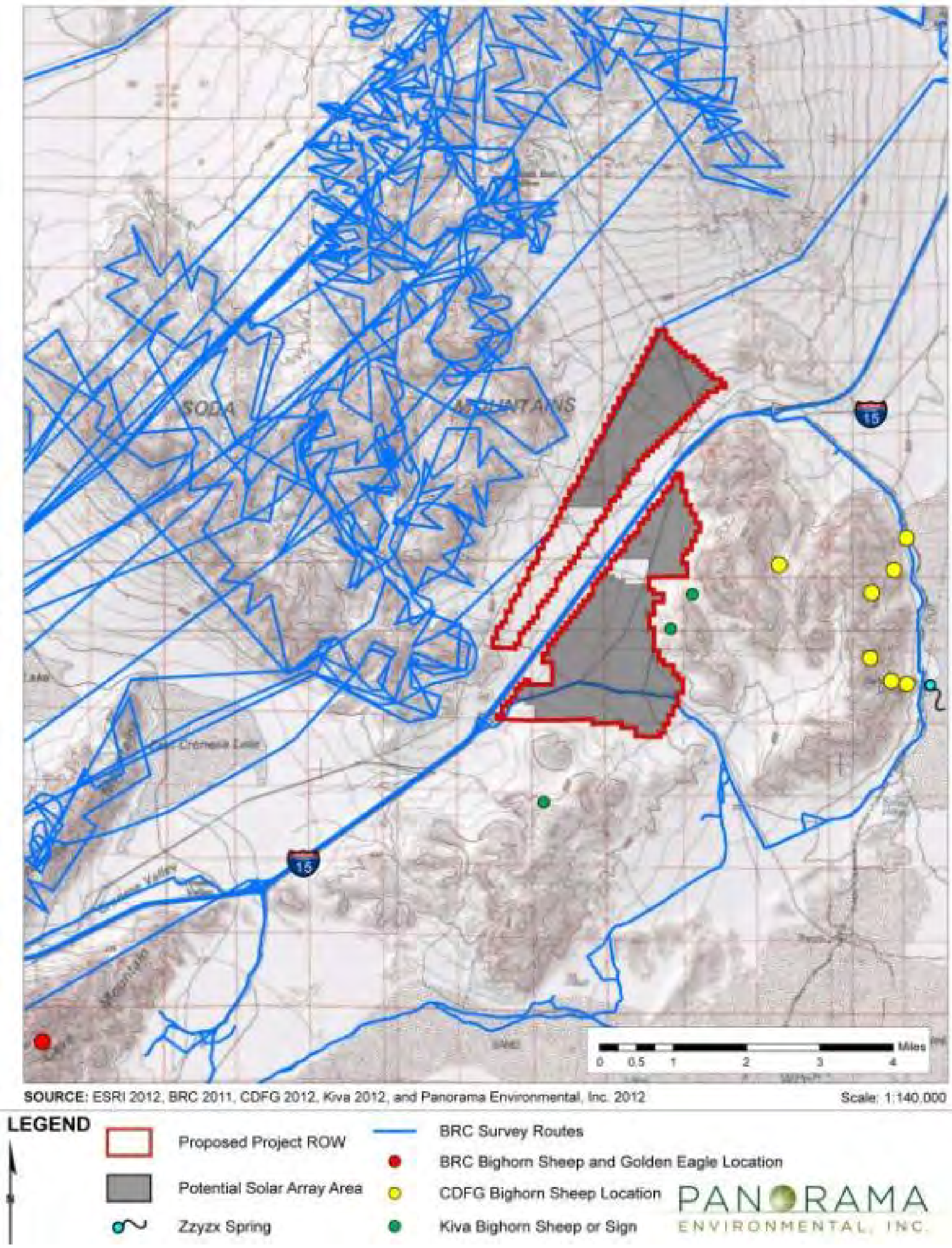


Figure 6 shows the recent locations of bighorn sheep as reported in SMS surveys (BRC 2011; Kiva 2012) and CDFW surveys (Abella 2012a). The 2011 SMS helicopter and ground survey (BRC 2011) identified sheep in the Cave Mountains, 7.75 miles south of the project area and Kiva (2012) identified sheep and sign on the western edges of the south Soda Mountains. The CDFW survey found very little sign of recent use by bighorn above the 1,960 foot elevation where sheep were found (Abella 2012a). It appears that the eastern portion of the south Soda Mountains, where most of the sheep were seen, is occupied primarily by females and associated younger sheep in the spring. Given that few adult males were seen, and that there are likely additional males, this population can be projected to fall into the 51 to 100 population size category (Abella 2012a). Abella (2012a) also indicated that the bighorn sheep seem acclimated to the humans at the Desert Research Center at Soda Springs, which is used as a water source for the sheep.

Modeled Bighorn Sheep Habitat

The results of the DRECP bighorn sheep modeling for intermountain and mountain habitats (Figures 7 and 8) are consistent with recent survey results in the SMS project area. There have been many studies of the project area (vegetation, desert tortoise, cultural resources) and none of the surveys have found sign (scat, bedding, trails) in the SMS project area. The lack of sign is evidence of little or no use of the project area by bighorn sheep, which is consistent with the DRECP model results for bighorn sheep intermountain habitat (Figure 7).

Bighorn sheep and sign were consistently found in the mountains in all recent surveys in the project area, zones of influence, and within a 10-mile radius of the project (BRC 2011; CSESA 2012; Kiva 2012; Abella 2012a). These survey results are consistent with the DRECP modeled bighorn sheep mountain habitat (Figure 8).

Analysis of Connectivity in the Soda Mountains

No Evidence of East-West Connectivity in the Soda Mountain Valley

The SMS project area is not a known connectivity or linkage area for bighorn sheep, or a linkage corridor for bighorn sheep (Penrod et al. 2012). No scat, sign, or trails of bighorn sheep were documented on the SMS project during surveys of the project area in 2009 and 2012 (URS 2009b; CSESA 2012; Kiva Biological 2012). Bighorn sheep were identified in the Soda Mountains to the south and east of the project as shown in Figure 6 (Kiva Biological 2012; Abella 2012a).

Bighorn sheep are known to prefer steep, rocky terrain and to avoid flat areas with no cover. It is logical to assume that sheep would move long distances through mountains, rather than across the Soda Mountain valley, which is bisected by northeast-southwest oriented highway I-15 in the valley. Sheep in the project region are likely moving north-south through the south Soda Mountains and there would be no reason to move east-west, given that there are no water sources in the western Soda Mountains or the west side of the valley.

Figure 7: DRECP Bighorn Sheep Intermountain Habitat and SMS Project

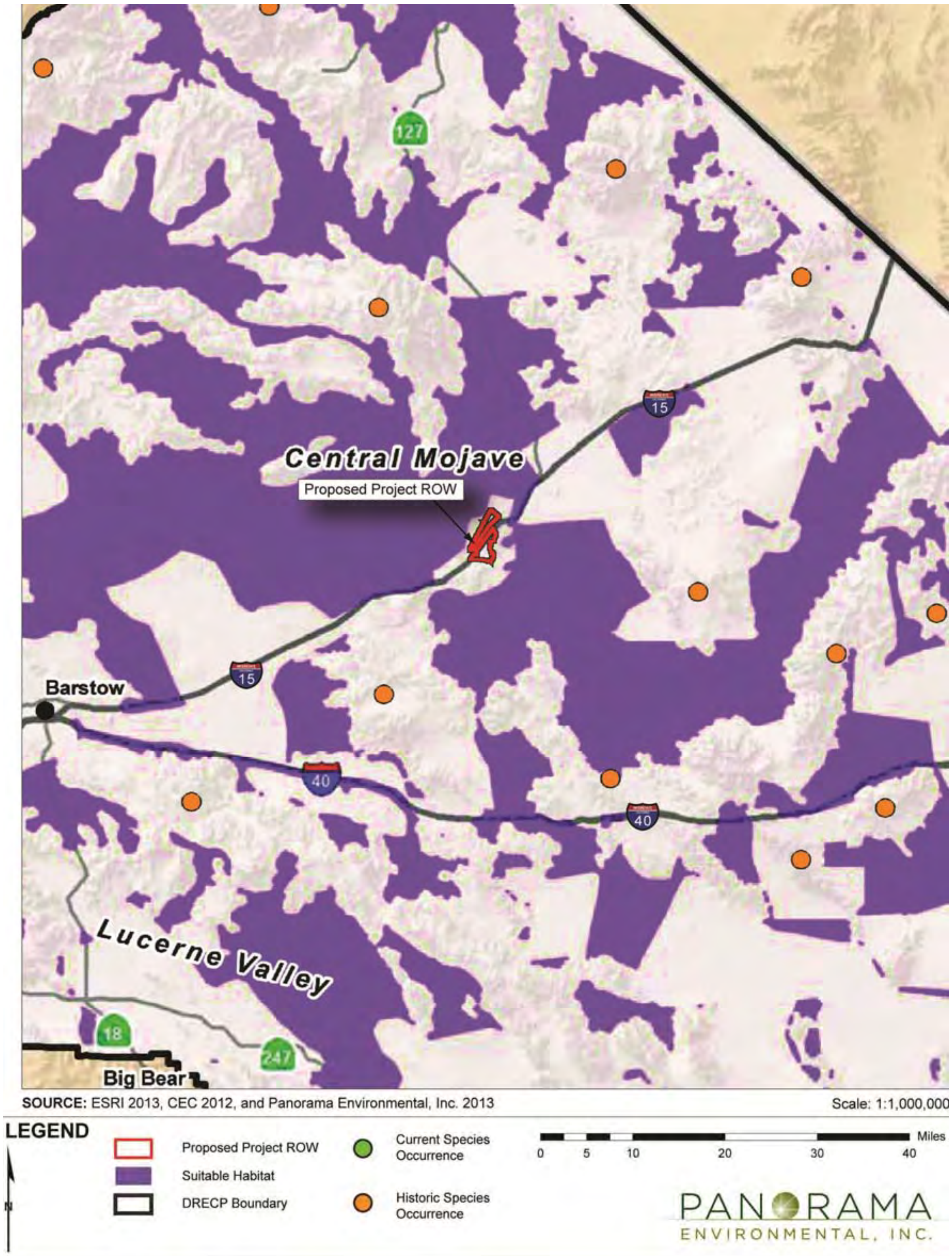
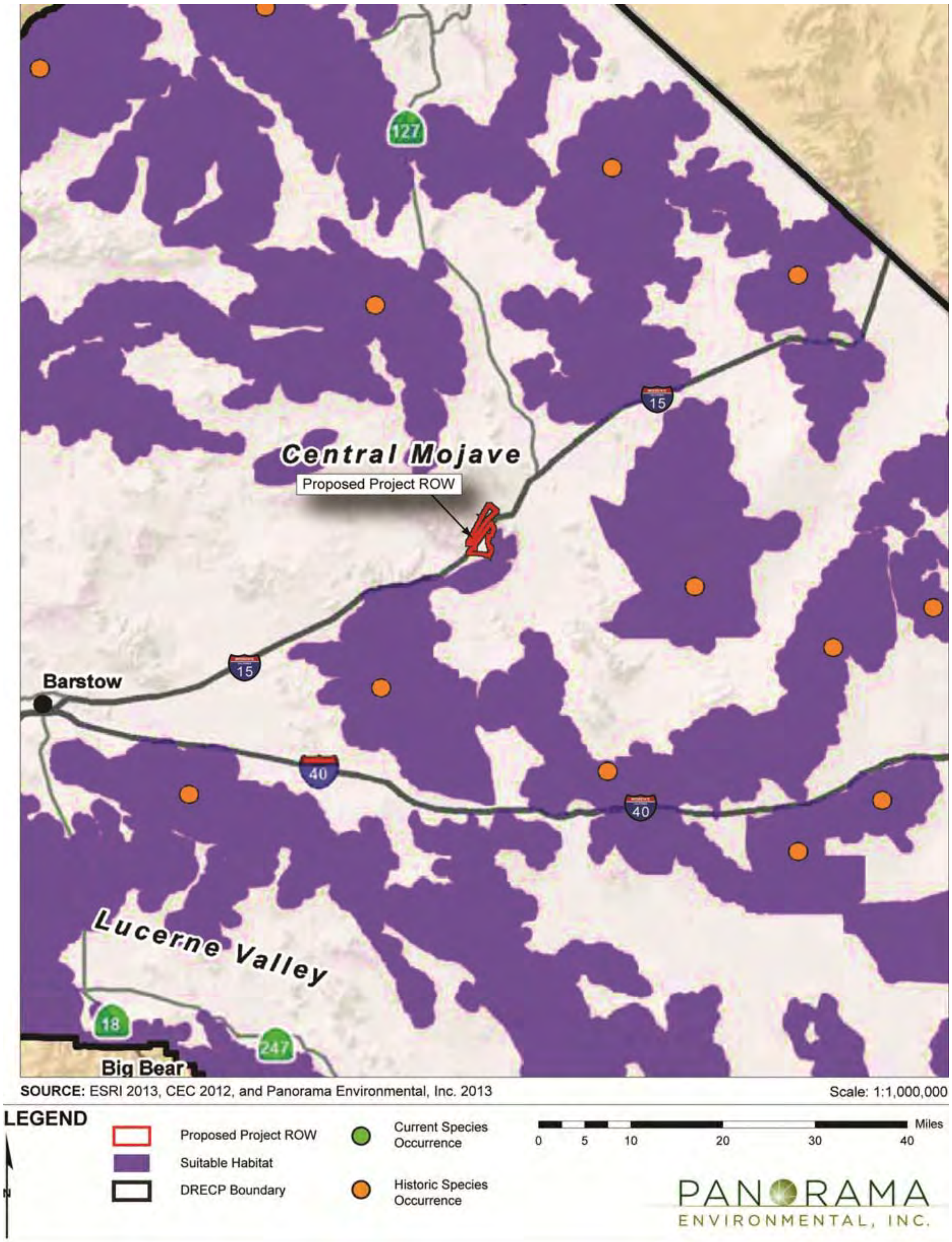


Figure 8: DRECP Bighorn Sheep Mountain Habitat and SMS Project



CDFW installed cameras in two I-15 underpasses near the SMS project area in August 2012. No sheep have been identified using the underpasses (Abella 2012a).

Literature Shows Highways are a Barrier to Bighorn Sheep Movement
Interstate highways are typically barriers to bighorn sheep connectivity (Turner 2010). Frequent traffic can make sheep, particularly ewes, reluctant to cross roads and actual crossing exposes the sheep to mortality (USFWS 2001). Roads have reduced long-term population viability when they bisect a bighorn sheep group's range (USFWS 2001). I-15 and I-40 have segregated desert bighorn sheep into metapopulations (north, central, and south) with no connectivity across the highways between the metapopulations (Wehausen 2006). I-15 acts as a major barrier to connectivity for bighorn sheep. Sheep have been sighted on the north side of I-15 to the north of the SMS project area, suggesting that they may cross the highway using the underpasses or overpasses to the north of the SMS project area in order to access the south Soda Mountains bighorn population.

Bighorn sheep occasionally use underpasses to cross highways. One study in Arizona monitored wildlife use at three highway underpasses for 10 months and recorded 25 times when bighorn sheep crossed under the highway (AZDOT 2008). Most (88 percent) of the crossings occurred at the culvert located in the most rugged terrain at the narrowest highway span (AZDOT 2008). The study concludes that higher intensity of culvert use was most associated with their proximity to traditional trails of bighorn sheep, while other factors, such as proximity to steep terrain, underpass structure, lines of sight, and other animals' presence may also be important influences (AZDOT 2008). Another study suggests that ungulate underpasses must be a minimum of 14 feet high and 26.3 feet wide (Penrod et al. 2008).

Potential Highway Crossings of I-15 in the Soda Mountain Valley
There are four box culverts (#2, 3, 5, 6 on Figure 8) and two bridges (underpasses 1 and 4 on Figure 9 and 10) that bighorn sheep could potentially use to cross under the I-15 highway near the project area. These box culverts and bridges were evaluated for potential bighorn sheep use (Table 2). The four box culverts (underpasses 2, 3, 5, 6) are unlikely to be used by bighorn sheep due to a combination of freeway noise within the overpass/ box culvert, darkness (inability to see predators), and because they are smaller than the minimum width identified for underpass use by bighorn sheep (Burke 2012; Penrod et al. 2008). Based on the criteria identified in the Arizona study discussed above, the bridge at Opah Ditch (underpass 4, Figure 10) is unlikely to be used by bighorn sheep, even though it is of sufficient size, because it is far from steep terrain. The underpass at Zzyzx Road (underpass 1, Figure 9) has a higher likelihood of bighorn sheep use because it is wider and closest to steep terrain. Game cameras installed by CDFW under the underpasses at Opah Ditch and Zzyzx Road in August 2012 have not detected any bighorn sheep use to date (Abella 2012b). There are also no bighorn sheep trails at either underpass. The

Figure 8: Box Culverts 2, 3, 5, and 6

SOURCE: TerraMetrics 2012, GeoEye 2012, USDA Farm Service Agency 2012, DigitalGlobe 2012, Google Earth Pro 2012, and Panorama Environmental, Inc. 2012

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ENVIRONMENTAL, INC.

Figure 9: Underpass 1, North of Zzyzx Road

SOURCE: ESRI 2012, TerraMetrics 2012, GeoEye 2012, USDA Farm Service Agency 2012, DigitalGlobe 2012, Google Earth Pro 2012, and Panorama Environmental, Inc. 2012

LEGEND

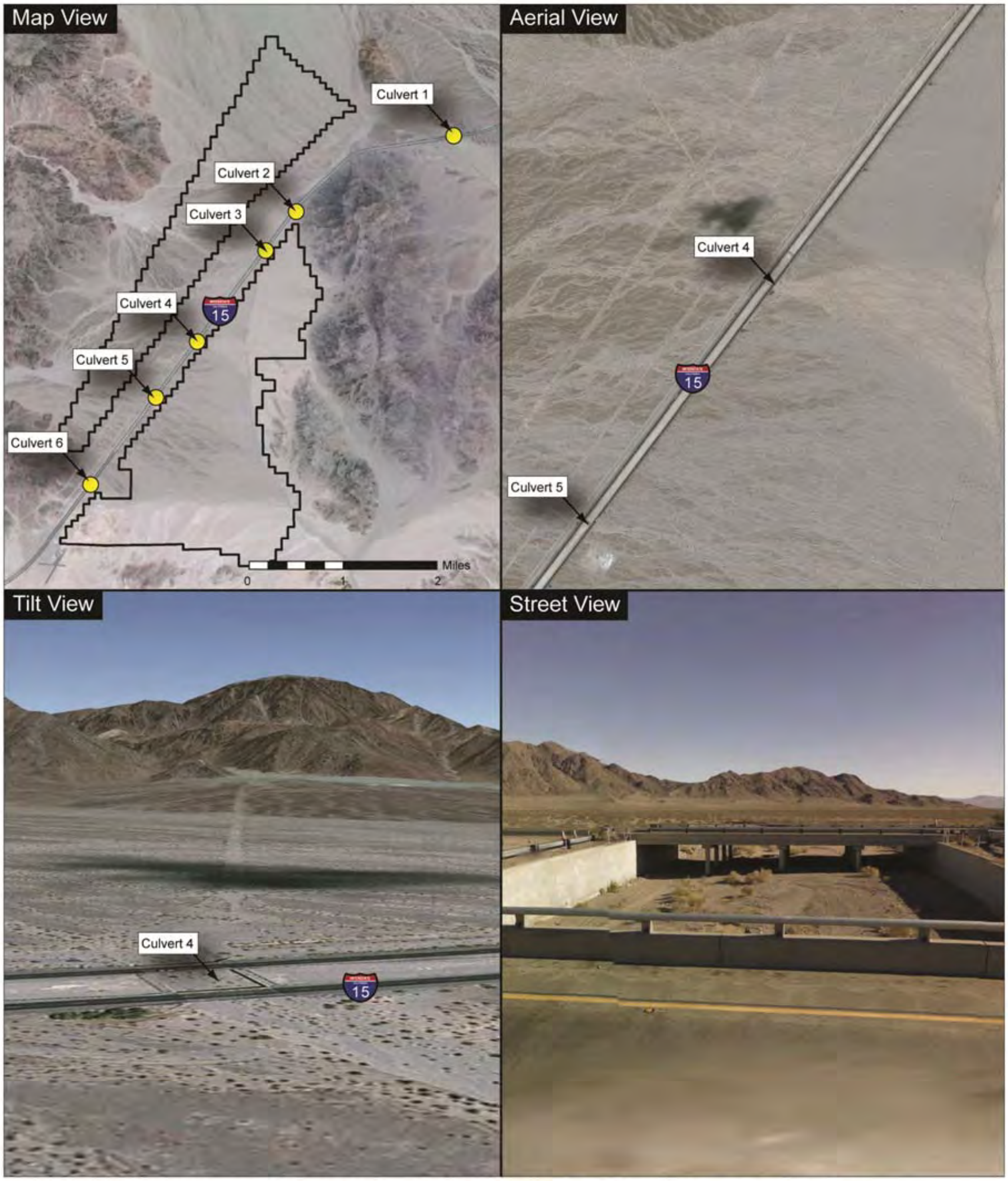
Proposed Project ROW

Existing Culvert

N

PANORAMA ENVIRONMENTAL, INC.

Figure 10: Underpass 4, Opah Ditch



SOURCE: ESRI 2012, TerraMetrics 2012, GeoEye 2012, USDA Farm Service Agency 2012, DigitalGlobe 2012, Google Earth Pro 2012, and Panorama Environmental, Inc. 2012

LEGEND

Proposed Project ROW

Existing Culvert

PANORAMA ENVIRONMENTAL, INC.

Table 2: Likelihood of Bighorn Sheep Use of Box Culverts/Bridges for Undercrossing				
Underpass	**Dimensions (width by length in feet)**	**Distance to Nearest Mountainous Terrain (miles)**	**Proximity to Nearest Known Bighorn Sheep Occurrence**	**Probability of Use**
1 (Zyzzx Road bridge)	100 by 15	0.15 north	2.2	**Moderate.** Of adequate size, close to steep terrain, near known location, no bighorn sheep trail, approximately 2.5 miles from mapped occurrence
2 (box culvert)	25 by 15	0.16 east	1.6	**Low.** Under minimum width of 26.3 feet (Penrod et al. 2008)
3 (box culvert)	25 by 15	0.49 east	1.3	**Low.** Under minimum width of 26.3 feet (Penrod et al. 2008), far from steep terrain
4 (Opah Ditch bridge)	80 by 15	1.14 east	1.3	**Low.** Of adequate size, far from steep terrain, no bighorn sheep trail
5 (box culvert)	25 by 15	1.5 east	1.7	**Low.** Under minimum width of 26.3 feet (Penrod et al. 2008), far from steep terrain
6 (box culvert)	25 by 15	0.12 west	2.7	**Low.** Under minimum width of 26.3 feet (Penrod et al. 2008), far from known occurrences

absence of any bighorn sheep tracks or trails near these underpasses in combination with the absence of observed use indicates that any potential bighorn sheep use of these underpasses is infrequent.

Bighorn sheep could also use the I-15 overpasses that cross over I-15 at Zzyzx Road and Rasor Road. Both of these existing overpasses are located within mountainous terrain and near locations where bighorn sheep have previously been sighted. However, there are no bighorn sheep tracks or trails near these overpasses or reports of sightings of sheep using the overpasses, indicating that use of the bridges to cross over I-15 is infrequent.

The DRECP Critical Linkage Map (Figure 5) is Unsubstantiated and Should be Deleted because I-15 is a Substantial Barrier

The DRECP-modeled mountain and intermountain habitat depicted in Figures 7 and 8 reflects current and potential habitat use in the project vicinity fairly well. It is unclear why a separate delineation of “critical linkages” in Figure 5 is needed or what supports the delineation. The intermountain habitat results more accurately identify locations where bighorn sheep could connect between core mountain habitat areas. We suggest removing the critical linkage map because it is unsubstantiated and does not reflect the results of the more precise modeled mountain and intermountain habitat. If the critical linkage map is not removed, at a minimum it would need to be updated to reflect the reality that I-15 is not permeable except for at specific overpasses and underpasses where conditions are suitable for bighorn sheep crossing, which is essentially the conclusion drawn in Figure 6 of this comment. I-15 experiences near-continuous traffic in the SMS project area. Bighorn sheep would be struck by vehicles if they were to attempt to cross the highway at locations other than the specified overpasses or underpasses. Figure 5 fails to take this into account and ignores the viability of movement through the underpass at Zzyzx Road.

INACCURATE AND INAPPROPRIATE HIGH BIOLOGICAL SENSITIVITY DESIGNATION OF SODA MOUNTAIN VALLEY

The project area is designated as "high biological sensitivity" in the DRECP reserve design. This designation is inappropriate given the biological resource on the site identified in site-specific surveys. This inappropriate designation was discussed at length in previous comments submitted by Soda Mountain Solar, LLC (attached hereto as Exhibit1). Since that comment letter was submitted, supplemental surveys were performed for desert tortoise, burrowing owl, kit fox, bighorn sheep, bats and rare plants in the fall of 2012. The results of these additional surveys are provided in Table 3. These additional surveys support the conclusion that the project area does not meet the criteria for "high biological sensitivity".

Table 3: Surveys and Results

Survey	Survey Timing	Results
Desert tortoise	Fall 2012	Protocol survey of eastern extremes of project area. No live tortoise observed. Sign along toe of hill slope and on eastern margin of project area
Floristic survey for rare plants	Fall 2012	No special-status plants
Bighorn sheep	Fall 2012	No bighorn sheep or trails on site. Bighorn and sign observed in mountainous area east and south of the project.
Bats	August 2012	No special-status bats observed on site. Townsend's big-eared bat observed at Blue Bell mine; Pallid bat observed at Otto Mine.
Burrowing owl	Fall 2012	Active burrows and sign of recent use
Kit fox and American badger	Fall 2012	Kit fox and dens observed. American badger sign.

Appendix H of the Alternatives Analysis (CEC 2012) identifies the methods that were used to formulate the reserve design. The "high biological sensitivity" designation appears to reflect the assumption that the SMS project area is within a desert tortoise least-cost corridor. As stated above in "USFWS Desert Tortoise Least Cost Corridors" (i) site-specific survey results and habitat suitability analysis; (ii) USFWS' own Revised Recovery Plan; and (iii) genetic studies strongly indicate that tortoise populations are not crossing the Baker Sink and are not connecting between the West Mojave recovery unit and East Mojave recovery unit.

The substantial data that has been collected on the SMS project area does not support a conclusion of "high biological sensitivity." This designation should be revised in the Draft EIS/EIR to reflect the resources that are on the site.

THE SODA MOUNTAIN VALLEY SHOULD BE DESIGNATED A DEVELOPMENT FOCUS AREA

The SMS project site warrants a DFA designation within the DRECP, across all alternatives. The 4,400-acre project site is currently not located within a DFA in any of the five draft DRECP alternatives.

DFA Designation Criteria

The Alternatives Analysis states that suitable locations for DFAs were identified:

> "[u]s[ing] resource distribution data in combination with agency and stakeholder input to identify and characterize areas suitable for renewable energy development based on the principles laid out above, and accounting for the conservation goals identified during the reserve design process." (CEC 2012, page 1.2-22).

There are three guiding principles identified in the Alternatives Analysis. In general, they include:

1. Develop generation "either on already disturbed land or in areas of lower biological value."
2. Aggregate transmission to the extent feasible to avoid transmission cost, sprawl, and disturbance. This principle reduces disturbance to biologically sensitive areas.
3. Allow sufficient flexibility in the Plan so as to not limit competition or "unnecessarily result in distorted or environmentally incompatible incentives when implemented, i.e., where feasible, the Plan should remain market neutral between different technologies or different project configurations." (CEC 2012, page 1.2-21.)

Reserve Design Designation

The project area is designated as "high biological sensitivity in the DRECP reserve design, which supports its exclusion as a DFA; however, this designation is inappropriate, as demonstrated above. Site-specific survey data do not support a conclusion of "high biological sensitivity" due to the low level of biological resources identified in site-specific surveys, as discussed under "Inaccurate and Inappropriate High Biological Sensitivity of Soda Mountain Valley." Therefore, designation of the project area as a DFA would not conflict with conservation goals.

Guiding Principles
The project area would be consistent with all three guiding principles outlined in the Alternative Analysis, warranting its designation as a DFA.

The project site is located in an area that contains substantial human disturbance and has lower biological value. Anthropogenic disturbance of the Project site is abundant, including the presence of I-15, multiple linear projects, OHV recreational use, and the former Arrowhead Highway. The site-specific species data for the project site demonstrate limited biological value for special status species, both as habitat and as a connectivity corridor.

Development at the project site would allow aggregation of transmission, thereby reducing transmission sprawl, cost, and disturbance. Located within a Section 368 energy corridor and RETI CREZ, the Project site already has been identified as suitable for substantial infrastructure development and is one of the primary transmission and transportation routes into California. Moreover, the BLM has concurred that development of the Project would not conflict with the transmission objectives of the Section 368 corridor (BLM 2009). LADWP's system impact study indicates that its existing transmission line through the Project site has sufficient capacity to accommodate 350MW of renewable generation without the need for upgrading. Because of its proximity to existing roads and transmission infrastructure, no generation intertie transmission line construction is necessary and access road development would be limited to internal access.

Alternatives
Designation of the project area as a DFA under each alternative would not conflict with selected themes of each alternative (excluding the No Action Alternative) as described in *Primary Features of DRECP Alternatives* and briefly summarized in Table 4, below.

Table 4: Alternatives Characteristics

Alternative	Geographic Distribution of Development	Resource Conflicts	High and Moderate Biological Sensitivity Lands in DFAs	Project Site Conflicts
1	Low-conflict disturbed lands	Lowest	70,559 (6 percent of DFAs)	Project site has low biological value and contains existing infrastructure and other signs of human disturbance; therefore, it would be an appropriate DFA under Alternative 1.
2	Distributed across plan area	Moderate	477,051 (26 percent of DFAs)	Project site has low biological value and contains existing infrastructure and other signs of human disturbance; therefore, it would be an appropriate DFA under Alternative 2 because it would not add to amount of resource conflict.

Table 4: Alternatives Characteristics				
Alternative	**Geographic Distribution of Development**	**Resource Conflicts**	**High and Moderate Biological Sensitivity Lands in DFAs**	**Project Site Conflicts**
3	Focused on western portion of plan area	High in West Mojave; moderate elsewhere	507,827 (26 percent of DFAs)	The project site has low biological value and thus would not create more resource conflicts; however, the project site is not located in the West Mojave area near other DFAs in this Alternative. Past reports have noted that Alternative 3 has least impact on tribal lands (e.g., Overview and Discussion of DRECP Alternatives, DRECP Stakeholders Meeting, July 2012 [REAT Agency Team 2012]). The DRECP does not identify culturally sensitive areas in the project area or its vicinity. Thus, designation of the project site as a DFA under Alternative 3 would not increase impacts to tribal concerns.
4	Distributed across plan area	Moderate	191,427 (13 percent of DFAs)	Project site has low biological value and contains existing infrastructure and other signs of human disturbance; therefore, it would be an appropriate DFA under Alternative 4 because it would not add to amount of resource conflict.
5	Distributed across plan area	Moderate to high	690,013 (30 percent of DFAs)	Project site has low biological value and contains existing infrastructure and other signs of human disturbance; therefore, it would be an appropriate DFA under Alternative 5 because it would not add to amount of resource conflict.
6	Distributed across plan area	Moderate to high	371,926 (22 percent of DFAs)	Project site has low biological value and contains existing infrastructure and other signs of human disturbance; therefore, it would be an appropriate DFA under Alternative 5 because it would not add to amount of resource conflict.

Source: CEC 2012.

The Project site's designation as a DFA would comport with the three guidelines described above, and its low biological value means that it is not vital for conservation. We request that the preparers of the DRECP and its associated NEPA and CEQA reviews draw from the wealth of existing project-specific data to substantiate a DFA designation for the project site across all alternatives.

APPENDIX E

The myriad of allowable uses and use restrictions of Appendix E of the Alternatives Analysis (CEC 2012) are extraordinarily sweeping in their effect. While they ostensibly provide some flexibility for development, the use restrictions and mitigation requirements are so stringent that they either directly or effectively prohibit development altogether. They are also confusing and potentially inconsistent. Take, for example, the general desert tortoise management provisions within BLM lands, which categorically prohibit utility-scale energy development within BLM conservation lands (Appendix E, page 56), and which appear to conflict with some Alternatives that allow development within reserve lands as follows (Appendix E, pages E-60 and E-61):

Alternative	Live Tortoise Limit	Mitigation Ratio
1, 2, 4, 6	No more than 5 per non-linear project within reserve system	5:1
3, 5	No utility scale energy development allowed within BLM reserve system; more than 2 for non linear projects within reserve system	10:1

In addition, while the provisions in the table above appear to allow development on their face, they will prohibit it in practice. Very few, if any, project survey results will remain below the live tortoise limit of alternatives 1, 2, 4 and 6, and, even if they do, a mitigation ratio of 5:1 will make the project cost prohibitive. It is highly unlikely that any non-linear project survey results outside the BLM reserve system will remain below a two tortoise limit (which essentially requires no live tortoise identification on-site under USFWS guidance, and, to our knowledge, has only occurred on two solar projects on BLM-administered lands to date) and, even if they did, a mitigation ratio of 10:1 for the entire project is impossible to justify under a project feasibility analysis.

Moreover, if a project's survey results indicated two or fewer live tortoises, why should the project be subject to a 10:1 mitigation ratio when its extraordinarily low survey results suggest that habitat quality on the site is poor? If the REAT agencies desire to impose new, higher mitigation ratios within DRECP reserve lands, shouldn't a project's mitigation burden still be directly correlated to its survey results (as it usually is under project-specific incidental take authorizations), rather than inversely, as here?

The second question above is important because it raises the issue of proportionality. Under state law, mitigation for a project must be "roughly proportional" to its impacts, just as dedications of land under federal law must be "roughly proportional". *Napa Citizens for Honest Gov't v Napa County Bd. of Supervisors*, 91 Cal.App.4th 342, 364 (2001); E*nvironmental Council of Sacramento v City of Sacramento*, 142 Cal.App.4th 1018, 1040 (2006) ; 14 Cal Code Regs §15126.4(a)(4)(B); *Dolan v City of Tigard,* 512 US 374 (1994). The same question also invites scrutiny under the arbitrary and capricious standard of judicial review of the Administrative Procedure Act. *Marsh v.Oregon Natural Res. Council*, 490 U.S. 360 (1989).

The negative manner in which the DRECP reserve design and many of the restrictions of Appendix E have been defined similarly invite scrutiny. Although the DRECP reserve design distinguishes between high and moderate biological sensitivity lands, it is, at its heart, simply defined negatively as all undeveloped, unprotected lands that are not within a Development Focus Area (DFA), irrespective of the fundamental biological values of the lands themselves, the only distinction being moderate and high sensitivity.

The preliminary desert bighorn sheep habitat map (Map 1) on page E-84 of Appendix E is another example; the map categorically defines bighorn inter mountain (i.e., linkage) habitat as all lands lying between core mountain habitat segments that aren't already legislatively and legally protected, without any reference to the fundamental biological values of the lands in question or an assessment of their suitability as bighorn linkage habitat.

Limitations within linkage and wildlife corridors appear to be similarly arbitrary and divorced by design from on-the-ground conditions. For example, to manage for bighorn by asserting that "No new development is allowed within the specific interstate crossings identified in Wehausen (2012)" (Appendix E, page E-81) leaves no room for an on-the-ground assessment of the validity of each programmatically imposed interstate crossing designation. Nor does it leave room for projects that may actually be able to improve pre-project interstate crossing rates through project-specific mitigation. Rather than an outright prohibition, the measure should require any new development within specific interstate crossings to improve pre-project interstate crossing rates. Similarly inflexible percentage-based limitations on cumulative ground disturbance within linkage and wildlife corridors also appear in Appendix E (e.g., pages E-58, E-81), without any substantiation as to why a particular percentage has been applied.

Appendix E is so far reaching and complex that an exhaustive assessment of its contents could not be completed within the short comment period for review of the Alternatives Analysis. It is our hope, however, that the examples above demonstrate basic principles that should be carried forward through the entirety of Appendix E.

APPENDIX I PENDING PROJECTS

Appendix I of the Alternatives Analysis (CEC 2012) identifies DRECP criteria for the processing of existing BLM right-of-way applications. We recommend the following changes to make the criteria more balanced.

1. Projects on BLM land that receive a ROD prior to issuance of the DRECP ROD.

This criterion will incentivize the misuse of project-specific land use plan amendment protests. Protestors will try to delay protest resolution beyond the date of the DRECP ROD. We recommend adding a clause that also includes the RODs of projects that were subject to the protest resolution process at the time of issuance of the DRECP ROD.

2. Projects proposed on BLM lands that do not receive a ROD prior to issuance of the DRECP ROD.

Criterion 1) under this category exempts from the land use allocation decisions of the DRECP any project applications filed before June 30, 2009 within a BLM Solar Energy Zone. However, the "pending projects" exemption of the PEIS also applies to applications filed *outside* Solar Energy Zones before October 27, 2011.

The pending projects exemption of the Solar PEIS is the fulcrum upon which many compromises were made by the environmental community on one side and the solar industry on the other. It would be unfortunate if the DRECP were to upset such a hard-won (and well-supported) collaborative balance, especially given that it is embodied in a comprehensive, multi-state land use plan amendment that is less than four months old.

Criterion 1 therefore should include all pending projects under the Solar PEIS. Short of that, Criterion 1 should apply to "pending projects" within variance areas identified by the Solar PEIS as well as Solar Energy Zones, but not exclusion areas. Or, at the very least, Criterion 1 should apply to all applications filed before June 30, 2009 if they are located in Solar PEIS variance areas or Solar Energy Zones. Although still a much reduced form of the pending project exemption of the Solar PEIS, the latter would more fittingly comprehend only those applications filed within variance areas or Solar Energy Zones before BLM began to formally designate areas best suited for solar energy development and before the DRECP planning agreement had been developed.

3. Add a new, third criterion for projects proposed on BLM lands that do not receive a ROD until 60 days or more after issuance of the DRECP ROD.

As evidenced by our comments above (as well as by our July and August 2012 comments on the DRECP) the landscape-scale modeling assumptions of the DRECP will not always correspond with ground-truthed, site-specific data. The DRECP therefore should be flexible in instances where the DRECP's landscape-scale land use allocations are at odds with site-specific data. To that end, we recommend adding a third criterion for projects that do not receive a ROD until 60 days or more after the issuance of the DRECP ROD, as follows:

> 3) A project with a published Draft EIS or EA later than 60 days after the release of the DEIS for the DRECP (expected late summer 2013) provided the project-level NEPA document (FEIS for projects with a DEIS published before the release of the DEIS for the DRECP) includes:
>
> a) Analysis using the best available information at the time of publication, including data developed in support of DRECP conservation and recreation strategies,
>
> b) Analysis describing the relationship between the project and the DRECP conservation and recreation strategies, and
>
> c) Analysis conclusively demonstrating that the landscape-scale land use allocation decisions of the DRECP are unsupported by the best available site-specific information for the project.

Because it would be resource-based rather than strictly temporal, our recommended exemption would not be as categorical as the other exemptions; it would apply only to the extent of the resource discrepancies identified in factor c) proposed above.

REQUEST FOR EXTENSION OF TIME FOR REVIEW AND COMMENT

Soda Mountain Solar, LLC requests an extension of time to review and comment on the extensive materials posted for the Alternatives Analysis. The comment period should be extended by 60 days to allow for a review period commensurate with the amount of time commonly allowed for public review of a Draft EIS of the same size as the Alternatives Analysis.

CONCLUSION

To conclude, the unprecedented size of the DRECP of course requires generalized, over-inclusive measures to a certain degree in order for its implementation to be feasible. But it need not be so monolithic in its application as proposed in the Alternatives Analysis, particularly when the vast amount of land slated for inclusion within the DRECP reserve system is roughly eight times larger than the amount of land slated for development. This discrepancy leaves ample room for significantly more flexibility than currently proposed.

Soda Mountain Solar, LLC appreciates the opportunity to review and comment on these documents in advance of the Draft EIS/EIR. Thank you for reviewing our comments. We request that these comments be incorporated into the Draft EIS/EIR for the DRECP.

Sincerely,

for

Adriane E. Wodey
Manager
Soda Mountain Solar, LLC.

Exhibit 1: SMS Comments on July 25, 2012, Stakeholder Meeting Materials
SMS Comments on Baseline Biology Report July 24, 2012

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Attachment 1

SMS Comments on July 25, 2012, Stakeholder Meeting Materials

SMS Comments on Baseline Biology Report

August 9, 2012

California Energy Commission
Dockets Office, MS-4
Docket No. 09-RENEW EO-01
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Comments on DRECP July 25 and 26, 2012 Stakeholder Meeting Materials
Docket Number 09-RENEW EO-01

Dear Sir/Madam:

Soda Mountain Solar, LLC, a subsidiary of Bechtel Development Company, Inc., is submitting comments in response to materials and information presented at the Desert Renewable Energy Conservation Plan (DRECP) Stakeholder Committee Meeting on July 25 and 26, 2012. The Soda Mountain Solar project (Project) is a proposed 350 megawatt photovoltaic solar generating facility located on BLM-administered lands in San Bernardino County, California (Figure 1). The BLM right-of-way Serial Number for the Project is CACA-49584. These comments specifically address inappropriate proposed designations for the Project site in the DRECP, namely:

- A high biological sensitivity designation (Project site biological reports do not support a moderate biological sensitivity designation);
- A high conflict Development Focus Area (DFA) designation (unsupported by Project site biological reports and land use planning status); and
- Lack of DFA designation for the Project site across draft DRECP alternatives (DFA designation warranted across all alternatives due to prior disturbance, Section 368 status, and demonstrated lack of biological and land use planning conflicts).

As mentioned below, our opinion on these matters is backed by three years of Project site-specific data presently on file with the BLM, as well as by a rigorous, peer reviewed analysis of the modeling assumptions of the DRECP previously filed under this docket.

Finally, we also recommend carrying forward into the DRECP the "pending projects" concept embodied in the Solar Energy Development Programmatic Environmental Impact Statement (PEIS) insofar as the DRECP concerns BLM-administered lands.

INAPPROPRIATE CLASSIFICATION OF THE SODA MOUNTAIN PROJECT WITHIN THE BIOLOGICAL RESERVE DESIGN

Reserve Design and Categories

A biological reserve design was prepared for the DRECP to guide the California Environmental Quality Act/National Environmental Policy Act (CEQA/NEPA) alternative development process. Among other categories, the biological reserve design identifies areas of high and moderate biological sensitivity. Areas of high and moderate biological sensitivity are proposed for conservation as a part of the DRECP.

The plan-wide biological reserve design for the DRECP was developed using Marxan (Ball et al. 2009) and expert-based analysis. Marxan is a computer-based planning tool to aid in reserve design[1]. Marxan requires data on species habitat and quality to optimize the reserve design. The plan-wide biological reserve design includes eight categories. The reserve categories were defined in the presentation for the April 25 and 26, 2012, DRECP stakeholder meeting and are presented in Table 1, below (DRECP 2012a).

Marxan does not consider data uncertainty or accuracy, therefore the quality of the reserve design is dependent on the quality of the input data. According to the DRECP, the plan-wide biological reserve design was refined through expert-based analysis, post-Marxan, through consideration of:

- Species habitat distribution and occurrences;
- Natural communities;
- Large habitat blocks;
- Habitat linkages;
- Physiographic and environmental characteristics; and
- Ecological processes (DRECP 2012a).

At the July 25th stakeholder meeting, the BLM stated that the reserve design was based in large part on the "naturalness" of the landscape. The use of models based on habitat naturalness was used in lieu of species specific modeling and connectivity analysis, or detailed, site-specific data because the DRECP area is very large and it would be infeasible to assess each of the covered species in the entire Plan Area at a site-specific level.

[1] The Marxan objective function seeks to optimize the reserve design through econometrics by applying costs for preservation within reserve areas and penalties to areas of high conservation value that are not preserved (Ball et al. 2000). The optimal design has the lowest reserve cost with lowest penalties.

Table 1: Reserve Categories and Descriptions	
Reserve Category	**Description**
Legislatively and Legally Protected Areas	Existing protected lands; emphasis on existing protection and management of biological resource values. No renewable energy development covered by DRECP.
High Biological Sensitivity	Based on Marxan Scenario 5 additional conservation area zone (blue areas), desert tortoise (conservation areas and least cost corridors), Mohave ground squirrel conservation areas and range, flat-tailed horned lizard management areas, major rivers, desert linkage network, and expert input. Higher biological sensitivity signifies areas where biological resources are more sensitive to perturbation or where biological resources are concentrated or where highly sensitive biological resources occur. In general, fewer uses or less intensive uses are compatible with these areas.
Moderate Biological Sensitivity	Based on Marxan Scenario 5 conservation area zone (green areas) and other biological resource information, including species occurrence and model data, natural community data, landscape-level information, and expert input. In general, moderate biological sensitivity signifies areas where biological resources are moderately sensitive to perturbation or where biological resources are less concentrated or where moderately sensitive biological resources occur. In general, more uses or more intensive uses are compatible with these areas.
Military and Military Expansion Mitigation Lands	No renewable energy development or conservation covered by DRECP currently displayed or considered (subject to change pending DOD input).
Open OHV Lands	Biological conservation is area dependent.
Tribal Lands	No renewable energy development or conservation covered by DRECP currently displayed or considered (subject to change pending tribal input).
Impervious and Urban Built-up Land	Utility-scale renewable energy development and conservation unlikely.
Undesignated	Conservation unlikely.

Source: DRECP 2012a; DRECP 2012b

Why the Designation of the Soda Mountain Solar Project Site is Inappropriate

Although the DRECP is a landscape-scale endeavor, more detailed regional and local species specific analyses should replace large scale modeling based on habitat naturalness.[2] In this instance, the Project site is designated as "Plan-wide Conservation Area – High Biological Sensitivity – Public" within the plan-wide biological reserve (Figure 1). The output of the Marxan analysis presented in the meeting materials showed a moderate biological sensitivity for the Project site (DRECP 2012a). The elevation to high biological sensitivity was therefore an output of the expert-based analysis. The high biological sensitivity designation indicates that the area contains biological resources that are sensitive to perturbation, high concentrations of biological resources, or highly sensitive biological resources. However, as explained below, neither a High Biological Sensitivity nor a Moderate Biological Sensitivity designation is consistent with the multiple Project-specific, habitat and focused species field surveys that have been on file with the BLM under right-of-way application CACA-49584 since 2009.[3]

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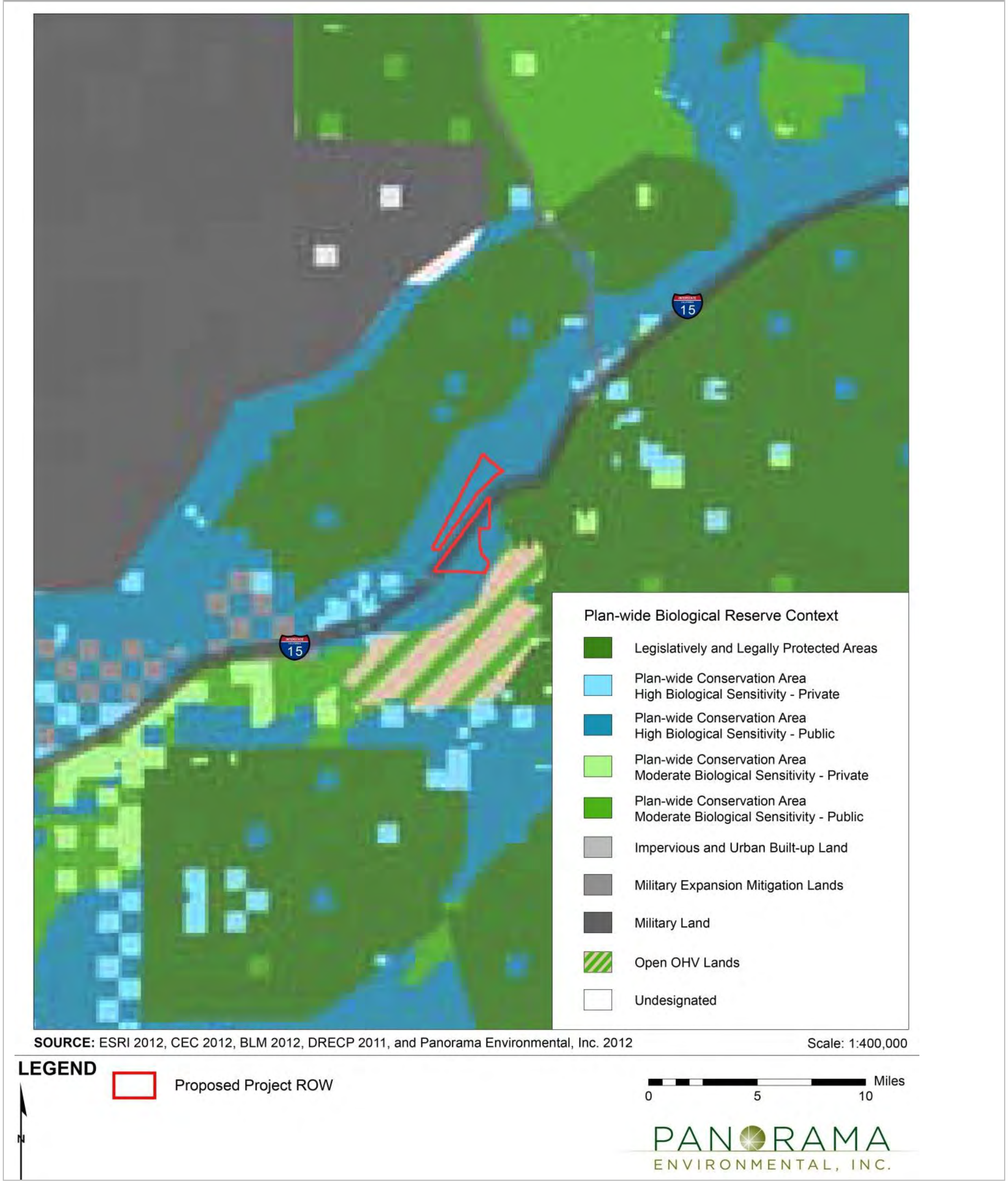
[2] This approach is recommended in *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* (Spencer et al. 2010), which specifically states:

> "*Essential Connectivity Areas are placeholder polygons that can inform land-planning efforts, but that should eventually be replaced by more detailed Linkage Designs, developed at finer resolution based on the needs of particular species and ecological processes. It is important to recognize that even areas outside of Natural Landscape Blocks and Essential Connectivity Areas support important ecological values that should not be "written off" as lacking conservation value. Furthermore, because the Essential Habitat Connectivity Map was created at the statewide scale, based on available statewide data layers, and ignored Natural Landscape Blocks smaller than 2,000 acres; it has errors of omission that should be addressed at regional and local scales*".

[3] SMS has completed detailed environmental studies within the proposed Project site as part of the right-of-way application process, including: desert tortoise survey; golden eagle and bighorn sheep survey; special-status plant survey; Mojave fringe-toed lizard survey; avian surveys; habitat assessment; water resource investigation and delineation; hydrologic and groundwater evaluation; geologic characterization; and a percolation and scour analysis. The results of each of these surveys are on file with the BLM under right-of-way application CACA-49584.

Figure 1: Soda Mountain Solar Reserve Classification



Marxan Reserve Design for Soda Mountain Solar Project Site

The reserve design that resulted from Marxan Scenario 5 displayed the Project site as a green area of moderate biological sensitivity and therefore an area considered for conservation according to the DRECP. As stated by the BLM during the stakeholder meeting on July 25, 2012, this sensitivity was based largely upon land cover naturalness; species-specific biological goals and objectives were not developed or considered. Naturalness is an inaccurate proxy for species habitat and use. Species niche habitat and connectivity reflect landscape population dynamics that are independent of the naturalness of the habitat, for example. Areas of high "naturalness" may be unsuitable for species use for a variety of reasons: areas with few impervious surfaces may be unsuitable for niche habitat preferences, other factors may have contributed to habitat degradation (e.g., predators, invasive species), or an area may be outside of a species range due to natural or man-made landscape barriers (e.g., mountains, unvegetated playas, highways). Likewise, highly-disturbed habitats may be suitable to species use or contain important corridors, such as riparian areas for connecting wildlife populations. The reserve design does not provide targeted protection of the species that the DRECP is tasked with conserving because detailed, "ground-truthed" species and linkage analysis was not used in the design. Because the reserve design is based on naturalness of habitat, the reserve design reflects very large areas of moderate and high biological sensitivity due to the relatively few developed areas (impervious areas which would not be "natural") located within the DRECP Area. These areas may not be key habitat or linkage areas for species covered under the DRECP. Therefore, in the absence of detailed species analysis, the Marxan reserve design is unlikely to identify targeted areas for protection because it did not consider the species and uses that need to be protected.

Soda Mountain Solar Compared to Expert-Based Analysis Criteria

The DRECP used expert-based analysis to improve the reserve design output of Marxan, and, in this instance, to elevate the Project site's designation from "Moderate Biological Sensitivity" to "High Biological Sensitivity". Table 2, below, reevaluates the biological sensitivity of the Project site by comparing the expert-based criteria to Project-specific intensive habitat and species field survey results on file with BLM under CACA-49584. The analysis in Table 2 indicates that the Project site does not meet any of the criteria for high biological sensitivity.

Table 2: Soda Mountain Solar Biological Sensitivity Analysis	
Expert Evaluation Criteria	**Soda Mountain Solar Project Site**
Species habitat distribution and occurrences: concentrations, major populations, essential locations	The Project site does not have high concentrations or major populations of species. The Project site is characterized by sparse vegetation and low abundance and diversity of wildlife (URS 2009a). None of the DRECP-covered species are known to occur or were observed within the Project site during focused species surveys for desert tortoise, Mojave fringe-toed lizard, golden eagle, and bighorn sheep (URS 2009b; RMT 2010; RMT 2011).
Natural communities: representation and capture of rare and sensitive types	There are no rare or sensitive natural communities within the Soda Mountain Solar Project site. The Project site is completely dominated by Mojave creosote bush scrub, which is common throughout the desert (URS 2009a).
Large habitat blocks/core areas	The Project site lies within a relatively small valley that is separated geographically from larger landscape blocks or units. The Project site was not identified as a natural landscape block or core area within the Desert Connectivity Project (Penrod et al. 2012)
Habitat linkages and corridors	No habitat linkages were identified within the Project site by the Desert Connectivity Project (Penrod et al. 2012). An essential connectivity area was identified within the Project site (REF); however, the essential connectivity areas should be succeeded by the linkages identified in the Desert Connectivity Project (Spencer et al. 2010; Heim and Hietter 2012); *see* fn 2, above.
Physiographic and environmental representativeness: elevation gradients, slope, aspect, temperature, rainfall, including climate change	The Soda Mountain Solar Project site is contained within a valley where slopes range from 2-4%. The Project site is very uniform in elevation, gradient, rainfall, and temperature due to the overall small size of the Project site (4,400 acres) and the uniformity of site conditions. The habitat within the Project site is also uniform, exhibiting low vegetation and species diversity. The Project site does not include unique or distinct physiographic elements.
Ecological processes: landscapes supporting aeolian processes, alluvial and fluvial processes, geomorphological processes	There are no intermittent or perennial streams within the proposed Project site. There are numerous small ephemeral drainages within the Project site that are geomorphically stable and have not changed course over the last 50 years based upon analysis of historical aerial imagery. The ephemeral drainages and general area contain course grain sediments including gravels, cobbles, and sands. These course grain sediments are not subject to aeolian processes. While there are alluvial fans within the Project site, the alluvial processes are not an important source of sediment for downstream habitat. The Project site is geomorphically stable with coarse grain sediment, and would not be a significant source of sand or other materials for downstream areas (Wilson 2011).

Soda Mountain Solar Project Site Conditions Compared to Moderate Biological Sensitivity Description

The results of the Marxan reserve design indicated that the Project site should be designated as moderate biological sensitivity. The Project site does not meet the definition for moderate biological sensitivity as defined by the DRECP. The definition for moderate biological sensitivity includes areas that contain:

1) Biological resources that are moderately sensitive to perturbation;
2) Biological resources are less concentrated; or
3) Moderately sensitive biological resources.

1. Sensitivity of Biological Resources to Perturbation

The Project vicinity has been highly disturbed by past land use actions. The Project site is adjacent to and divided by the four- lane, divided Interstate-15 (I-15) highway. Other land uses directly adjacent to the Project site include:

- Rasor Road off-highway vehicle area
- Two transmission lines
- Power distribution line
- Telephone line
- Cellular tower
- Two fuel pipelines
- Underground fiber optic cable

Biological resources that are sensitive to perturbation would not be expected in the Project site due to the existing intensive land uses, particularly I-15 which exhibits nearly constant traffic as the primary thoroughfare between Las Vegas, Nevada and Los Angeles, California. Biological resources that would use the Project site would be limited to those that are habituated to human disturbance. The level of existing disturbance and on-going intensive uses of the Project site would not be suitable for biological resources that are moderately sensitive to perturbation.

2. Concentration of Biological Resources

Biological field studies were conducted for the Project site in 2009 and 2011. These studies included:

- Special status plants survey
- Focused desert tortoise survey
- Mojave fringe-toed lizard survey
- Golden eagle and bighorn sheep surveys
- Avian point count surveys
- Water resource investigation

Species diversity and abundance within the Project site is low and typical of areas containing sparse and uniform vegetation (URS 2009a). Neither vegetation nor wildlife occur within the Project site in high concentrations. The Project site does not support high concentrations of sensitive or other biological resources. The focused surveys for desert tortoise, Mojave fringe-toed lizard, golden eagle, and bighorn sheep did not identify presence of these species within the Project site (URS 2009b; RMT 2010; RMT 2011). Avian point count surveys were conducted in the fall and spring of 2009. A total of 629 birds were identified in the spring consisting of 22 common species. 210 birds were identified in the fall consisting of 23 common species. The most abundant species accounting for the majority of the birds observed in the Project site was the horned lark which is abundant through the Mojave Desert (URS 2010). There was no presence or concentration of DRECP covered species during Project site surveys.

3. Sensitive Biological Resources

The *DRECP Baseline Biology Report* (CEC 2012) identified modeled suitable habitat for both desert tortoise and bighorn sheep within the Project site. Suitable habitat was not identified for any other species covered under the DRECP. The suitable habitat models for desert tortoise and bighorn sheep used in the *DRECP Baseline Biology Report* inaccurately characterize and overestimate the habitat suitability within the Project site.

Protocol-level desert tortoise surveys were conducted for the Project site. No tortoise, burrows, or sign were identified within the study area during 100% coverage surveys conducted on 10-meter transects throughout the entire Study Area (URS 2009 and RMT 2010). No desert tortoise or sign were identified in any of the studies conducted in the study area (biology, geology, and cultural resources). The field surveys also indicate that conditions are not likely to support populations of desert tortoise because:

- The elevation of the area (less than 1,600 feet) is low for desert tortoise
- Vegetation is sparse with low diversity
- Soils are very rocky
- Habitat is fragmented by Interstate-15 (I-15)
- Disturbance from off-highway vehicle use and construction of two transmission lines, a cellular tower, a distribution line, a fiber optic cable, and two fuel pipelines

These conditions, combined with the field survey results for desert tortoise, indicate that few, if any, desert tortoise would be expected in the Project site (Heim and Hietter 2012).

Surveys for bighorn sheep were conducted in Project site and in the Soda Mountains in 2011 (RMT) and 2012 (Abella). No bighorn sheep were identified within the Project site and suitable habitat was not identified within the Project site during a habitat evaluation (URS 2009a). Bighorn sheep experts determined that the Project site does not provide habitat for bighorn sheep because:

- The Project site is flat and does not contain mountains (Kerr 2010)
- The Project site does not provide any water sources
- Bighorn sheep prefer to stay in mountainous areas which provide views of the surrounding areas and vantage points (Turner 2010)

These habitat conditions indicate that bighorn sheep would not occupy the Project site or stay in the Project site for long if they were to travel through the Project site (Heim and Hietter 2012).

The Project site does not contain sensitive biological resources including desert tortoise or bighorn sheep.

Appropriate Designation for Soda Mountain Solar Project Site

The Project site exhibits low biological sensitivity and should not be designated as a moderate biological sensitivity area. The Project site is highly affected by the presence of I-15 and the existing intensive land uses within the area. Wildlife use of the Project site is limited by the Soda Mountains to the north and south, the Baker sink to the east, and I-15 dividing the Project site. These barriers to wildlife movement and the increased incidence of mortality associated with the highway limit the potential for future wildlife use of the Project site. The Project site does not meet any of the criteria for biological sensitivity and should be categorized as unclassified land (i.e., "conservation unlikely"), particularly when its low biological sensitivity is considered in the context of current disturbance and the site's designation as a Section 368 transmission corridor and a (biologically ground-truthed) Renewable Energy Transmission Initiative (RETI) Competitive Renewable Energy Zone (CREZ). The reserve design should be modified to designate the Project site as unclassified land.

INAPPROPRIATE DESIGNATION OF SODA MOUNTAIN SOLAR PROJECT SITE AS A HIGH CONFLICT DEVELOPMENT FOCUS AREA

The Project site falls within the "Dinosaur" polygon that was designated as a "high conflict" Development Focus Area (DFA) on the basis of potential biological and public land use planning conflicts. The conflicts identified for the Dinosaur polygon do not apply to the Project site.

The following potential biological conflicts were identified(Figure 2):

- Bighorn sheep (29,326 acres of inter-mountain habitat; 7,390 acres of mountain habitat)
- Desert tortoise (17,583 acres of modeled habitat)
- Mojave fringe-toed lizard (29,821 acres of modeled habitat)
- Habitat linkages (16,117 acres of desert linkages)
- Total number of modeled DRECP Species: 10

The Project site, consisting of approximately 4,400 acres, is included in a larger potentially high conflict area. The majority of the Dinosaur polygon is located north of the Soda Mountains in an area that is geographically separate from and includes different habitat elements than the Project site. The conflicts identified for the Dinosaur polygon do not apply to the Project site. The Project site does not contain Mojave fringe-toed lizard modeled habitat, and, as shown in Figure 3, is not located within any habitat linkages (CEC 2012 and Penrod et al. 2012), or habitat identified by intensive surveys (URS 2009). The modeled results for designating desert tortoise and bighorn sheep habitat inaccurately characterize and overstate the habitat suitability of the Project site because focused surveys for desert tortoise and bighorn sheep are in direct conflict with the model results. The surveys found no desert tortoise on the Project site and a lack of suitable habitat for bighorn sheep. As explained above, the models of desert tortoise and bighorn sheep habitat suitability overstate the habitat quality of the Project site.

The model for desert tortoise habitat suitability identified moderately suitable habitat for desert tortoise (0.6 to 0.8) within the Project site, while focused surveys using USFWS protocols did not find any tortoise or sign within the Project site. Similarly, suitable habitat for bighorn sheep was predicted within the southern portion of the Project site, which is flat and does not contain areas that meet bighorn sheep habitat criteria and bighorn sheep have not been identified in the Project site. The difference between model output and field surveys can be explained through 1) errors in the model input, 2) human impacts to the habitat, and 3) expected errors in modeling. Errors in the data used to model suitable habitat include GIS data showing 0% presence of rocks in the Project site when field geology studies identified abundant rocks and cobbles, and the model resolution at $1km^2$ would miss details that could impact the habitat suitability. Human impacts to the Project site are abundant, including the presence of I-15, multiple linear projects, and OHV recreational use. None of these previous land use impacts were considered in the modeling and no field ground-truthing was conducted to verify the results. Finally, the models would be expected to be inaccurate in some locations such as a relatively small area like the Project site. The multi-state model of tortoise habitat suitability was conducted over 6 states including a very large variety of habitat circumstances allowing for a high degree of variability in tortoise predicted suitable habitat. The model of bighorn sheep habitat was only conducted over the DRECP Plan Area, but included a limited number of presence data points (32 points total) from which to model suitable habitat. The limited amount of data used in the model would be expected to result in less accurate results (Heim and Hietter 2012).[1]

The high-conflict designation of the Dinosaur polygon is also founded on assumptions regarding potential conflicts with public land use designations, specifically, its adjacency to:

- BLM Wilderness,

[1] Due to the limited number of presence data points a relatively low threshold of 0.236 was used to classify suitable habitat for bighorn sheep.

- BLM Proposed Wilderness; and
- Proposed Feinstein Bill.

These potential conflicts identified for the Dinosaur polygon do not apply to the Project site. The Project site is not adjacent to BLM Wilderness. The Project site is adjacent to the Soda Mountain Wilderness Study Area (WSA), but the BLM determined the Soda Mountain WSA to be unsuitable for wilderness designation in 1990, stating:

> Known and potential mineral values, the need to keep the land available for full development of a designated utility corridor, and opportunities for motorized recreation, when coupled with the lack of outstanding or unique natural features in the WSA, are of greater importance than the area's value as wilderness. Designation of the area as wilderness would not contribute any additional unique or distinct features to the National Wilderness Preservation System (BLM 1990).

While Senator Feinstein's Desert Protection Act of 2011 does propose designation of a portion of the Soda Mountain WSA as wilderness, the following express provisions of Section 1502 of the bill resolve any potential conflicts posed by renewable energy development of the Project site:

- The bill does not create a protective perimeter or buffer zone around the wilderness areas it creates (Section 1502(a)(1)).
- The bill does not require additional regulation of activities on land outside the boundary of the wilderness areas it creates (Section 1502(a)(3)).
- Perception of noise from or views of activities outside the wilderness areas created by the bill cannot be grounds for prohibiting or restricting such uses (Section 1502(a)(2)(A)).
- The impacts of a renewable energy project on a wilderness area created by the bill must be assessed based on the status of the proposed wilderness lands before their designation as wilderness if the renewable energy project initiates NEPA review prior to December 31, 2013 (Section 1502(a)(2)(B)).

The Project will initiate NEPA review prior to December 31, 2013.

In short, the High Conflict Area map needs to be revised to exclude the Project site because the potential biological and public land use conflicts ascribed to the Dinosaur polygon do not apply to the Project site.

Figure 2: Soda Mountain Solar "High Conflict Areas

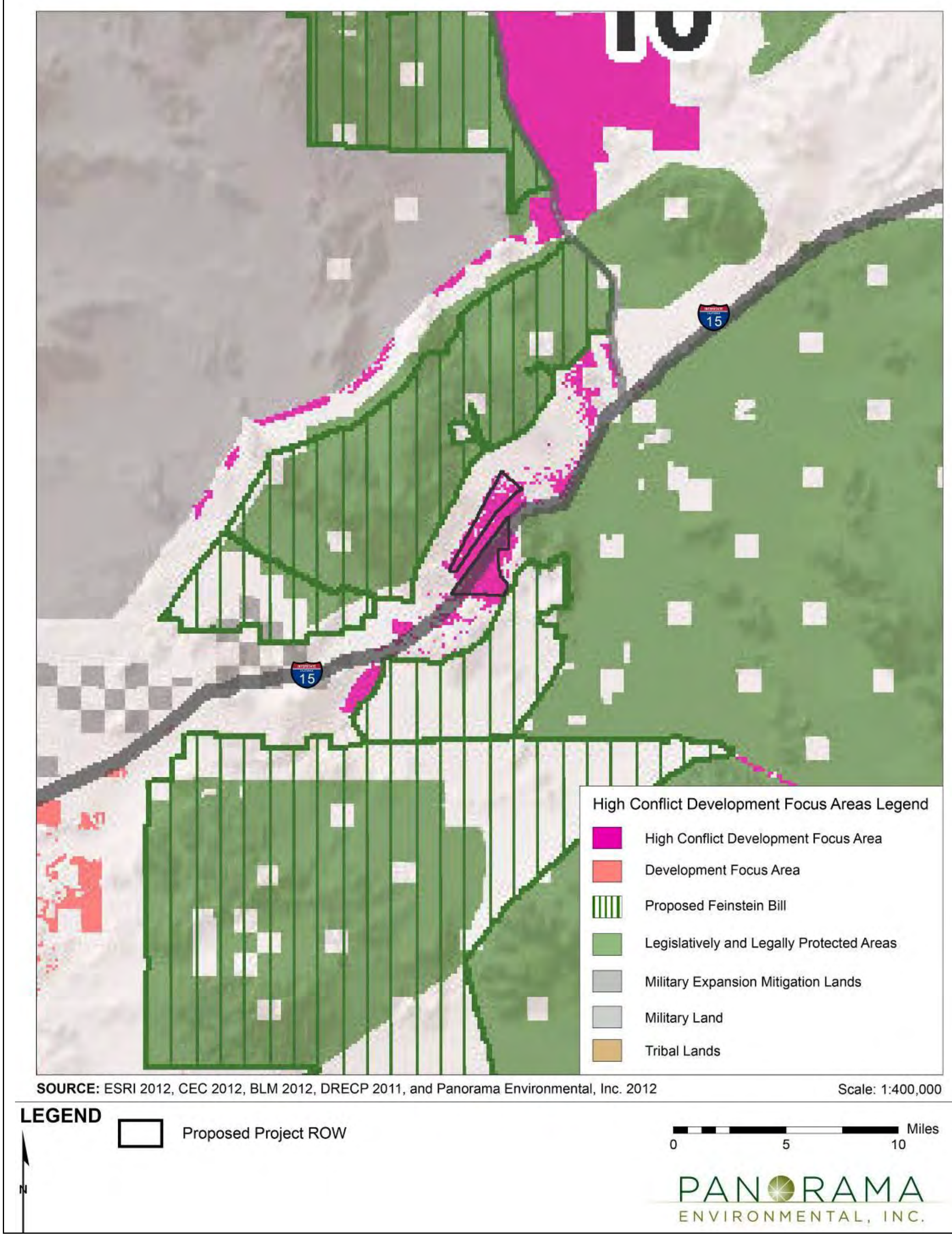
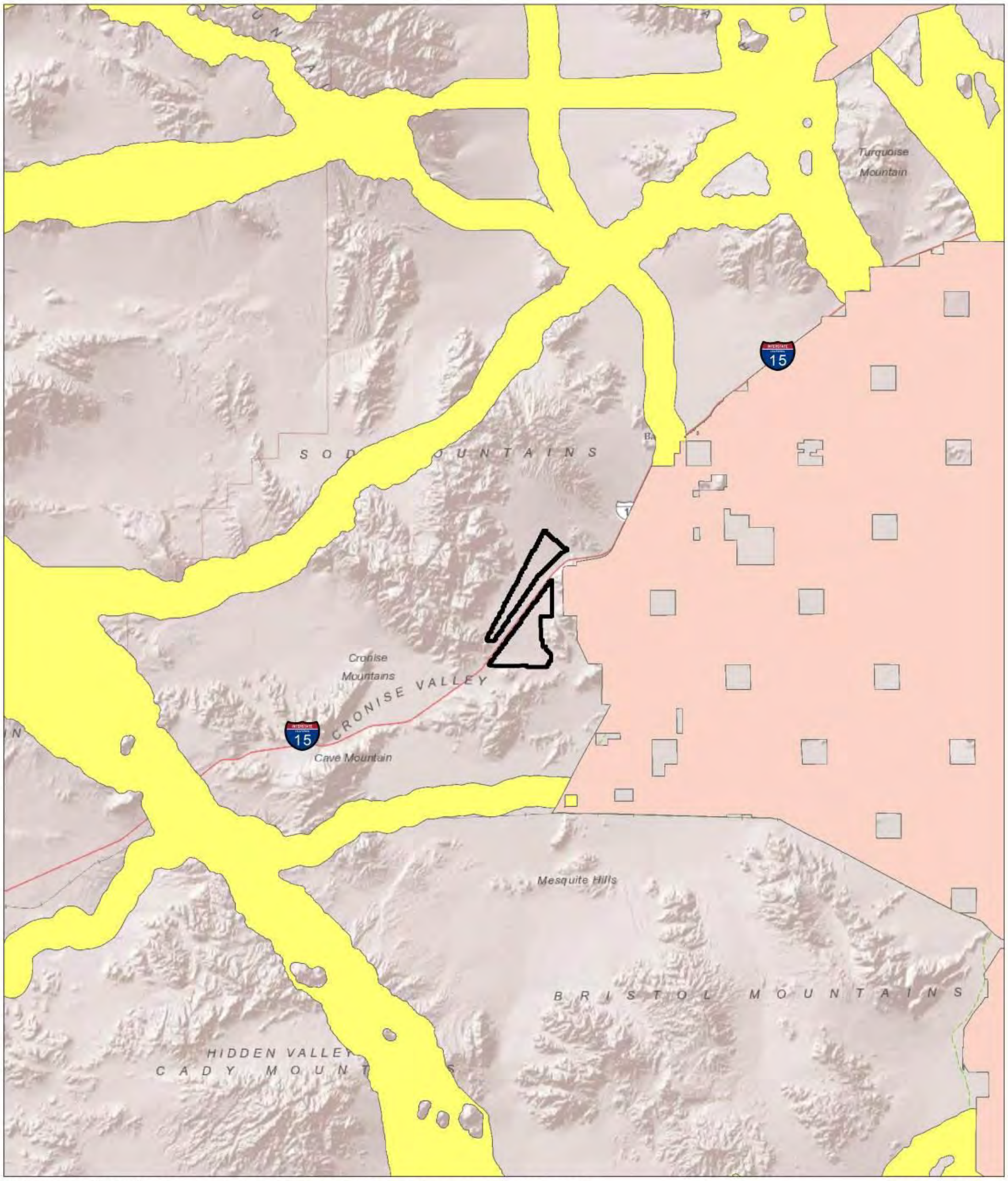


Figure 3: Soda Mountain Solar Connectivity Areas (Penrod et al. 2012)



SOURCE: ESRI 2012, Penrod, K. et al. 2012, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

- Proposed Project ROW
- Landscape Blocks
- Least Cost Unions

0 5 10 Miles

N

PANORAMA ENVIRONMENTAL, INC.

DFA STATUS OF THE PROJECT SITE ACROSS DRAFT DRECP ALTERNATIVES

The 4,400-acre Project site is not located within a DFA in any of the five draft DRECP alternatives, although it is depicted as a "variance" area in Alterative 1. The Project site warrants a DFA designation within the DRECP, across all alternatives. The site-specific species data for the Project site demonstrate limited biological value for special status species, both as habitat and as a connectivity corridor. Anthropogenic disturbance of the Project site is abundant, including the presence of I-15, multiple linear projects, OHV recreational use, and the former Arrowhead Highway. Located within a Section 368 energy corridor and RETI CREZ, the Project site already has been identified as suitable for substantial infrastructure development and is one of the primary transmission and transportation routes into California. Moreover, the BLM has concurred that development of the Project would not conflict with the transmission objectives of the Section 368 corridor (BLM 2009). LADWP's system impact study indicates that its existing transmission line through the Project site has sufficient capacity to accommodate 350 MW of renewable generation without the need for upgrading. Because of its proximity to existing roads and transmission infrastructure, no generation intertie transmission line construction is necessary and access road development would be limited to internal access. As explained above, Senator Feinstein's proposed Desert Protection Act of 2011 expressly avoids impeding renewable development of the Project site, and such development would not conflict with BLM's recommendation against designating the adjacent Soda Mountain WSA as wilderness. Finally, the National Park Service has confirmed its willingness to work with Soda Mountain Solar, LLC to address concerns regarding potential impacts to the interior of the Mojave National Preserve. All of the above information is on record with the BLM under ROW CACA-49584.

The Project site exhibits fewer siting constraints than most sites previously approved or currently under consideration by the BLM for solar development in California. We request that the preparers of the DRECP and its associated NEPA and CEQA reviews draw from the wealth of existing Project-specific data to substantiate a DFA designation for the Project site across all alternatives, rather than rely solely – and, in this particular instance, potentially arbitrarily - on the development assumptions proposed by the Center for Energy Efficiency and Renewable Technologies.

PENDING PROJECTS ON BLM-ADMINISTERED LANDS

After much negotiation, leaders of the renewable energy industry and the environmental community have jointly supported BLM's proposed decision to exempt from the PEIS all BLM solar energy right-of-way applications filed within Solar Energy Zones prior to June 30, 2009 and, within "variance" areas, prior to October 28, 2011 (Abengoa Solar, et al. 2012). Assuming the pending projects exemption is carried forward through the Record of Decision for the PEIS, we respectfully urge the BLM to continue to honor the concept if and when it amends its land use plans to factor in the DRECP once it is adopted. We also strongly recommend that the

DRECP design incorporate BLM's pending projects exemption into its conservation assumptions by (i) expressly stating that the DRECP's conservation assumptions do not apply to BLM-approved projects or PEIS "pending project" sites unless the approved project is cancelled or the pending project application is withdrawn or rejected; and (ii) overlaying BLM-approved projects and PEIS "pending project" boundaries on relevant DRECP maps with a legend item summarizing the concept. Please note that both CEQA and NEPA will require the cumulative analyses of the DRECP's EIR/EIS to account for the pending projects exemption.

The pending projects exemption is the fulcrum upon which many compromises were made by the environmental community on one side and the solar industry on the other. It would be poor policy if the DRECP were to upset such a hard-won (and well-supported) collaborative balance.

RECOMMENDATIONS

The following modifications to the DRECP reserve design, high conflict areas, and draft alternatives are recommended for the Soda Mountain Solar Project site:

1. The categorization for the Soda Mountain Solar Project site should be changed; from "High Biological Sensitivity – Public" to "Unclassified Land";
2. The high conflict DFA designation should be removed from the Project site;
3. The Project site should be identified as a DFA across all development alternatives; and
4. The PEIS "pending projects" exemption should be incorporated into the DRECP design.

Soda Mountain Solar, LLC, appreciates the opportunity to comment on the meeting materials. These comments seek to improve the reserve design process and to encourage the adoption of a plan that reflects the overall purpose of the DRECP: protection of covered species and streamlining of permitting for renewable energy projects.

Sincerely,

Adriane Wodey
Soda Mountain Solar, LLC

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July 24, 2012

California Energy Commission
Dockets Office, MS-4
Docket No. 09-RENEW EO-01
1516 Ninth Street
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RE: Comments on DRECP Baseline Biology Report

Dear Sir/Madam:

Soda Mountain Solar, LLC (SMS) is the developer of the Soda Mountain Solar Project (the Project). The Project is a proposed 350 megawatt photovoltaic solar electric power generating facility located approximately six miles southwest of Baker, California, along Interstate 15, in San Bernardino County. The Project would be located within a 4,400 acre right-of-way on federal land administered by the U.S. Bureau of Land Management. The Soda Mountain Project area is shown in Figure 1 at the end of this letter.

SMS has reviewed the *Draft Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report* (CEC 2012) and compared its habitat suitability results for desert tortoise and bighorn sheep with results of field studies conducted within the Soda Mountain Solar project area.[1] Our review also identified weaknesses in the methods used in the *Draft DRECP Baseline Biology Report*. The full analysis, including evaluation of the underlying models applied in the *Draft DRECP Baseline Biology Report*, is provided in the enclosed document, "Analysis of Habitat Suitability and Connectivity in the Soda Mountain Area, San Bernardino County, California" (Heim and Hietter 2012). The findings and recommendations of this analysis as they specifically apply to the *Draft DRECP Baseline Biology Report* and the Soda Mountain Solar Project site are

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[1] As part of the right-of-way application process, SMS has completed detailed environmental studies within the proposed Project area, including: desert tortoise survey; golden eagle and bighorn sheep survey; special-status plant survey; Mojave fringe-toed lizard survey; avian surveys; habitat assessment; water resource investigation and delineation; hydrologic and groundwater evaluation; geologic characterization; and a percolation and scour analysis. The results of each of these surveys are on file with the BLM.

provided below. Our letter concludes with several recommendations for the revision of the *Draft DRECP Baseline Biology Report* as it applies to the Soda Mountain Solar Project site.

Recommendations

The *Draft DRECP Baseline Biology Report* should be revised as described below.

1) **Section 3: Figure 3-4.** The Soda Mountain Solar Project area should not be designated as a connectivity corridor in the Baseline Biology Report because the species-specific analysis conducted by the California Desert Connectivity Project did not identify any linkages within the Soda Mountain Solar area.

The polygons of essential connectivity areas from the California Essential Connectivity Project should be removed and replaced with the more detailed linkage network developed by the California Desert Connectivity Project, where the two efforts overlap. This replacement is recommended in *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* (Spencer et al. 2010):

> *"Essential Connectivity Areas are placeholder polygons that can inform land-planning efforts, but that should eventually be replaced by more detailed Linkage Designs, developed at finer resolution based on the needs of particular species and ecological processes. It is important to recognize that even areas outside of Natural Landscape Blocks and Essential Connectivity Areas support important ecological values that should not be "written off" as lacking conservation value. Furthermore, because the Essential Habitat Connectivity Map was created at the statewide scale, based on available statewide data layers, and ignored Natural Landscape Blocks smaller than 2,000 acres, it has errors of omission that should be addressed at regional and local scales"*.

The inclusion of Essential Connectivity Areas where detailed regional scale analyses are available is inconsistent with the methods and recommendations of the California Essential Connectivity Project. Figure 3-4 of the Baseline Biology Report should be revised by removing the Essential Connectivity Areas from the map where finer resolution linkages, such as the California Desert Connectivity Project, are available. The Soda Mountain Solar proposed project area should not be designated as a connectivity corridor in the Baseline Biology Report. The species-specific analysis conducted by the California Desert Connectivity Project did not identify any linkages within the Soda Mountain Solar area.

2) **Appendix B - PRELIMINARY DRAFT March 2012, DRECP Species Statistical Model: Desert Bighorn Sheep.** The Preliminary Draft statistical model for desert bighorn sheep should be revised to include additional data. The model was constructed using 32 presence data points, none of which are located within the Soda Mountains. There is a population of bighorn sheep that was surveyed in the south Soda Mountains by California Department of Fish and Game (CDFG 2012). These data should be incorporated into the model to assist in model refinement. There are seven locations where bighorn sheep were identified in the CDFG surveys. In addition, the model should be refined through ground-truthing. Low-lying areas and areas next

to highways, such as those in the southern portion of the Soda Mountain Solar Project area, should not be included in the model because they do not meet known conditions for suitable habitat, as confirmed by bighorn sheep survey work performed for the Soda Mountain Solar Project. Further documentation of methods should also be provided. The method should state which specific data sources listed in Appendix C were used in the final model, and the resolution of the model.

3) **Appendix B – PRELIMINARY DRAFT March 2012, DRECP Species Model: Desert Tortoise.** The Preliminary Draft species model for desert tortoise identifies suitable habitat throughout the entire valley between the Soda Mountains. This identification of suitable habitat is inconsistent with the method used for the species model (e.g., OHV areas and areas of disturbance were to be removed from suitable habitat areas) and it is inconsistent with field studies of habitat suitability. The OHV area to the south and east of the Project area is identified as suitable habitat for desert tortoise. Similarly, the I-15 highway and corridor, which are highly disturbed, are identified as suitable habitat. The enclosed study provides an evaluation of habitat suitability for desert tortoise within the Project area. The habitat is not likely to sustain a population of desert tortoise due to the limited area between the mountains, high level of human disturbance (I-15 highway and OHV area), low elevation, abundance of rocks and cobbles, and sparse vegetation cover with low vegetative diversity. The model should be updated to reflect a lower quality of habitat within the Project area.

4) The DRECP should be revised to include the Soda Mountain Study Area as a solar development area in draft integrated alternatives 2, 3, and 5. Alternative 2, "Geographically Balanced/Transmission Aligned Alternative," state that development should be aligned with the existing and planned transmission network. The C is located in a BLM utility corridor that currently includes two transmission lines and a distribution line.

Alternative 3, "West Mojave and Tribal Sensitivity Emphasis," is designed to emphasize development in the West Mojave and to exclude projects in areas considered by multiple tribes to have high sensitivity. The Soda Mountain Study Area is located in the West Mojave area and no tribal conflicts have been identified after initial consultation by BLM.

Alternative 5, "Increase Geographic and Technology Flexibility," seems to be the alternative with the highest allowed resource conflicts and the greatest flexibility. The Soda Mountain Study Area has limited resource conflicts and is consistent with Alternative 5.

Conclusion

Based on the enclosed "Analysis of Habitat Suitability and Connectivity in the Soda Mountain Area, San Bernardino County, California", we recommend revising the *DRECP Baseline Biology Report* as it applies to the Soda Mountain Solar Project site as follows:

- Remove the connectivity corridor designation from Figure 3-4 at the Soda Mountain project area;

- Remove the suitable habitat designation in the Soda Mountain project area from the DRECP Statistical Model for Desert Bighorn Sheep; and
- Remove the suitable habitat designation in the Soda Mountain Solar Project area from the DRECP Species Model for Desert Tortoise.

A process should also be designed for updating the Baseline Biology Report to incorporate detailed species-specific survey data as it becomes available. The *Baseline Biology Report* relies heavily on the use of models to develop information. Models are representations of reality based upon assumptions. Models are limited in their ability to characterize real world conditions and should be updated by field data like those generated for the Soda Mountain Solar Project. The enclosed analysis is essentially a case study demonstrating this point.

The Soda Mountain Study Area has been shown to be an area with limited resource conflicts. It should therefore be included in the DRECP as a solar development area in draft integrated alternatives 2, 3, and 5.

Please review the enclosed study upon which we base our recommendations. We believe it will help to improve the accuracy of the DRECP particularly as it applies to the Soda Mountain Solar Project site. We appreciate the opportunity to review and provide comments.

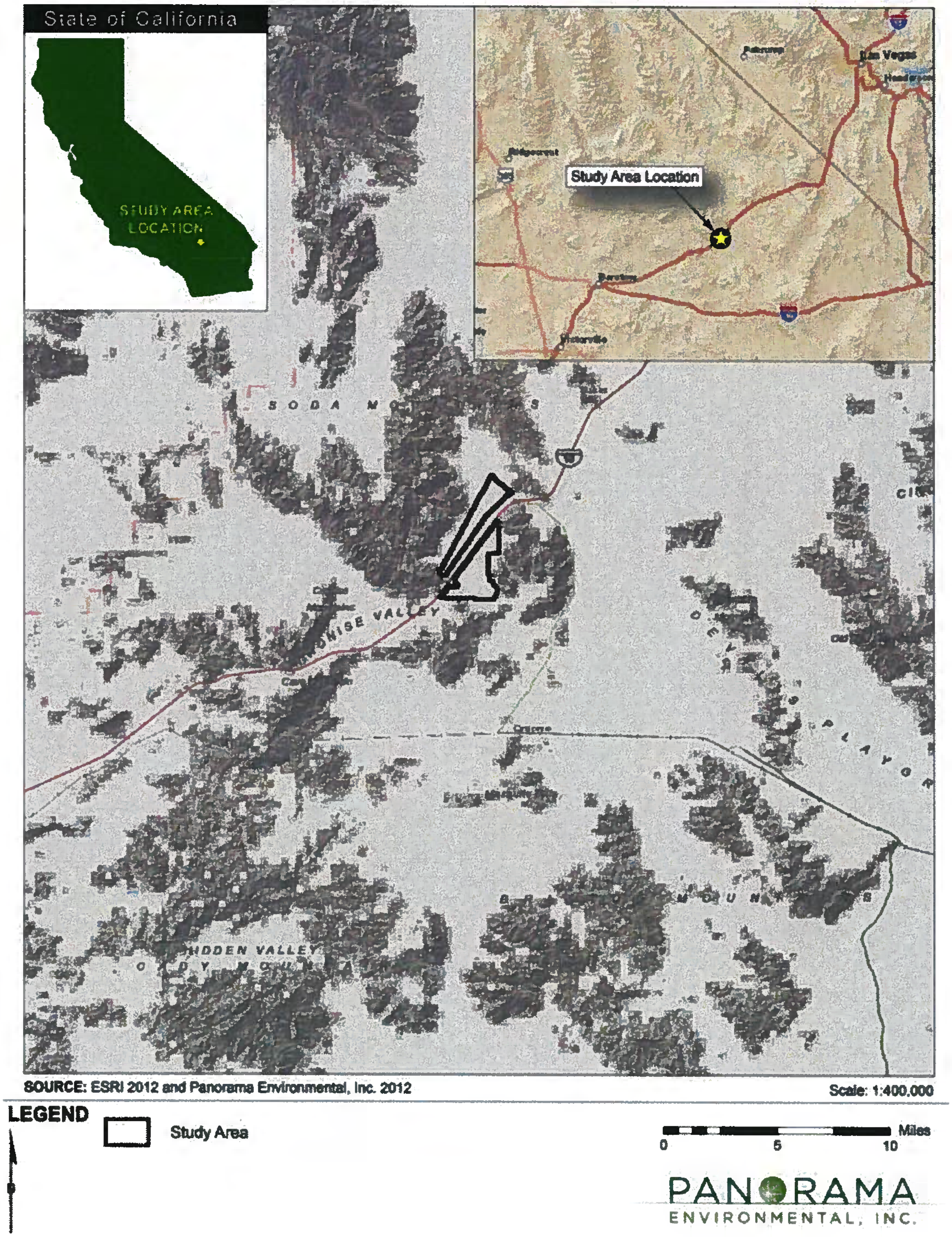
Sincerely,

Adriane E. Wodey

Adriane E. Wodey
Manager
Soda Mountain Solar, LLC

Enclosure: "Analysis of Habitat Suitability and Connectivity in the Soda Mountain Area, San Bernardino County, California"

Figure 1


State of California
STUDY AREA LOCATION
Study Area Location
Las Vegas
Barstow
Victorville
SODA MO
DEV
PLAYOR
HIDDEN VALLEY
SOURCE: ESRI 2012 and Panorama Environmental, Inc. 2012
Scale: 1:400,000
LEGEND
Study Area
Miles
0
5
10
PANORAMA
ENVIRONMENTAL, INC.

Analysis of Habitat Suitability and Connectivity in the Soda Mountain Area, San Bernardino County, California

Susanne Heim and Laurie Hietter

July 2012

PANORAMA ENVIRONMENTAL, INC.

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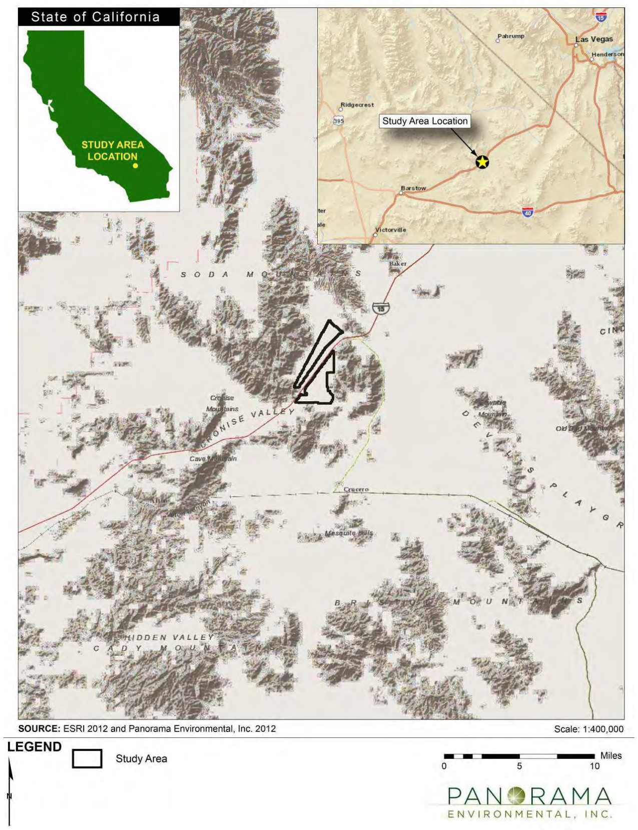
EXECUTIVE SUMMARY

This study was commissioned by Soda Mountain Solar, LLC to assess habitat suitability and connectivity for desert tortoise (*Gopherus agassizii*) and desert bighorn sheep (*Ovis canadensis nelsoni*) in the valley between the north and south Soda Mountains, San Bernardino County, California, which is referred to as the Soda Mountain Study Area. This study provides an analysis of the accuracy of habitat suitability and connectivity model predictions for an approximately 7,000 acre area within the Mojave Desert. Habitat suitability and connectivity models are being used by regulatory agencies to define areas for habitat conservation and development. The accuracy and limitations of model predictions are important considerations for decision-makers when relying on habitat suitability and connectivity models for land use decisions.



Five studies of desert tortoise and bighorn sheep habitat and connectivity were reviewed. The results of these studies were compared with the results of field surveys performed in the Soda Mountain Study area, which is in the valley located between the north and south Soda Mountains. The comparison provides insight into the accuracy of models to correctly predict habitat and species occurrence. The comparison revealed that habitat suitability models have inherent weaknesses and should not substitute for field studies, particularly where detailed field survey data are available.

STUDIES REVIEWED

Habitat and Connectivity Models

Several studies have been conducted that used models to identify suitable habitat for desert tortoise and bighorn sheep, and to identify potential wildlife connectivity corridors. Studies reviewed in this paper include:

1. *Modeling Habitat of the Desert Tortoise (Gopherus agassizii) in the Mojave and Colorado Deserts, California, Nevada, Utah, and Arizona* (Nussear et al. 2009) -

2. "Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert - Tortoise" (Hagerty et al. 2010) -
3. *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* (Spencer et al. 2010) -
4. *A Linkage Network for the California Deserts* (Penrod et al. 2012)
5. *Draft Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report* (California Energy Commission [CEC] 2012)

Field Studies

Field studies were performed in the Soda Mountain Study Area between 2009 and 2012. Field studies that were compared with the habitat model predictions include:

- Desert tortoise survey, 100% coverage (2009)
- Bighorn sheep surveys, aerial and ground-based (2011 and 2012)
- Special-status plant surveys (2009)
- Avian point count surveys (2009)
- Water resource investigation (2009)
- Geology studies (2010)

DESERT TORTOISE HABITAT

Desert tortoise habitat suitability models predict moderately suitable habitat (0.6 to 0.8 predicted probability) for desert tortoise within the Study Area (Nussear et al 2009) and the area is defined as suitable habitat (CEC 2012). The model results differ from the field survey results, which identified no tortoise, burrows, or sign within the study area during 100% coverage surveys conducted on 10-meter transects throughout the entire Study Area. No desert tortoise or sign were identified in any of the studies conducted in the study area (biology, geology, and cultural resources). The field surveys also indicate that conditions are not likely to support populations of desert tortoise because:

- The elevation of the area (less than 1,600 feet) is low for desert tortoise
- Vegetation is sparse with low diversity
- Soils are very rocky
- Habitat is fragmented by Interstate-15 (I-15)
- Disturbance from off-highway vehicle use and construction of two transmission lines, a distribution line, a fiber optic cable, and two fuel pipelines)

These conditions, combined with the field survey results for desert tortoise, indicate that few, if any, desert tortoise would be expected in the Study Area.

DESERT TORTOISE CONNECTIVITY

The Study Area is not identified within a modeled desert tortoise connectivity corridor (CEC 2012), and the Baker sink, located east of the Study Area, is identified as a barrier to tortoise movement (Hagerty et al 2010). The modeled lack of desert tortoise connectivity within the area is consistent with the presence of 1) mountains surrounding the Study Area, 2) the Baker sink to the east of the Study Area, and 3) highway I-15 bisecting the Study Area. These landscape features individually and cumulatively inhibit tortoise movement through the Study Area.

BIGHORN SHEEP HABITAT

The model of suitable habitat for bighorn sheep identified suitable habitat within the southern portion of the Study Area (CEC 2012). The model results differ from field survey and habitat assessment results, which indicate the area is not suitable habitat for bighorn sheep. The flat and open terrain, absence of a water source, and presence of I-15 all indicate that if bighorn sheep were to use the habitat, the use would be temporary and they would not be expected to stay in the valley for long. The adjacent south Soda Mountains are considered suitable habitat and the herds have been identified as using the east slope of the mountains, which is closer to the water source at Zzyzx Spring,

BIGHORN SHEEP CONNECTIVITY

The model of bighorn sheep connectivity does not identify linkage areas within the Study Area (Penrod et al. 2012). This conclusion is consistent with the field results, which identified a population of bighorn sheep in the south Soda Mountains, but no bighorn sheep to the north. Prior to I-15, the area may have been used for connectivity between the north and south Soda Mountains; however, the presence of I-15 reduces the potential for connectivity in the area. Individual bighorn sheep may cross through the Study Area and attempt to cross I-15, but populations of bighorn sheep would not be expected to use the area as a connectivity corridor.

CONCLUSION

Models of habitat suitability and connectivity have limitations that can result in inaccurate predictions of species habitat and connectivity. The primary limitations of these models include:

1) Errors in the model input that would cause errors in the model predictions,
2) Human disturbance, which has fragmented the habitat or reduced the value of habitat for species, is not considered, and
3) Model errors due to application to a small area.

These limitations should be considered when using the models to make conservation or land use decisions. Where field data are available, the data should be incorporated into the decision-making process.

ABSTRACT

Species habitat and connectivity models are frequently used to support land management decisions. While modeling provides an important tool for decision makers, there are limitations of habitat suitability and connectivity models that land use managers and decision makers should be aware of. Models of desert tortoise (*Gopherus agassizii*) and bighorn sheep (*Ovis canadensis nelsoni*) habitat suitability and connectivity are evaluated in this case study. The model predictions are compared to field study results of desert tortoise and bighorn sheep presence and use within an approximately 2,800-hectare (7,000-acre) area of the Mojave Desert along the Interstate-15 corridor between the North and South Soda Mountains. The comparison of model predictions to field conditions is used to evaluate the strength of each model. This analysis identifies limitations that are common to habitat and species distribution models. Model results can be inaccurate and should only be used in the absence of, rather than as a substitute for, field survey results.

PEER REVIEW

We would like to thank the following experts for their contributions and review of this paper: -

Richard Tracy, Ph.D. -
University of Nevada, Reno -

Peter Woodman -
Kiva Biological -

Brent Helms, Ph.D. -
NOREAS Environmental Science and Engineering -

Eric Dugan, Ph.D. -
NOREAS Environmental Science and Engineering -

Lenny Malo -
NOREAS Environmental Science and Engineering -

Tim Glenner -
NOREAS Environmental Science and Engineering -

1 INTRODUCTION

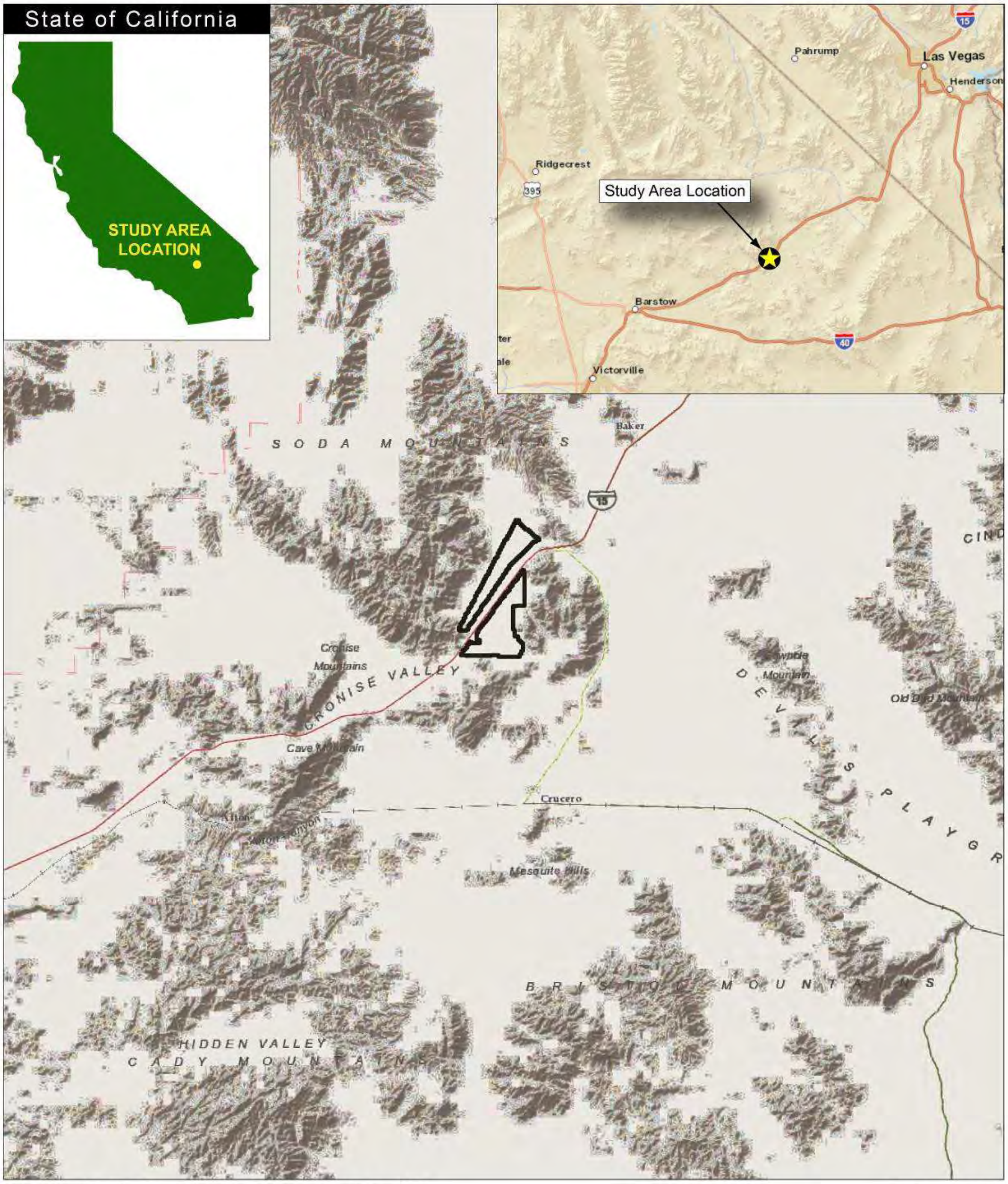
Recent studies of habitat suitability and linkage corridors in the Mojave Desert have used habitat modeling to predict suitability of species habitat and connectivity over multi-state, state, and regional geographic areas. The model results are being used to guide land use decisions related to development and conservation. This case study presents an analysis of the effectiveness of habitat models developed to predict habitat suitability at large geographic scales for use in estimating suitable habitat at a much smaller scale (4,000 hectares or less).

The primary method for determining habitat suitability and connectivity over large geographic areas is through the use of stochastic models. A stochastic modeling approach applies computer processing power to large data sets to estimate a probability distribution. This probability distribution is used to determine habitat suitability for areas within the model. Models of habitat for the desert tortoise (*Gopherus agassizii)*, bighorn sheep (*Ovis canadensis nelsoni*), and wildlife connectivity are reviewed in this case study. Field studies are reviewed to analyze model accuracy for a 2,800-hectare (7,000 acre) area.

1.1 STUDY AREA

The focus area for this study is an approximately 2,800-hectare (7,000-acre) area located along the Interstate 15 (I-15) corridor between the north and south Soda Mountains, referred to here as the Soda Mountain Study Area, San Bernardino, California (Figure 1).The Soda Mountain Study Area lies south and west of the town of Baker, California within an intermontane desert valley composed of alluvial fan deposits and surrounded by the Soda Mountains. Most of the Soda Mountains are northwest of the Study Area and reach an elevation of approximately 1,100 meters. Lower mountains to the south and east of the Study Area form a discontinuous border reaching elevations of approximately 730 meters. Elevations in the Study Area range from approximately 470 meters in the north to 380 meters in the southeast. The Baker sink, a relic of one of the drainages feeding the Pleistocene Lake Manley in Death Valley, is located east of the Study Area and the south Soda Mountains. Average annual precipitation in the Study Area is approximately 4.1 inches (Prism Climate Group 2012).

Figure 1: Soda Mountain Study Area



SOURCE: ESRI 2012 and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Study Area

0 5 10 Miles

N

PANORAMA ENVIRONMENTAL, INC.

2 BACKGROUND

2.1 HABITAT

2.1.1 Desert Tortoise

Mojave desert tortoises are known to occur from below sea level to an elevation of 2,225 meters (U.S. Fish and Wildlife Service [USFWS] 2011). Desert tortoises occur most commonly on gently sloping terrain (bajadas) consisting of sand- and gravel-rich soils where there is sparse cover of low-growing shrubs. Soils normally must be friable enough for digging burrows, yet firm enough so that burrows do not collapse (USFWS 2011). Tortoises generally cannot construct burrows in rocky soils or shallow bedrock (USFWS 2011). Typical habitat for the desert tortoise in the Mojave Desert has been characterized as creosote bush scrub between 600 meters and 1,800 meters, where precipitation ranges from 2 to 8 inches, and vegetation diversity and production is high (Nussear et al. 2009). Desert tortoises are known to occupy large home ranges.

Threats to desert tortoise populations identified in the Desert Tortoise Recovery Plan (USFWS 1994) are numerous and include:

6. Human contact and mortality, including vehicle collisions and collection of tortoises
7. Predation, primarily from raven, but also from feral dogs, coyotes, mountain lions - and kit fox -
8. Disease
9. Habitat destruction, degradation, and fragmentation resulting from grazing, land - development, off-highway vehicles (OHVs), wildfire, and road construction -

2.1.2 Bighorn Sheep

Bighorn sheep populations are found in steep, rocky, mountainous areas, commonly on slopes of 10 percent or greater (URS 2009a). Sixty-nine discrete population groups have been documented within the Mojave Desert (Bare et al. 2009). Steep, rugged terrain is the primary habitat used by bighorn sheep, particularly females and lambs, because it affords good protection from predators. Alluvial fans and washes on gently sloping terrains are also used to obtain forage and water. The availability of water is an important habitat element for bighorn sheep, particularly between May and October, when reproduction occurs (California Energy Commission [CEC] 2012).

2.1.3 Habitat Connectivity

The pace of development in the western deserts has increased with the institution of renewable portfolio standards in California, Nevada, and Arizona and federal goals for renewable energy development (CDFG et al. 2010). Wildlife corridors are increasingly impacted by land development and linear transportation features, such as highways, which can bisect and abate migration routes resulting in segregation and isolation of wildlife populations. Engineered features, such as under-highway culverts, can provide the means to cross roads safely and allow populations to connect across highways. Habitat connectivity studies are needed to identify and preserve key habitat corridors that support movement of wildlife populations and gene flow. Maintaining key corridors for wildlife dispersal is also important under changing climate conditions where wildlife populations may need to move to new habitat areas as optimal habitat is sought.

2.2 MODELS OF HABITAT SUITABILITY AND CONNECTIVITY

Several recent studies of habitat suitability and wildlife connectivity involving the California deserts have been performed to support protection of rare or threatened species, identify key areas of the desert that include the highest value habitat, and identify areas that are used by species for movement and migration. The studies analyzed in this paper are:

1. *Modeling Habitat of the Desert Tortoise (Gopherus agassizii) in the Mojave and Colorado Deserts, California, Nevada, Utah, and Arizona* (Nussear et al. 2009)
2. "Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise" (Hagerty et al. 2010)
3. *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* (Spencer et al. 2010)
4. *A Linkage Network for the California Deserts* (Penrod et al. 2012)
5. *Draft Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report* (CEC 2012)

The regional, state, and multi-state geographic scale of these studies required the use of stochastic models with large data sets to determine the potential for suitable habitat and wildlife connectivity. The purpose, methods, limitations, and results of each study are summarized.

2.2.1 Model Methods and Limitations

1. *Modeling Habitat of the Desert Tortoise (Gopherus agassizii) in the Mojave and Colorado Deserts, California, Nevada, Utah, and Arizona* (Nussear et al. 2009)

Purpose

The US Geological Survey (USGS) modeled desert tortoise habitat to evaluate the effectiveness of management efforts for the desert tortoise outlined in the 1994 USFWS Recovery Plan (Nussear et al. 2009). The USGS model was intended for use in conservation program design and to evaluate changes in species distributions. The USGS model was developed to support preparation of the Revised Recovery Plan published by USFWS in 2011.

Approach and Methods

Desert tortoise habitat suitability was modeled using the Maximum Entropy Model (Maxent) (Phillips et al. 2006). The area modeled included the desert region of California, Nevada, Utah and Arizona. Maxent allows for modeling of species distribution using presence-only data. The Maxent model is appropriate for species where there is limited absence data, or where absence is difficult to verify due to the habits of the species. The model uses presence data to define an expected probability of suitable habitat on the basis of past observances of presence of the species.

Habitat suitability was modeled using 16 data layers in a geographic information system (GIS). The model used continuous independent variables. The GIS data were obtained from various data sources and included:

1. Mean dry season precipitation for 30-year normal period
2. Dry season precipitation, spatially distributed coefficient of variation (CV)
3. Mean wet season precipitation for 30-year normal period
4. Wet season precipitation, spatially distributed coefficient of variation (CV)
5. Elevation
10. Slope
11. Northness (aspect)
12. Eastness (aspect)
13. Average surface roughness
14. Percent smooth
15. Percent rough
16. Average soil bulk density
17. Depth to bedrock
18. Average percentage of rocks >254 millimeters B-axis diameter
19. Perennial plant cover
20. Annual plant cover

A total of 15,311 presence data points representing desert tortoise presence or occurrence were aggregated from desert tortoise surveys performed from 1970 through 2008. Presence was determined from evidence of live tortoises, carcasses, burrows, scat, or other sign. Absence data were randomly selected from model grid cells where there were no desert tortoise observances during desert tortoise surveys.

The model was developed at a resolution of 1 square kilometer (km^2) (i.e., grid size). The model was tested using area under the curve (AUC)[1] to estimate model sensitivity and specificity. Due

[1] Area under the curve (AUC) is used to test model performance by plotting sensitivity (true positive rate) on the y-axis, and specificity (false positive rate) on the x-axis (Nussear et al. 2009). The AUC characterizes the performance of the model, and is summarized by a single number ranging from 0 to 1, where 1 indicates perfect model performance, 0.5 indicates the equivalent of a random guess, and less than 0.5 indicates performance worse than random (Nussear et al. 2009). In general, AUC scores between 0.7 and 0.8 are considered fair to good, and scores above 0.9 are considered excellent (Swets 1988).

to the lack of absence data, AUC tested the model performance against pseudo-absence data rather than true absence data (Phillips et al. 2006). Pearson's correlation coefficient was calculated as the correlation between the predicted model values and 1) test presence data points where tortoises were observed, and 2) the random background points where no tortoises were observed. Pearson's correlation coefficient was used as a more direct measure of how the model predictions vary from observations. Several variables were not predictive of suitable habitat including eastness, northness, wet season precipitation CV, dry season precipitation CV, percent roughness, and slope. These variables were eliminated from the final model.

The model output of habitat potential was binned into categories ranging from 0 to 1 at increments of 0.1, where 0 represents areas where the habitat potential approaches 0 percent habitable, and 1 represents areas where the habitat potential approaches 100 percent habitable. The categories were mapped for each 1-km^2 grid cell to represent percent potential habitat.

Limitations

Limitations of the method used to predict habitat suitability include:

1. Presence-only-based modeling is commonly subject to sampling bias and spatial - autocorrelation (Phillips et al. 2006). -
2. Errors may be present in the data used for the model. No data were collected for - this study, so it is dependent on the accuracy of the various data sources (Nussear - et al. 2009). -
3. There may be variables that are important to tortoise habitat suitability that were - not accounted for in the model (e.g., soil type, vegetation diversity) (Phillips et al. 2006). -
4. The model output was not corrected to remove areas where desert tortoises have - historically not been found to inhabit, areas that are not inhabited due to biotic - interactions, or areas of anthropogenic effects such as habitat destruction, - fragmentation, or natural disturbances (Nussear et al. 2009; Phillips et al. 2006). -
5. The approach predicts suitability statistically rather than mechanistically as in - Kearney and Porter (2009). Species presence and absence in sampling data are - assumed to reveal habitat suitability, but may actually reflect stochastic population - dispersion (Tracy 2012).

2. "Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise" (Hagerty et al. 2010)

Purpose

Hagerty et al. (2010) evaluated the impacts of habitat fragmentation on desert tortoise genetic diversity. Genetic testing was used to identify landscape features that could facilitate or impede tortoise movement. This study identifies barriers and limitations to tortoise movement to provide a better understanding of how landscape features can impact desert tortoise genetic diversity. Maintaining genetic diversity is particularly important for rare species whose continued existence can be threatened by disease. An improved understanding of landscape genetics is needed to identify methods to maintain or tortoise genetic diversity and support species recovery efforts.

Approach and Methods

Habitat connectivity for desert tortoise was modeled and used in combination with genetic data to determine the factors that influence tortoise gene flow. DNA was extracted from blood collected from 744 desert tortoises in 25 different geographic areas within California, Nevada, Utah and Arizona deserts. Genetic distance measures or the genetic divergence within the desert tortoise population were calculated for the 25 sampling locations. Euclidian distances (geographic distances) were also calculated as a straight-line measure between the center points of the 25 areas using GIS tools.

A habitat suitability model was developed using Maxent. The model was similar to the model developed by Nussear et al. (2009) and used the same tortoise presence data and 12 of the 16 data layers in its construction. Three separate models were constructed using the outputs of a habitat suitability model:

1. Least-cost path
2. Isolation by resistance
3. Isolation by barriers

Two models of landscape friction, least-cost path and isolation by resistance, were developed using a resistance surface[2] where cells of lower potential habitat would reduce the ability for desert tortoise to traverse the landscape. The least-cost path was identified between the center point of each of the 25 geographic areas, where the shortest distance with least cost for movement (determined by the resistance surface) was defined. In the isolation by resistance model, a resistance distance was estimated similar to least-cost pathway, except the resistance distance decreases proportionally with the increase in available pathways between locations. The resistance distance also assumes a random walk between locations where the habitat suitability in each adjacent cell is used to determine friction resisting movement. The third model, an isolation by barriers model, was created by identifying barriers to movement across the landscape. Areas with a predicted probability of potential habitat less than 0.125 were coded as “no data” and defined as complete barriers to movement. Within the isolation by barriers model, tortoise were allowed to move across all non-barrier cells without friction.

[2] A resistance surface is developed in GIS using a habitat suitability model. The probability of suitable habitat is subtracted from 1 for each cell in the model. The resulting values are the resistance surface representing the “cost” of movement from one habitat cell in the model to an adjacent cell.

Limitations

Due to the long generational time (25 years) of desert tortoise, the results of the study based upon genetic information cannot reflect current habitat connectivity or barriers. It normally would take several tortoise generations before the effects of roads or other human made barriers would be reflected in population genetics (Hagerty et al. 2010).

Landscape friction was not significantly correlated with genetic diversity. The variables used in the landscape friction model describe desert tortoise habitat in the present and may not capture the appropriate temporal scale to explain the genetic population structure. The resistance surfaces developed from the habitat suitability model may only reflect habitat use and not the resistance to dispersal (Hagerty et al. 2010).

3. *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* (Spencer et al. 2010)

Purpose

The *California Essential Habitat Connectivity Project* was prepared for the California Department of Transportation (Caltrans) and California Department of Fish and Game (CDFG). The purpose of the study was to increase efficiency and decrease costs of transportation and land use planning, and to reduce wildlife-vehicle collisions. The report was prepared to define a functional and connected network of wildlands. High quality habitat areas and the connections between these areas were defined to maintain wildlife diversity, which is threatened by human development and climate change.

Approach and Methods

The California Essential Habitat Connectivity Project identified habitat connectivity corridors throughout California. The process for defining wildlife connectivity corridors involved:

1. Delineating Natural Landscape Blocks (areas with high habitat value)
2. Identifying which Natural Landscape Blocks to connect
3. Defining Essential Connectivity Areas

Natural Landscape Blocks were delineated based on a rating of the naturalness of the landscape, called an ecological condition index. Within the Mojave Desert, landscape blocks were limited to those areas larger than 4,000 hectares (10,000 acres) with an ecological condition index greater than 95 and with high biological value. High biological value was defined as areas with GAP Conservation Status 1 or 2 and areas with 1) critical habitat for threatened or endangered species, 2) wetlands or vernal pools, 3) CDFG mapped hotspots using a rarity-weighted richness index, or 4) BLM Areas of Critical Environmental Concern. Lines were drawn between the center point of a landscape block and the center point of the closest and second closest landscape blocks.

Least-cost corridor models were used to define essential connectivity areas between Natural Landscape Blocks along each of the lines. The least-cost corridor model used a resistance surface based on the ecological condition index (0 percent to 100 percent) representing the resistance of the landscape to ecological flow. Using the resistance layer, the cost to move from one landscape block to another was calculated by subtracting the resistance value from 1. The cost of movement from one landscape block to the adjacent block was summed along the entire distance. The area with the 5 percent lowest cost of movement from one landscape block to the next was designated as an Essential Connectivity Area.

Limitations

1. Natural Landscape Blocks excluded Department of Defense lands and multiple-use - lands administered by BLM because they did not meet the criteria of being highly - conserved and being mapped as having high biological value. Department of - Defense lands include areas of high ecological value (Spencer et al. 2010).
2. Spencer et al. modeled connectivity areas on the basis of naturalness of habitat. Species-specific modeling was not used to identify connectivity corridors. The lack - of species-specific modeling produces a result that is of limited use to - understanding how wildlife would use these corridors as different species have - different habitat requirements that affect their movement across the landscape (Tracy 2012). To overcome this limitation, , "Essential Connectivity Areas are - placeholder polygons that can inform land-planning efforts, but that should - eventually be replaced by more detailed Linkage Designs, developed at finer - resolution based on the needs of particular species and ecological - processes."(Spencer et al. 2010) Results of finer-scale regional analyses for - connectivity should replace the Essential Connectivity Map for those areas in the - statewide report. -

4. *A Linkage Network for the California Deserts* (Penrod et al. 2012)

Purpose

The California Desert Connectivity Project was designed to identify areas of ecological connectivity that are essential for conserving biological diversity within the Mojave and Sonoran Deserts in California. Key areas of connectivity are identified to maintain genetic diversity. The key areas of connectivity collectively form a linkage design within the California Deserts. The linkage designs were developed to inform land management, land acquisition, restoration, and stewardship decisions in ecological connectivity zones.

Approach and Methods

Habitat connectivity was evaluated for 44 species that were identified as important to the Mojave and Sonoran Desert habitat. Landscape blocks were defined in this study as those areas that are highly protected, including wildlife management areas and Department of Defense lands. The landscape blocks were connected through 22 separate corridors where connectivity analysis was conducted.

Habitat suitability was modeled for the focal species using expert-assigned scores from 0 to 10 for habitat suitability for each factor (see list below). Weights were assigned for the factor to express relative influence of each factor, such that the weights for all factors summed to 100 percent. Each 30-square-meter (m^2) grid cell was scored across the modeled area. Data used in the expert-based models included scores for:

- Land cover
- Elevation
- Aspect (i.e., facing direction)
- Slope
- Distance to streams
- Road density

Corridor modeling was performed to evaluate habitat connectivity for both desert tortoise and bighorn sheep. A corridor was then defined using a least-cost corridor model and selecting those areas with the 5 percent least cost of movement[3].

Additional wildlife corridors were also defined using least-cost corridor modeling. Land facets[4] were used to define pathways for wildlife to move from high elevation to low elevation under changing climatic conditions. Field surveys were conducted to:

1. Ground-truth data (i.e., field data were collected to verify model data)
2. Document habitat barriers (e.g., roads, railroads, and canals)
3. Document potential crossing structures along those barriers
4. Identify locations where restoration and management would enhance connectivity

The land facet corridors and species-specific corridors were combined and used as a preliminary linkage design. The preliminary linkage design was refined through field investigation and removal of redundant connections between landscape blocks. The resulting linkage design incorporated the analyses of fieldwork, species-based modeling, and land facet corridors.

Limitations

1. The expert-based models used habitat scores and weights selected by experts. This - approach is subject to expert bias and differences in expert opinions (Rochet and - Rice 2004; Greenland and O'Rourke 2001). -
2. An expert-assigned score of 0 for any criterion would reduce the habitat score to 0 - regardless of the relative weight of that criterion (Penrod et al. 2012). -

[3] Least-cost corridor modeling involves calculating the "cost" of movement from one cell in a model to the next cell using a resistance surface. The cost of movement is aggregated over the distance between the start and end point.

[4] Land facets are enduring landscape features or units with uniform topographic and soil attributes that are "areas of biological activity" (Penrod et al. 2012).

5. *Draft DRECP Baseline Biology Report* (CEC 2012)

Purpose

The Desert Renewable Energy Conservation Plan (DRECP) is being developed to protect and conserve California's deserts while allowing for renewable energy development in areas that have a low level of environmental conflict. The DRECP Baseline Biology Report provides a summary of environmental and biological conditions within the DRECP Plan Area[5] (Figure 2). The biological baseline data will serve as the basis for conservation planning under the DRECP.

Approach and Methods

Desert Tortoise. The *Draft Desert Renewable Energy Conservation Plan Baseline Biology Report* (CEC 2012) identifies suitable desert tortoise habitat through a GIS model that is built on the results of the model developed by Nussear et al. (2009). The DRECP Plan Area covers areas within southern California deserts. The output of the desert tortoise habitat model developed by Nussear et al. (2009), was used as a base layer in GIS. Potential suitable habitat was first defined in this model as those areas with a predicted probability of desert tortoise habitat suitability of 0.6 or greater. Suitable habitat was then limited to all areas with a probability of suitable habitat between 0.6 and 1.0 that could be reached from any 1.0-rated area, with no intervening unconnected habitat areas.

The model was adjusted for anthropogenic disturbance using the National Landcover Dataset impervious surfaces layer and The Nature Conservancy's (TNC) "highly converted areas" data (TNC 2009; TNC 2010). Areas with high anthropogenic disturbance were converted to zero habitat potential. Additionally, military bases and OHV areas were manually removed from the suitable habitat model layer because they would not be considered for development or reserve areas.

Bighorn Sheep. Suitable habitat for bighorn sheep was modeled at a 1-km^2 resolution using the Maxent model (Phillips et al. 2006). Twenty-four occurrence data points obtained over the DRECP Plan Area were used to calibrate the model and eight occurrence points were used to test the model. Suitable habitat was defined as areas with a modeled probability of 0.236[6] or higher. The threshold for suitable habitat was determined using Jenks Natural Breaks[7] to classify the model output. AUC was used to determine model predictive capability.

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[5] The DRECP Plan Area covers the Mojave and Colorado Desert Ecoregions within California.

[6] The threshold for suitable habitat is much lower for bighorn sheep than for desert tortoise. This could be attributed to the small number of data points used to construct the model for bighorn sheep.

[7] The Jenks method maximizes between class variability and minimizes within class variability to find the strongest natural breakpoint in the histogram of cell probability values. This approach is used to separate

Habitat Connectivity. Habitat connectivity in the DRECP baseline biology study was defined using the GIS outputs of previous habitat connectivity mapping projects, which included:

- *A Linkage Network for the California Deserts* (Penrod et al. 2012)
- *The California Essential Connectivity Project* (Spencer et al. 2010)
- *The South-Coast Missing Linkages Project* (Beier et al. 2006; South Coast Wildlands - 2008) -
- *A Linkage Design for the Joshua Tree-Twentynine Palms Connectivity* (Penrod et al. 2008) -

Limitations

Desert Tortoise. Because the methods used in this study relied on the results of a previous desert tortoise habitat suitability model (Nussear et al. 2009), several limitations of that study would apply:

1. Presence-only-based modeling is commonly subject to sampling bias and spatial autocorrelation (Phillips et al. 2006).
2. Errors may be present in the data used for the model. No data were collected for this study, so it is dependent on the accuracy of other studies (Nussear et al. 2009).
3. There may be variables that are important to tortoise habitat suitability that were not accounted for in the model (e.g., soil type, vegetation diversity, desert pavement) (Phillips et al. 2006).
4. An Off-Highway Vehicle (OHV) area located directly south and east of the Soda Mountain Study Area was included as suitable habitat, which conflicts with the methods described for this study (i.e., OHV areas are not to be included in the model).

Bighorn Sheep. The following aspects are limitations of the model for bighorn sheep:

1. The model may be subject to sample bias and spatial autocorrelation (Phillips et al. 2006).
2. Model accuracy depends on the accuracy of the data used to construct the model - (Phillips et al. 2006).
3. The home range of Desert bighorn sheep can be very large, and observations of - presence is generally temporally fleeting, and may not adequately represent habitat - that can, or will be used by sheep (Tracy 2012). -
4. The model was not corrected for human disturbance or other factors that may - preclude species presence (Phillips et al. 2006). -

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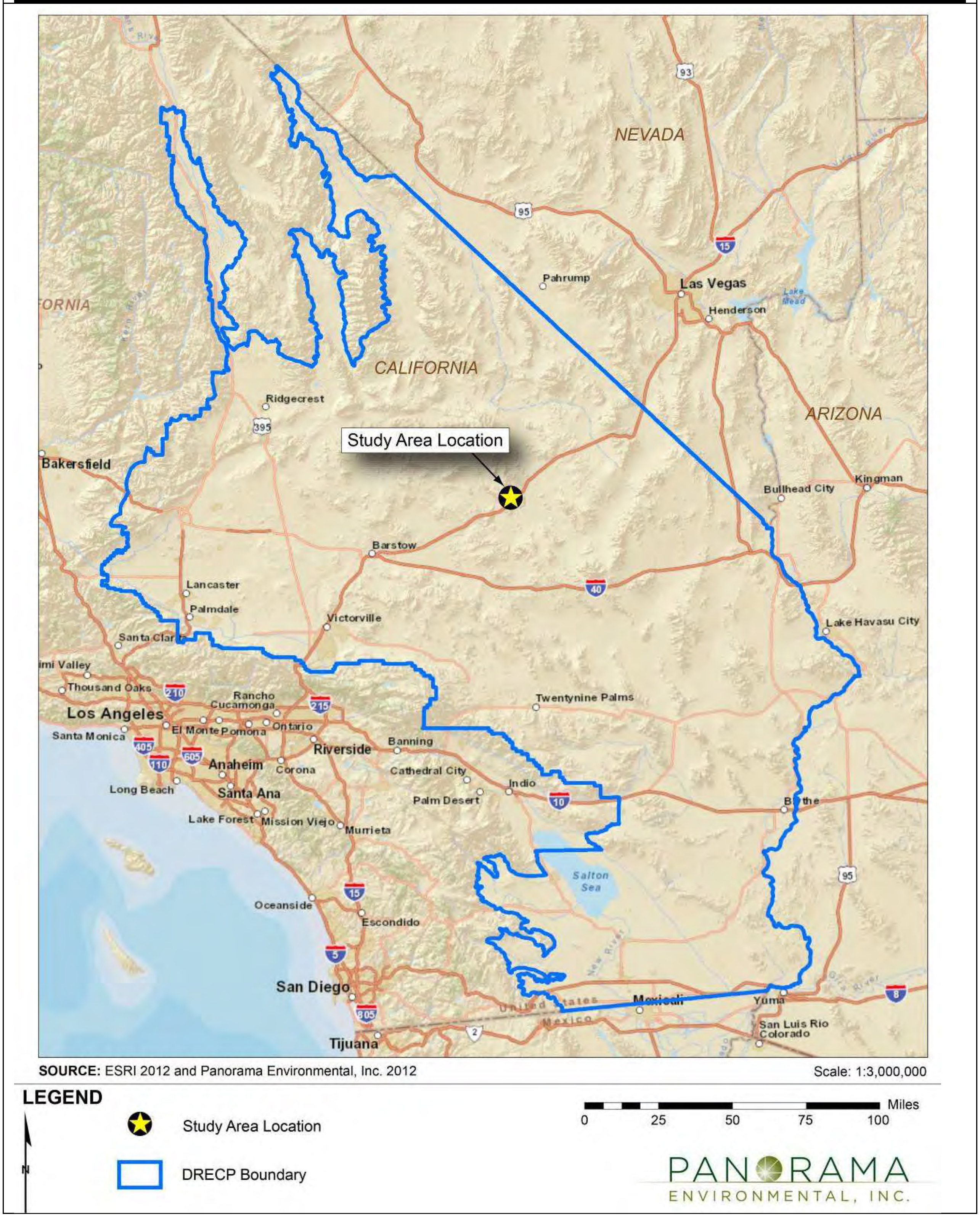
areas of higher probability of occurrence (habitat) from areas of lower probability of occurrence (non-habitat) (CEC 2012).

Figure 2: DRECP Plan Area



Connectivity. The *DRECP Baseline Biology Report* used the base maps from *A Linkage Network for the California Deserts* (Penrod et. al 2012) and *The California Essential Connectivity Project* (Spencer et al. 2010); therefore, the limitations of those efforts, presented previously, apply to the *DRECP Baseline Biology Report* as well. This study did not critically evaluate or prioritize the mapping efforts where there was overlap. The base map for the *California Essential Connectivity Project* includes essential connectivity areas in the Mojave Desert (Figure 3.8, Spencer et al. 2010). Where the linkage map from *A Linkage Network for the California Deserts* (Penrod et al. 2012) overlaps with the base map for the *California Essential Connectivity Project* (Spencer et al. 2010), the finer scale linkage map developed by Penrod et al. (2012) should replace the connectivity base mapping layer developed by Spencer et al. (2010).In the *DRECP Baseline Biology Report*, there was no replacement of mapped connectivity areas with the finer-scale species-specific regional linkage maps where the finer-scale maps overlapped with the generalized connectivity map. The *DRECP Baseline Biology Report* violates and is inconsistent with the method proposed by Spencer et al. 2010, which included replacement of the general connectivity maps with the finer-scale regional maps developed using species specific analysis.

2.2.2 Modelled Results for Soda Mountain Study Area

The general results for habitat suitability and wildlife connectivity modeling are presented in Table 1. Specific results within the Soda Mountain Study Area are also provided in Table 1.

2.3 SODA MOUNTAIN STUDY AREA FIELD STUDIES

Field studies were conducted to evaluate habitat for desert tortoise and bighorn sheep within the Soda Mountain Study Area. These studies include:

- Surveys for desert tortoise
- Aerial and ground surveys for bighorn sheep
- Field surveys of vegetation and wildlife
- Water resources studies
- Geology studies

Table 1: Modelled Results for the Study Area

Study	Results/Output	Results for Soda Mountain Study Area
Desert Tortoise		
1 Nussear et al. 2009	The model output was used to produce a map of predicted habitat suitability for the Mojave, Colorado, and Sonoran Deserts. The model result was significant and the AUC test score was	Areas within the Soda Mountain Study Area have a predicted habitat potential between 0.6 and 0.8, indicating the presence of adequate, predicted suitable habitat for desert tortoise, and thus, a

Table 1: Modelled Results for the Study Area		
Study	**Results/Output**	**Results for Soda Mountain Study Area**
	0.93, indicating a good fit between model data and observations. The mean model score for cells where tortoise were observed was 0.84. Ninety-five percent of cells with documented tortoise presence had a model score of 0.70 or higher.	high likelihood of tortoise presence (Figure 3).
5 CEC 2012	The output of this study is a GIS layer depicting suitable habitat for desert tortoise.	The entire Soda Mountain Study Area is identified as suitable habitat for desert tortoise (Figure 4).
Bighorn Sheep		
5 CEC 2012	A map depicting suitable habitat was constructed using the model output. The model had an AUC value of 0.962 for the calibration data and 0.889 for the test data, demonstrating good predictive capability.	The Maxent model identified suitable habitat for bighorn sheep within the southern portion of the Soda Mountain Study Area. Suitable habitat was also identified within the Soda Mountains north and south of the Study Area (Figure 5).
Habitat Connectivity		
2 Hagerty et al. 2010	Geographic distance and dispersal barriers using the isolation by barriers model were identified as dominant factors and were significantly correlated with genetic structure. Landscape friction was not significantly correlated with gene flow. To construct the model and test hypotheses, GIS models of tortoise barriers, resistance, and least-cost corridors were developed. This study supports the conclusion that habitat within the Mojave population of the desert tortoise is well connected.	Barriers to tortoise movement were identified to the south, east and north of the Soda Mountain Study Area. These barriers included the Baker sink to the south and east, and the mountains to the north. No specific barriers to dispersal were identified within the Study Area (Figure 6).
3 Spencer et al. 2010	An Essential Connectivity Map was developed for California. The map includes 850 Natural Landscape Blocks. Areas that connected two or more	The Soda Mountain Study Area is located within an Essential Connectivity Area (Figure 7).

Table 1: Modelled Results for the Study Area		
Study	**Results/Output**	**Results for Soda Mountain Study Area**
	Natural Landscape Blocks were identified as Essential Connectivity Areas. These maps should be replaced with the results of finer scale regional studies (Spencer et al. 2010).	
4 Penrod et al. 2012	This study resulted in maps showing linkage corridors for 44 focal species and for wildlife connectivity in a union of linkages. Linkages were defined for desert tortoise and bighorn sheep.	The Soda Mountain Study Area does not fall within a least-cost corridor delineated for desert tortoise (Figure 8) or bighorn sheep (Figure 9), or a least-cost union.
5 (CEC 2012)	The result of the DRECP effort is a map of habitat connectivity generated using layers from each of the connectivity projects (including Study 3 and 4).	The Soda Mountain Study Area is identified within the Essential Connectivity Area mapped by the California Essential Connectivity Project (Study 3). It is not identified as a connectivity area within any of the other habitat connectivity mapping efforts.

Figure 3: Desert Tortoise Habitat Suitability (Nussear et al. 2009)

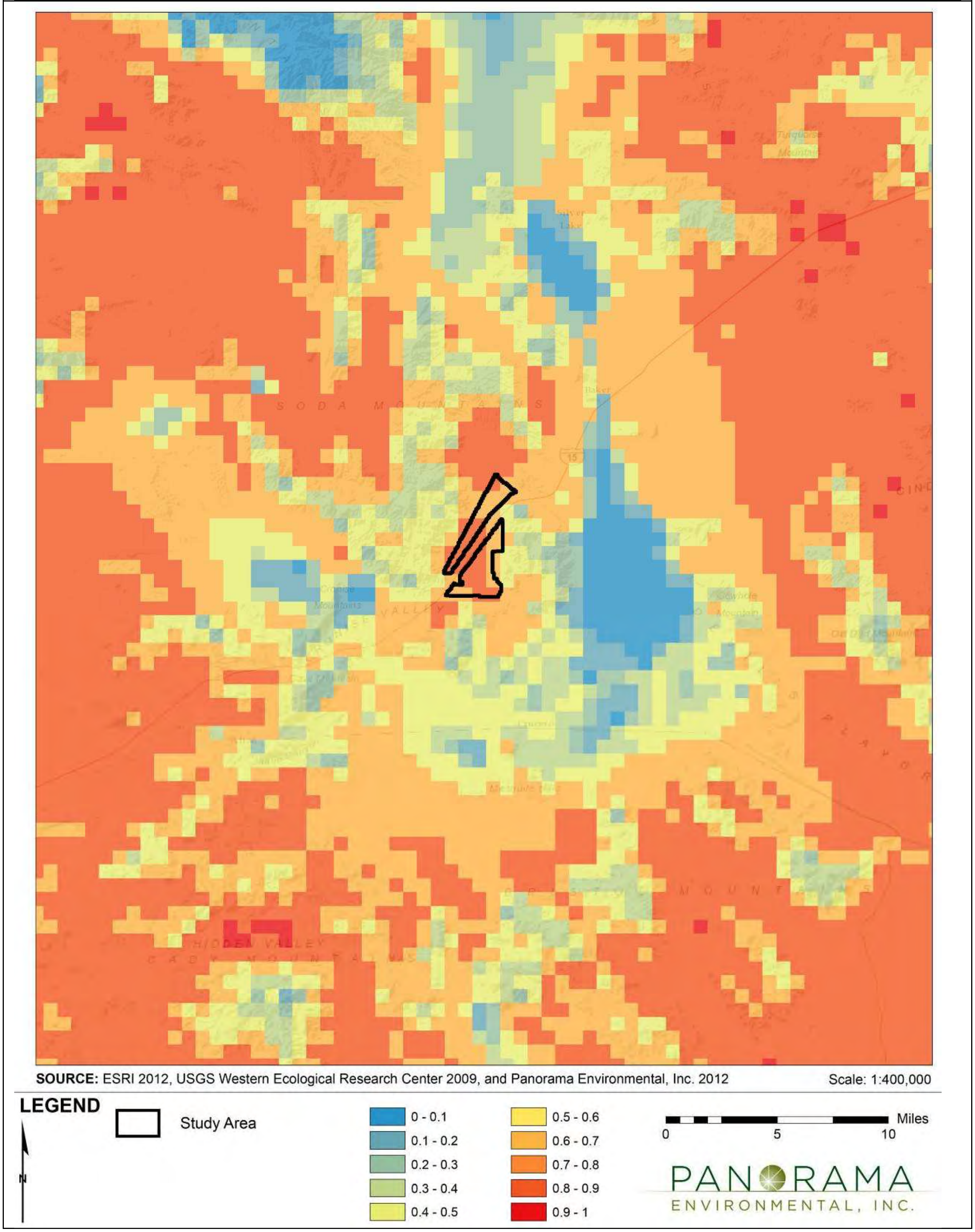


Figure 4: Desert Tortoise Suitable Habitat (CEC 2012)

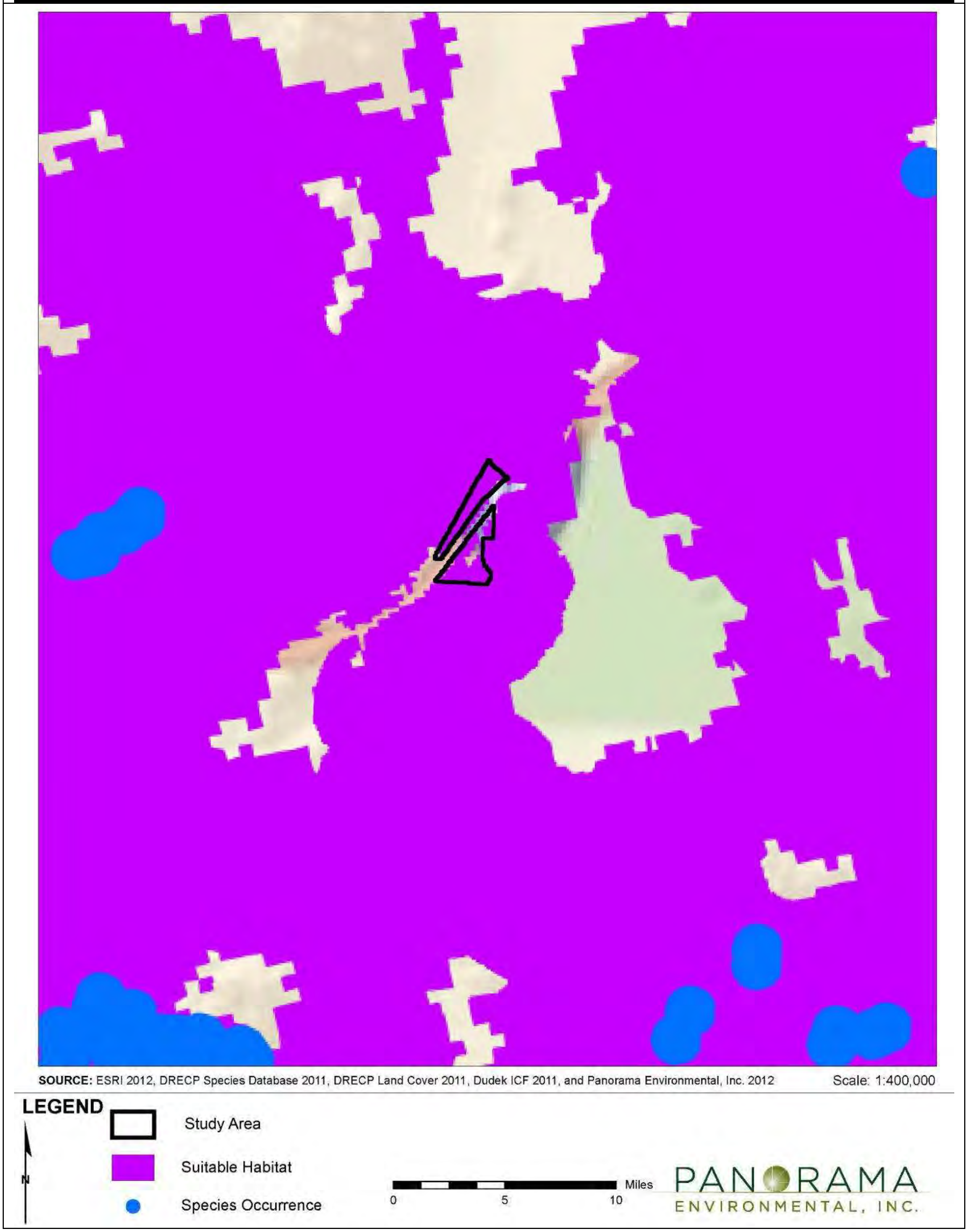


Figure 5: Bighorn Sheep Suitable Habitat (CEC 2012)

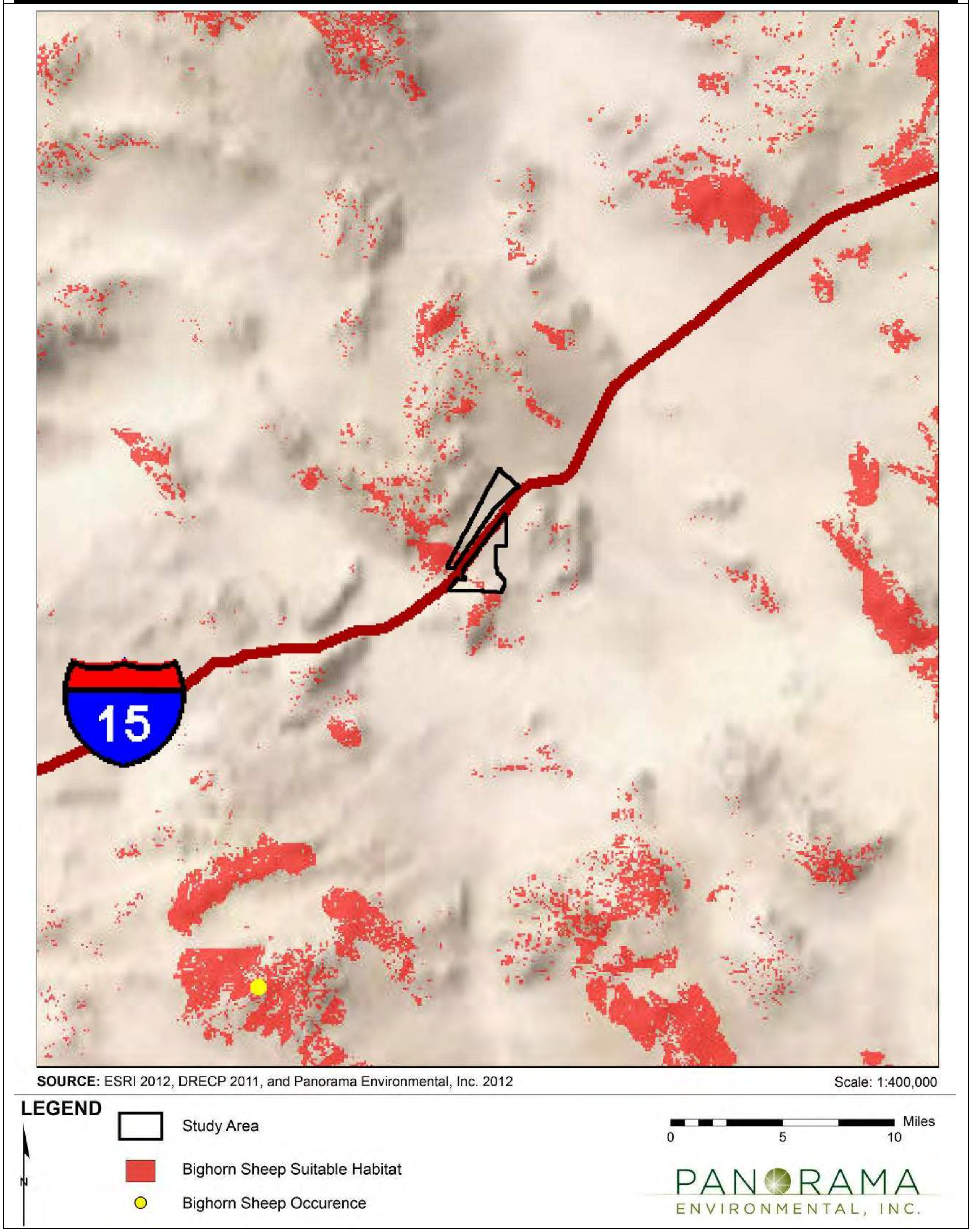
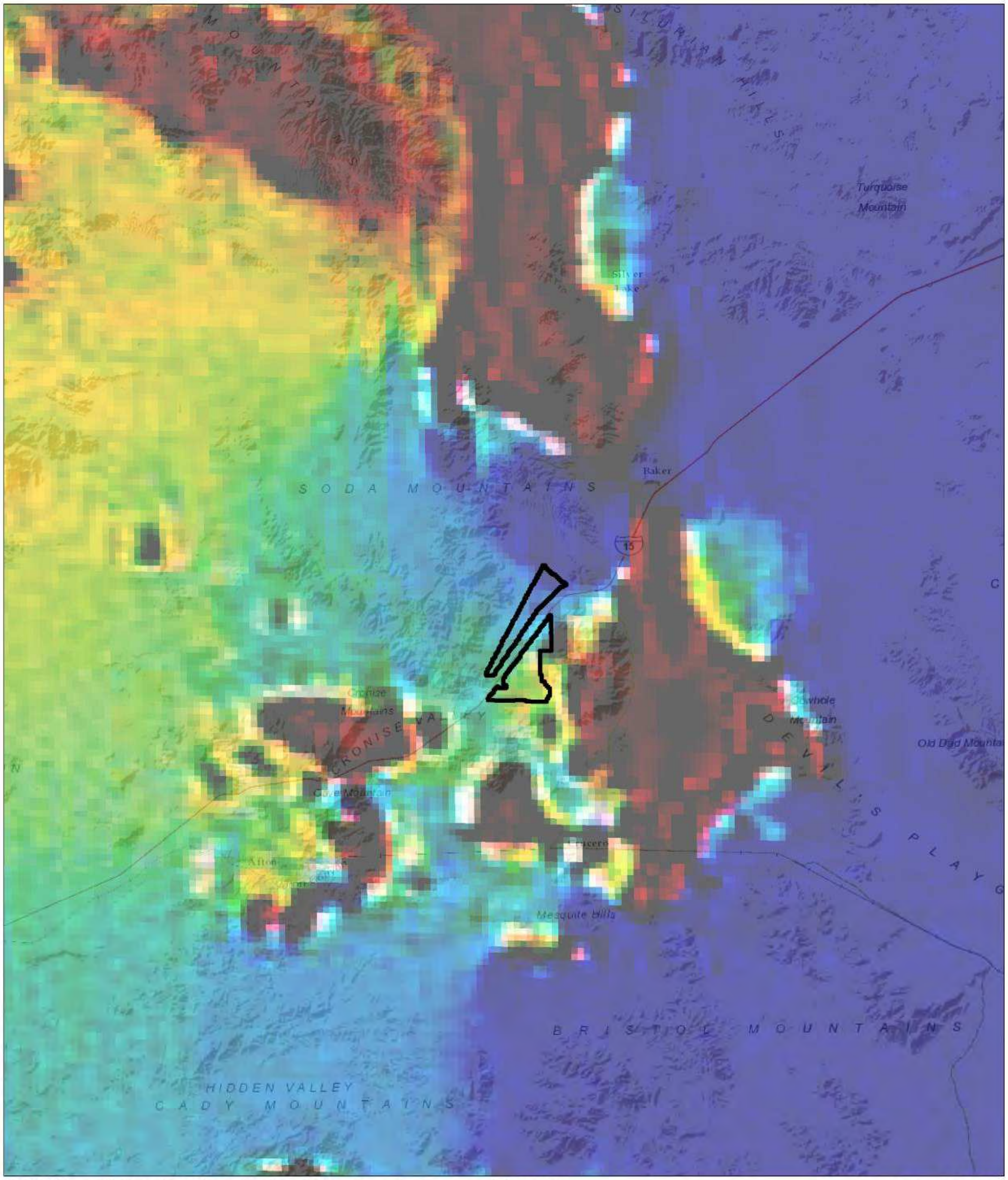


Figure 6: Barriers to Desert Tortoise Movement (Hagerty et al. 2010)



SOURCE: ESRI 2012, Hagerty et al 2010, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Study Area

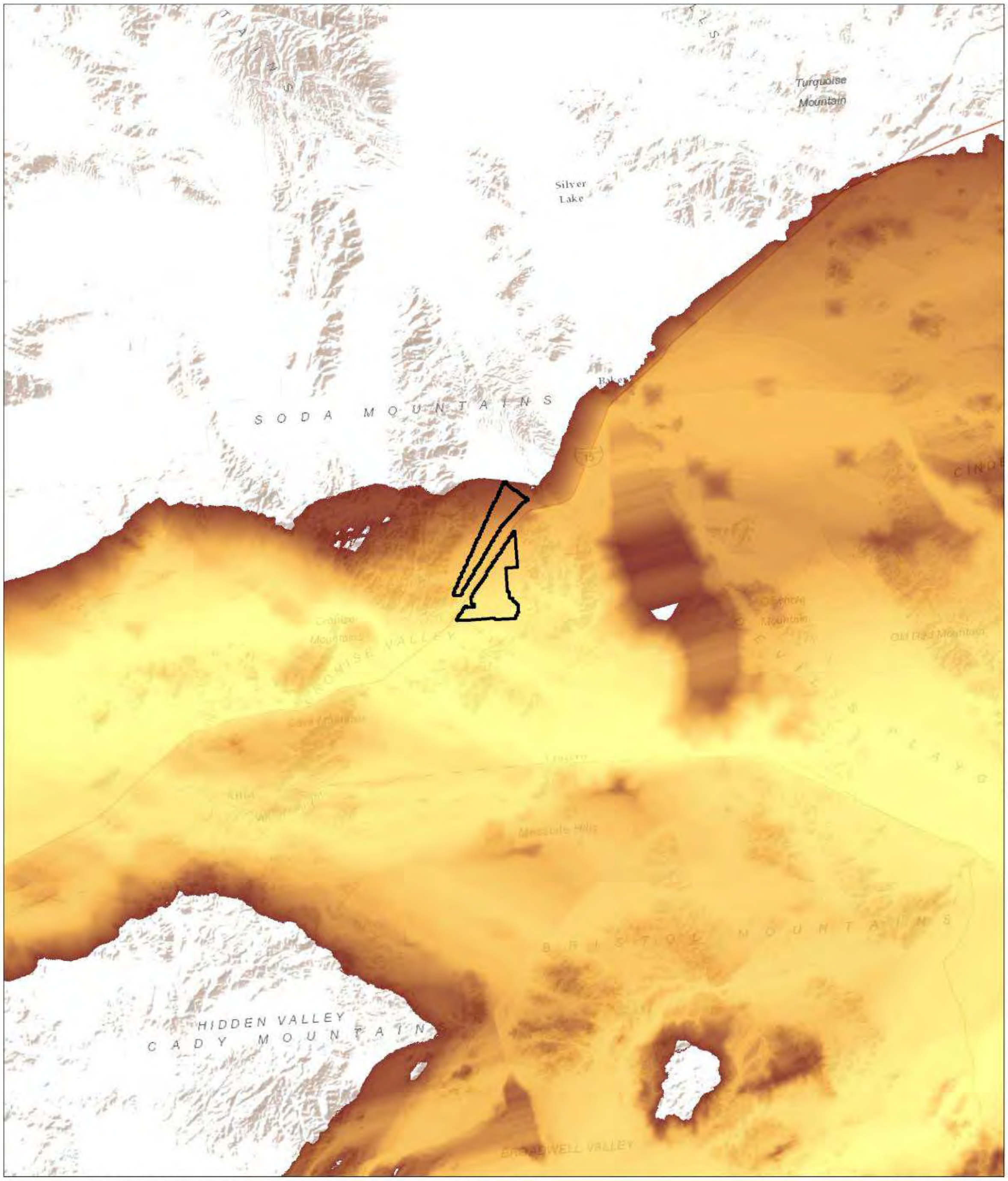
Barrier

0 5 10 Miles

N

PANORAMA ENVIRONMENTAL, INC.

Figure 7: Essential Connectivity Areas (Spencer et al. 2010)



SOURCE: ESRI 2012, CalTrans 2010, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Study Area

Essential Connectivity Area

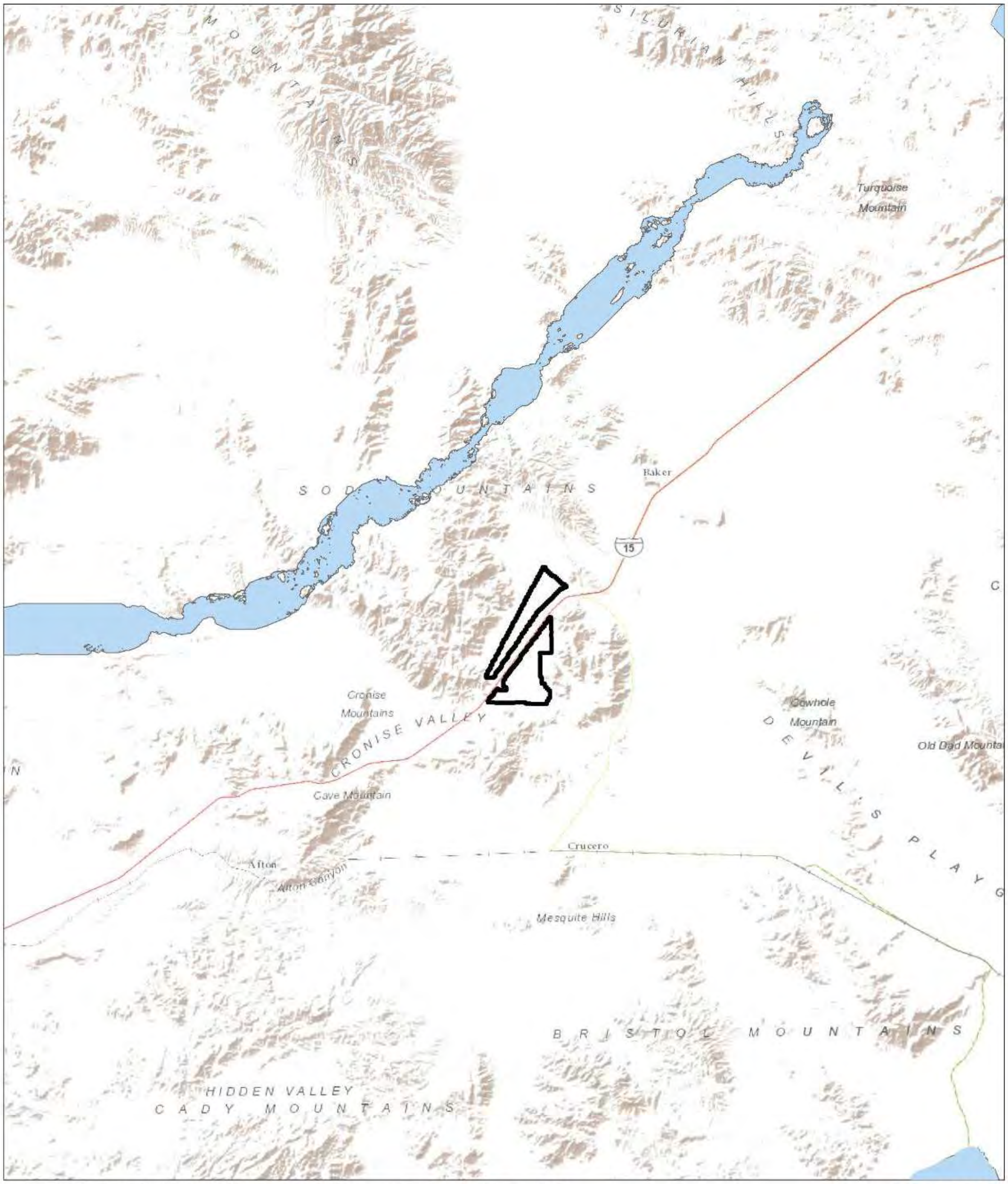
More Cost — Less Cost

N

0 5 10 Miles

PANORAMA ENVIRONMENTAL, INC.

Figure 8: Desert Tortoise Linkages



SOURCE: ESRI 2012, Nussear et al 2009, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Study Area

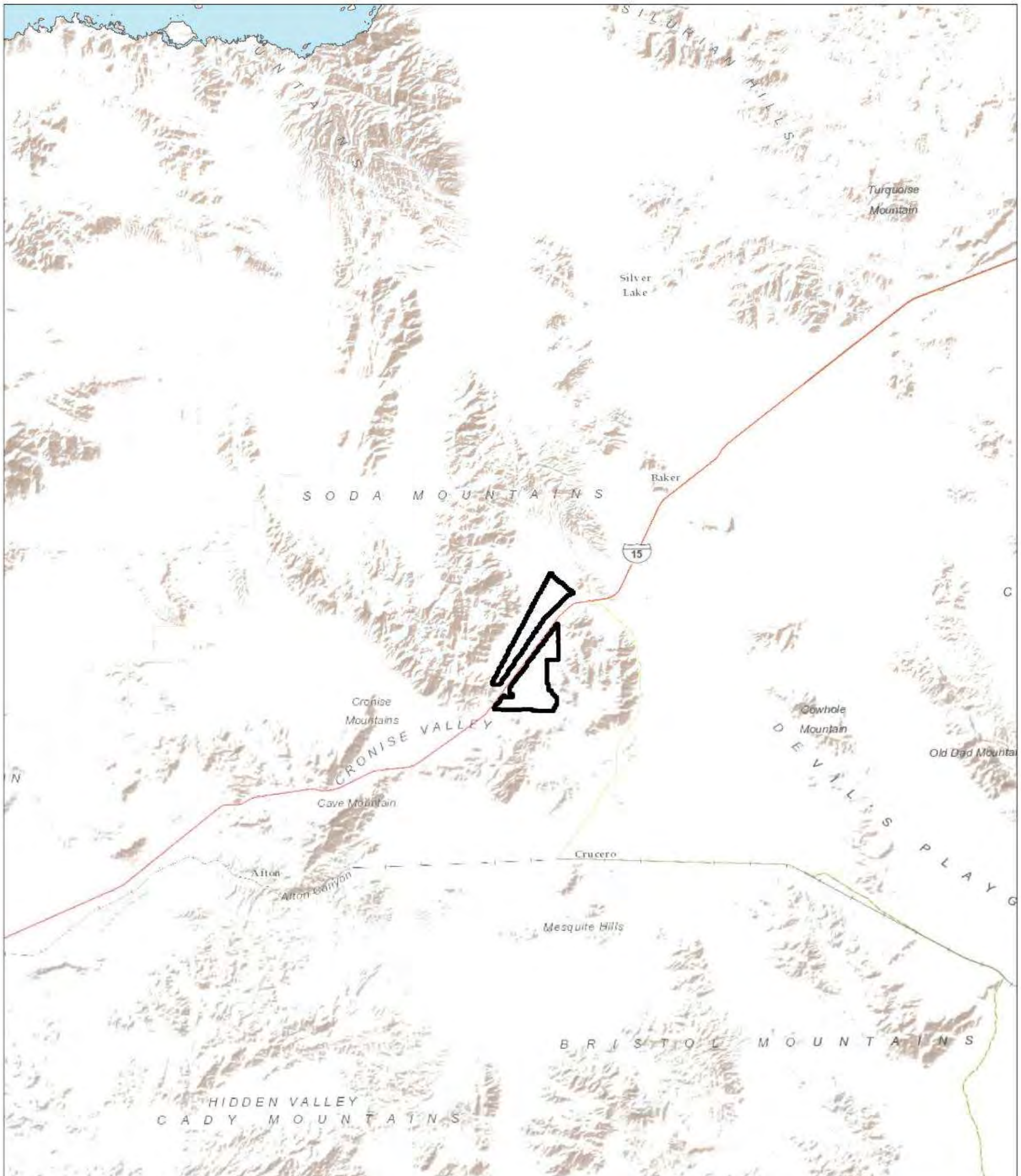
Desert Tortoise Linkage

0 5 10 Miles

N

PANORAMA ENVIRONMENTAL, INC.

Figure 9: Bighorn Sheep Linkages



SOURCE: ESRI 2012, Mojave Desert Ecosystem Program 2012, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Study Area

Bighorn Sheep Linkage

0 5 10 Miles

N

PANORAMA ENVIRONMENTAL, INC.

2.3.1 Methods

Desert Tortoise

Field surveys for desert tortoise were performed in 2001 and 2009 within the Soda Mountain Study Area and vicinity. The 2001 survey was performed in the Opah Ditch Mine area located in the foothills of the Soda Mountains north of I-15 and west of Los Angeles Department of Water and Power (LADWP) and Southern California Edison (SCE) transmission lines (Figure 10). The survey was performed on March 30 and April 4, 2001, in accordance with USFWS-recommended *Field Survey Protocol for Any Non Federal Action That May Occur Within the Range of the Desert Tortoise* (1992). Belt transects spaced approximately 10 meters (30 feet) apart were walked over approximately 80 percent of the site and the dirt-haul road that provides site access (AMEC 2001). A 30-meter-wide buffer zone survey was performed in accessible areas adjacent to the site. Desert tortoise sign were marked and mapped.

The 2009 survey was conducted for the Soda Mountain Study Area north and south of the I-15 corridor (Figure 10) between May 4 and May 29, 2009. Survey techniques followed both the 1992 USFWS protocol for desert tortoises (USFWS 1992), and the survey protocol described in *Preparing for Any Action that May Occur within the Range of the Mojave Desert Tortoise (Gopherus agassizii)* (USFWS 2009). The field survey consisted of 100 percent coverage belt transects spaced at 10 meters (33 feet) within the entire Study Area. In addition to 100 percent coverage of the study area, Zone of Influence (ZOI) transects[8] were also performed (URS 2009a). ZOI transect locations were located in areas containing potentially suitable tortoise habitat based on aerial image analysis, elevation, and field observations of potentially suitable habitat within the Study Area. ZOI transects were surveyed with transects spaced at 30, 90, 180, 370, and 730 meter intervals, where applicable (URS 2009a). Areas along the mountains where the topography was very steep were not included in the ZOI surveys.

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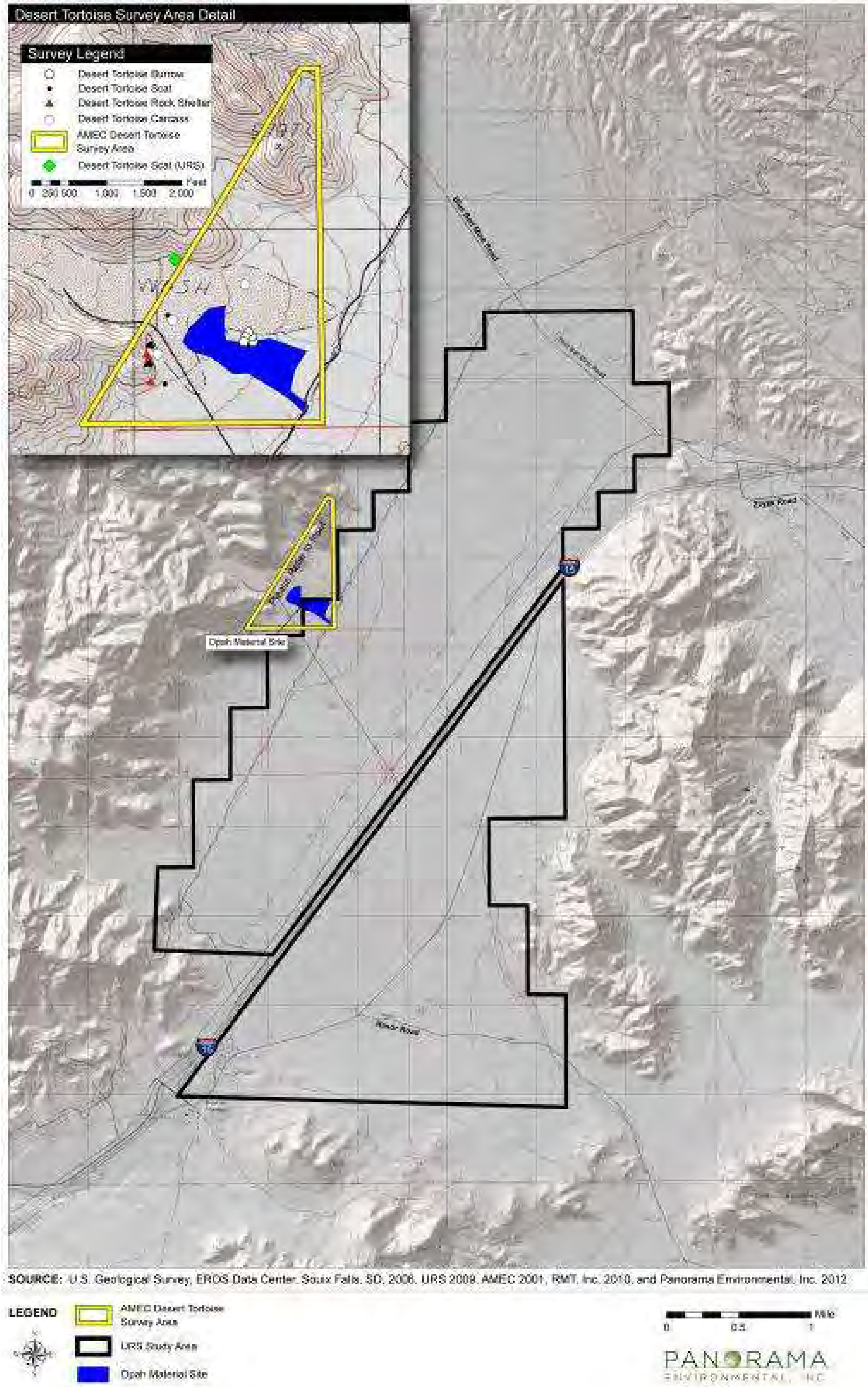
[8] The zone of influence is an area outside of the Study Area that may be affected by a land use action. Zone of influence transects were established outside of the Study Area running parallel to the Study Area boundary.

Figure 10: Desert Tortoise Survey Locations



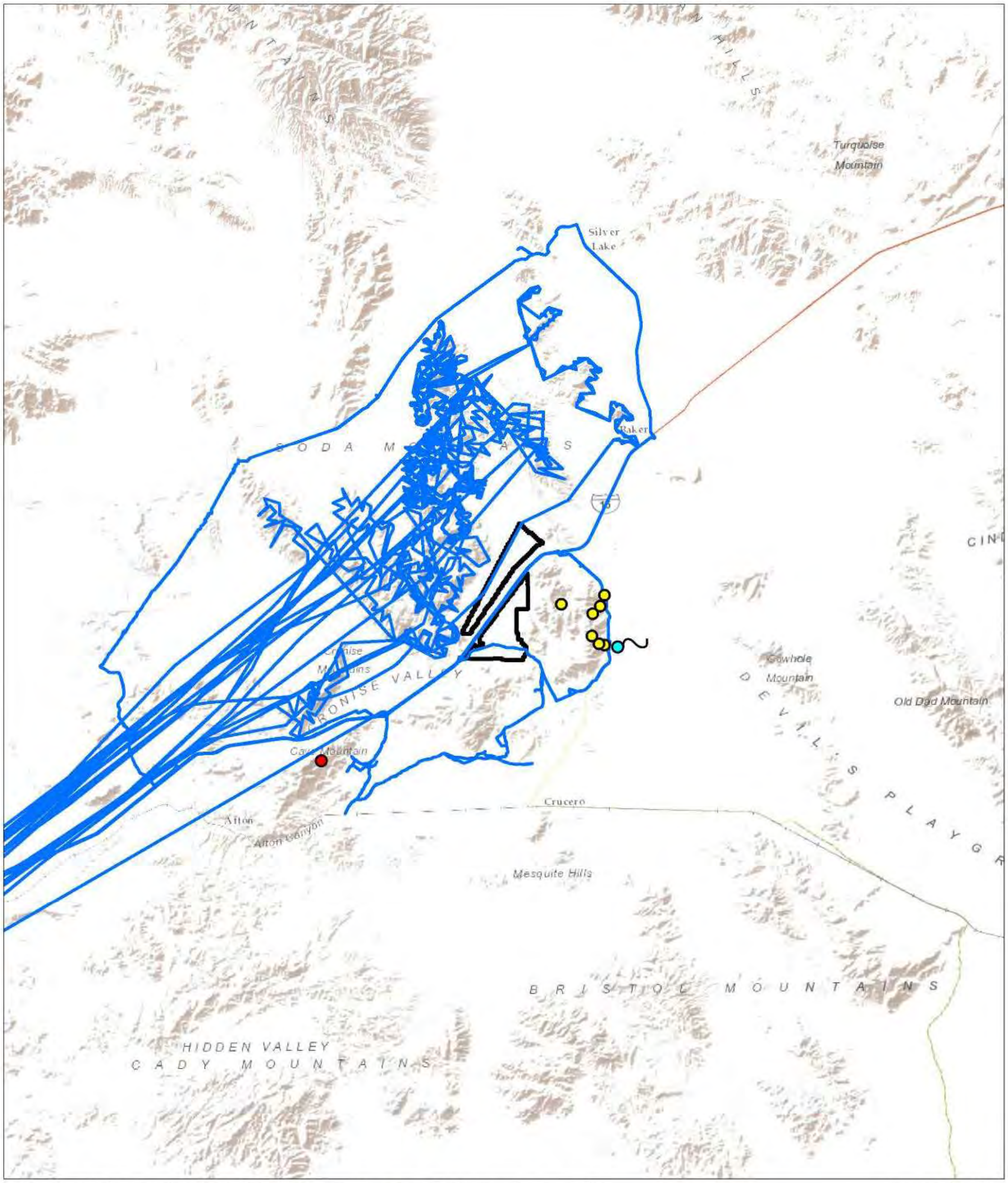
To validate the accuracy of the protocol surveys, biologists performed an additional intensive quality assurance/quality control (QA/QC) survey on 5 percent of the Study Area (USFWS 1992). This intensive survey effort was a 100 percent coverage using belt transects with spacing width reduced to 3 meters (10 feet) and was conducted in randomly chosen, representative habitats within the Study Area. QA/QC transects were conducted perpendicular to the initial transect survey direction to maximize tortoise detection. A comparison was then made between data recorded from transects during the 100 percent survey effort (10-meter belt transects) and data recorded during the intensive QA/QC survey effort (3-meter belt transects).

Bighorn Sheep
Surveys for bighorn sheep in the Soda Mountains were conducted in 2011 and 2012. Aerial surveys for bighorn sheep were conducted by BioResource Consultants on March 21 and 22, 2011 and May 9, 2011, and ground surveys between March 23 and 25, 2011 (RMT 2011c). The aerial surveys were six two-hour flights. Aerial surveys were conducted north of I-15 within the Soda Mountains. Each canyon was flown up and down. Contouring passes were made at different elevations to cover tall cliffs and long, steep slopes fully. Survey areas for bighorn sheep are identified on Figure 11. Ground surveys were conducted from observation points. During all aerial and ground-based survey work, biologists also scanned for any movement, sign, or habitat settings (e.g., water sources) that might accommodate or predict the presence of desert bighorn sheep. Potential water sources within the search area were identified in advance for surveying and evaluation. Data collected during the surveys included numbers of animals, age of animals and herd composition, general behavior, location, and habitat, where feasible (RMT 2011c).

CDFG conducted a ground survey on April 30 and May 1, 2012 in the south Soda Mountains near Zzyzx Spring. All sheep that could be located on the east side of the range in the vicinity of water were counted. Three groups of biologists explored areas not visible from the road area. One group climbed from the Zzyzx Field Station to the main ridge top above the road and followed the ridge north. Another group ascended a wash to the northwest of the main ridge and climbed into a separate section of the range. The third group searched further south of the field station along the main ridge. The location, number of sheep, class, and gender were logged at each sheep siting (Abella 2012).

Environmental Conditions
Field studies were conducted to document conditions for vegetation, wildlife, soils, water sources, and disturbance within the Soda Mountain Study Area. Biology field studies and a water resource investigation were conducted in 2009 and geology field studies were conducted in 2010 within the Soda Mountain Study Area.

Figure 11: Bighorn Sheep Survey Locations



SOURCE: ESRI 2012, BRC 2011, CDFG 2012, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Biology Studies
Field surveys of the Soda Mountain Study Area were performed in 2009 to assess general and dominant vegetation types, vegetation community sizes, habitat types, and wildlife and plant species present within communities (URS 2009b). Biologists documented wildlife observations for birds, mammals, amphibians, and reptiles within the Study Area during field surveys. The presence of a wildlife species was based on direct observation, wildlife sign (e.g., tracks, burrows, nests, and scat), or vocalization. Field data compiled for wildlife included the scientific name, common name, habitat, and evidence of sign when no direct observations were made. Field surveys conducted in 2009 include:

- Special status plants survey
- Desert tortoise survey (discussed above)
- Avian point count surveys
- Water resource investigation

Special Status Plants. Special status plant surveys were conducted between May 4 and May 30, 2009 in accordance with standardized guidelines issued by the USFWS, CDFG, and the California Native Plant Society (URS 2009c). Surveys were conducted in parallel belt transects spaced at approximately 10 meters throughout the entire Study Area.

Avian Point Count. Avian point count surveys were conducted in the spring and fall of 2009. Field survey methods were derived and adapted from *BLM Solar Facility Point Count Protocol* (2009) and *Managing and Monitoring Birds Using Point Counts* (Ralph et al. 1995). Point count locations were established within the Study Area using the following parameters:

- One (1) point count transect per square mile;
- Eight (8) point count locations per transect; and
- Point counts must be at least 250 meters apart

The point count locations were then further modified in the field based on placing the points in the most suitable areas for birds (e.g., washes, and high vegetation areas) (URS 2010). A total of 10 transects with 8 point count locations per transect (80 points total) were identified within the Study Area (URS 2010).

Spring surveys were conducted between April 23 and May 14, 2009, and fall surveys were conducted between September 30 and October 29, 2009 (URS 2010). Each point was surveyed for a 10-minute observation period and data were recorded on avian species observed within a 100-meter radius. Presence of avian species was determined using direct observation, vocalization, or avian sign (e.g., nests, pellets, whitewash, etc.) (URS 2010).

Water Resources Investigation. A water resources investigation was performed in May and June 2009. Water resources were delineated using U.S. Army Corps of Engineers and CDFG guidance for delineation of waters of the U.S. and waters of the State (URS 2009d). The ordinary high water mark was used to define the limits of waters within the Study Area.

Geologic Studies
Geologic field studies were conducted in September 2010 throughout the Study Area (Wilson Geosciences 2011). Fifteen geotechnical boreholes were located throughout the Study Area along dirt roads. Boreholes extended from approximately 4 meters to 30 meters (14 feet to 100 feet) feet in depth. Geologic studies defined material types and engineering properties within the construction zone (upper 6+ meters) at all 15 borehole locations; at 12 of these locations data were obtained to depths of 18 to 24 meters using geophysical methods. In addition, electrical resistivity (transient electromagnetic sounding—TEM) surveys at three locations defined general material types, saturated sediments, and estimated depth to buried bedrock.

2.3.2 Results

Desert Tortoise Surveys
The 2001 survey for desert tortoise located west of the Study Area found:

- Five desert tortoise burrows (Class 2-4)
- Nine tortoise scat (Class 2-4)
- Three highly fragmented tortoise carcasses (Class 5)
- Three desert tortoise rock shelters (Class 2)

No live tortoises were observed during the survey. All of the desert tortoise burrows observed were located within the scar of an old borrow (mining) pit, where rocks had been removed and soils were suitable for burrowing.

The 2009 survey for desert tortoise did not find live tortoise, burrows, or sign of tortoise within the Soda Mountain Study Area. One desert tortoise scat was found beyond the western edge of the Study Area during the ZOI surveys along a 370-meter (1,200 foot) interval transect. The scat was identified in the same general location as tortoise sign were previously identified (i.e., during the 2001 Opah Ditch Mine survey performed by AMEC), suggesting that conditions at the Opah Ditch site provide suitable habitat for tortoises. All of the previously identified burrows were located within the borrow pit scar, indicating that the site provides better habitat for tortoises than surrounding areas perhaps because rocks have been removed and the soil is more permeable than the surrounding areas.

Bighorn Sheep Survey
No desert bighorn sheep were observed during the March or May 2011 surveys in the Soda Mountains north and south of I-15. No springs, seeps, or pools of standing water were observed in the mountains above the desert floor. The only water resources observed in this area were the playa lake beds (east of the Soda Mountains and the project area), which still held some water during the March survey. In the plot area south of I-15, two desert bighorn sheep were observed during the March survey fleeing down a ravine approximately 13 kilometers southwest of the Study Area in the Cave Mountains (RMT 2011c). No other individuals or groups of sheep were

seen during the remainder of the March survey, nor during the second survey performed in May 2011 (RMT 2011c).

A total of 47 sheep in seven groups were identified within the south Soda Mountains during the CDFG 2012 survey (Figure 11). The sheep viewed during the survey (Abella 2012) included:

- 26 adult females
- 3 yearling females
- 5 lambs
- 7 yearling males
- 6 older males (three class II, two class III, and one class IV)

The upper elevations above where these sheep were seen had very little sign of recent use by bighorn (Abella 2012). It appears that the eastern portion of the south Soda Mountains, where most of the sheep were seen is occupied primarily by females and associated younger sheep this time of year. Given that few adult males were seen, this population can be projected to fall into the 51-100 size category with the additional males not seen (Abella 2012). Conditions within the south Soda Mountains are highly suitable for bighorn sheep because of the presence of a year-round water source at Zzyzx Spring.

Environmental Conditions

Biologic Resources

Vegetation and wildlife communities within the Study Area were identified during several area surveys, including the desert tortoise survey, avian point count surveys, special status plant surveys, and water resource investigation. The Study Area is sparsely vegetated and includes three vegetation communities/land types identified in Table 2 below. Community/land types are based on dominant vegetation composition and density observed during field surveys of the Study Area (URS 2009a).

Table 2: Vegetation Communities

Vegetation Community	Vegetation Species	Description	Hectares in Study Area
Mojave Creosote Bush Scrub	creosote bush (*Larrea tridentate*) burrobush (*Ambrosia dumosa*) desert senna (*Senna armata*) Mormon tea (*Ephedra sp.*) cheesebush (*Hymenoclea salsola*) big galleta (*Pleuraphis rigida*) chollas (*Cylindropuntia sp.*) beaver tail (*Opuntia basilaris*)	Shrubs are typically widely spaced, with an open canopy and bare ground between individual plants. An annual herb layer is usually present between shrubs and may flower in late March and April with sufficient winter rains. This community is usually found on well-drained secondary soils with very low available water-holding capacity on slopes,	2651 (6,552 acres)

Table 2: Vegetation Communities			
Vegetation Community	**Vegetation Species**	**Description**	**Hectares in Study Area**
		alluvial fans, bajadas, and valleys.	
Mojave Wash Scrub	smoke tree (*Psorothamis spinosus*) blue palo verde (*Cercidium floridum*) cheesebush (*Hymenoclea salsola*) sweetbush (*Bebbia juncea*)	Mojave Wash Scrub is a low, open desert shrub community with a scattered overstory of microphyllous trees. This community is most often observed on sandy bottoms of wide canyons, and sandy, braided, shallow washes of lower bajadas.	21 (52 acres)
Disturbed	N/A	Those areas devoid of vegetation, including unpaved roads, abandoned mining areas, OHV trails, and utility lines (e.g., transmission lines, pipelines, and fiber optic lines). Disturbed areas also include nonnative and/or native communities that have been significantly degraded due to anthropogenic activity.	65 (160 acres)

Source: URS 2009a

Wildlife. The prevailing wildlife species observed within the Study Area include a variety of commonly occurring avian species and, less frequently, commonly occurring mammals, reptiles, amphibians, and invertebrates typical of the Mojave Desert. In general, the Study Area contains relatively low species diversity with the majority of observed wildlife consisting of a few dominant species (URS 2009). This diversity is typical for many parts of the Mojave Desert where vegetation communities are generally sparse and uniform.

Avian Surveys. A total of 629 birds (22 species) were recorded within the Study Area during the spring avian point count surveys. The most abundant bird species observed during the spring surveys were horned lark (*Eremophila alpestris*), black-throated sparrow (*Amphispiza bilineta*), and white-crowned sparrow (*Zonotrichia leucophrys*) (URS 2010). Horned lark accounted for more than 65 percent of total bird observations during the spring surveys. A total of 210 birds (23 species) were recorded within the study area during the fall point count surveys. The most abundant bird species observed were horned lark (*Eremophila alpestris*), Say's phoebe (*Sayornis saya*), and common raven (*Corvus corax*) (URS 2010). Avian abundance was higher during the spring surveys, but species diversity was similar for spring and fall surveys.

Water Sources
There are no perennial water sources within the Soda Mountain Study Area or surrounding valley, all water resources are characterized as ephemeral (URS 2009d). During rain events water draining from the Soda Mountains is conveyed through the site in a series of unnamed desert washes. Water is only available on the site during and shortly after rain events, due to the low levels of precipitation in the area (approximately 4 inches annually) and high temperatures. There is a perennial water source at Zzyzx Spring, on the east side of the Soda Mountains, approximately 8 kilometers southwest of the Study Area.

Surface drainage flows predominantly east and southeast from the Soda Mountains; drainage is interrupted at the I-15 highway where it is directed to several culverts under the freeway. To a lesser extent, drainage flows from the lower mountains on the south, east, and north. Active drainage washes exit the Study Area on the northeast from north of I-15 at Zzyzx Road draining toward Silver Lake and on the southeast at Rasor Road, draining toward Soda Lake (RMT 2011a; RMT 2011b).

Geology/Soils
Soils within the Soda Mountain Study Area are predominantly sand and silty sand. Survey locations were characterized by granitic and volcanic, subangular to subrounded clasts. Particle size ranged from silt and clay to boulders, with most material in the coarse sand to cobble size range (Wilson 2011). Abundant cobbles and boulders were identified throughout the Study Area during field surveys. Alluvial fans and channels with vertical slopes up to 3 meters were observed throughout the Study Area.

Disturbance
The Soda Mountain Study Area lies within a valley that includes a designated BLM utility corridor. Highway I-15 bisects the Soda Mountain Study Area northeast to southwest and is a four-lane, divided highway. Other utilities constructed through the valley include:

- Two transmission lines (and associated access roads),
- Power distribution line
- Two fuel pipelines
- Fiber optic line
- Cell tower

The Xpress West (formerly Desert Xpress) rail right-of-way (ROW) was recently approved by BLM in December 2011 and follows the northwest edge of the I-15 ROW in the Study Area.

The Opah Ditch Mine is located just west of the Study Area. Rasor Road at the south end of the Study Area is a main entrance to the Rasor Road Off-Highway Vehicle (OHV) Recreation area. The OHV area is adjacent to and south and east of the Study Area. Evidence of OHV activity can be seen throughout the Study Area.

3 METHODS

3.1 DESERT TORTOISE HABITAT

Habitat predictions for desert tortoise presented in *Modeling Habitat of the Desert Tortoise* (Nussear et al. 2009) and the *DRECP Baseline Biology Report* (CEC 2012) were compared to desert tortoise field survey results. To evaluate model results for the Study Area, a GIS layer depicting the model results and each of the 16 GIS data source layers were obtained from the USGS (2012). Data layers were overlain with the Study Area to determine the specific results and data being used to characterize the Study Area in the model. Data obtained during field studies were compared with the data used in the model. Study Area field data, including vegetation diversity and density, area physiography and level of human disturbance, were reviewed to identify environmental conditions that could affect or fragment desert tortoise habitat.

3.2 DESERT TORTOISE CONNECTIVITY

Models of desert tortoise connectivity presented in "Making Molehills out of Mountains" (Hagerty et al. 2010) and *A Linkage Network for California Deserts* (Penrod et al. 2012) were evaluated for the Study Area. Because connectivity requires a larger scale analysis, the model results both within the study area and for the surrounding areas were evaluated to determine their accuracy in assessing field conditions and barriers to tortoise movement. Model results were compared with the results of field surveys of desert tortoise and conditions within the Study Area that could be barriers to tortoise movement. This comparison was used to assess the accuracy of connectivity predictions within the Study Area.

3.3 BIGHORN SHEEP HABITAT

Habitat predictions for bighorn sheep presented in the *DRECP Baseline Biology Report* (CEC 2012) were compared with field survey results for bighorn sheep and field-documented conditions within the Study Area.

3.4 BIGHORN SHEEP CONNECTIVITY

The following bighorn sheep experts were contacted to discuss bighorn sheep behavior and potential use of the Soda Mountain Study Area:

- Mr. Andrew Pauli, CDFG, Inland Deserts and Eastern Sierra Region, Apple Valley, - California -
- Dr. Jack Tuner, Sam Houston State University, Huntsville, Texas
- Mr. George Kerr, Society for the Conservation of Bighorn Sheep, Pasadena, - California -
- Mr. Chris Otahal, BLM, Barstow, California

The experts were provided information pertaining to the Study Area, including a map showing the study area in relation to the surrounding mountains and human-made features (e.g., I-15), and a description of the Study Area location. The experts were asked to provide information on expected bighorn sheep presence, use of the area, movement, and migration.

3.5 GENERAL WILDLIFE CONNECTIVITY

The methods for assessing wildlife connectivity presented in *California Essential Connectivity Project* (Spencer et al. 2010) and in *A Linkage Network for the California Deserts* (Penrod et al. 2012), were reviewed. Spencer et al. (2010) recommend that the generalized Essential Connectivity Areas developed by the California Essential Connectivity project be replaced by the species specific linkage designs like those prepared by the California Desert Connectivity Project (Penrod et al. 2012):

> "*Essential Connectivity Areas are placeholder polygons that can inform land-planning efforts, but that should eventually be replaced by more detailed Linkage Designs, developed at finer resolution based on the needs of particular species and ecological processes. It is important to recognize that even areas outside of Natural Landscape Blocks and Essential Connectivity Areas support important ecological values that should not be "written off" as lacking conservation value. Furthermore, because the Essential Habitat Connectivity Map was created at the statewide scale, based on available statewide data layers, and ignored Natural Landscape Blocks smaller than 2,000 acres, it has errors of omission that should be addressed at regional and local scales*".

In other words, the method of defining wildlife connectivity in the absence of species specific analysis is inherently flawed because connectivity is dependent on individual species habitat characteristics and how each species moves across the landscape (Tracy 2012). An aspect of the landscape that is a barrier for a reptile would likely not be a barrier to birds or large mammals, for example. General wildlife connectivity is not analyzed further in this case study, and connectivity is analyzed by species. Therefore, further consideration of Essential Connectivity Areas (Spencer et al. 2010) is rejected in favor of the species specific linkages presented in *A Linkage Network for the California Deserts* (Penrod et. al 2012).

4 ANALYSIS

The model results were compared with the field study results for desert tortoise habitat, desert tortoise connectivity, bighorn sheep habitat, and bighorn sheep connectivity. Results are presented in Table 3. The results presented in Table 3 are summarized from the model and field study results presented in Section 2.2.2 and 2.3.2, respectively.

Table 3: Comparison of Model Results to Field Study Results		
Topic	**Model Results**	**Field Study Results**
Desert Tortoise		
Desert Tortoise Habitat	The Study Area has a predicted habitat suitability rating of 0.6 to 0.8 (Nussear et al. 2009) indicating moderately suitable habitat. The Study Area is defined as suitable habitat for desert tortoise (CEC 2012).	No live tortoise, burrows, or other sign were identified within the Study Area during desert tortoise surveys. The Study Area would not be expected to support large populations of desert tortoise because: 1) The Study Area elevation (380 meters to 470 meters amsl) is below the optimum range for desert tortoise. 2) The Study Area is sparsely vegetated. 3) Soils within the Study Area consist of sand and gravel. 4) Numerous rocks, boulders, and cobbles are present in the Study Area. 5) I-15 bisects and fragments potential habitat in the area 6) An OHV area is located south and east of the Study Area and there is evidence of OHV use throughout the Study Area.
Desert Tortoise Connectivity	The Baker Sink is a barrier to desert tortoise movement (Hagerty et al. 2010). Desert tortoise linkage corridors are not identified within the Study Area (Penrod et al.	No live tortoise, burrows, or other sign were identified within the Study Area during desert tortoise or other field surveys. Large numbers of tortoise would not be

Table 3: Comparison of Model Results to Field Study Results		
Topic	**Model Results**	**Field Study Results**
	2012).	expected to move through the area because: 1) I-15 bisects the Study Area and restricts tortoise movement through the area 2) The Study Area is surrounded by mountains 3) Baker sink due east of the study area would inhibit tortoise movement 4) There are steeply sloping channels within the study area
Bighorn Sheep		
Bighorn Sheep Habitat	Suitable habitat for bighorn sheep was predicted in the southern portion of the Study Area and within the Soda Mountains north and south of the Study Area (CEC 2012).	Bighorn sheep were not identified within the Study Area or the north Soda Mountains during field surveys. A population of bighorn sheep exists within the south Soda Mountains and sheep were viewed 13 kilometers south in the Cave Mountains. There are no water sources within the Study Area. The Study Area is flat (<5% slope). There is over 450 meters of flat terrain between the Study Area and the Soda Mountains.
Bighorn Sheep Connectivity	Bighorn sheep linkage corridors were not identified within the Study Area (Penrod et al. 2012)	I-15 bisects the Study Area and is considered an impediment to bighorn sheep movement through the area, although bighorn sheep may

Table 3: Comparison of Model Results to Field Study Results		
Topic	**Model Results**	**Field Study Results**
		use the culverts under the highway.

5 DISCUSSION

5.1 DESERT TORTOISE

5.1.1 Suitable Habitat

The model predictions of desert tortoise suitable habitat (Nussear et al. 2009; CEC 2012) indicate a high probability of desert tortoise presence within the Study Area. Desert tortoise field surveys covering 100 percent of the Study Area along 10-meter transects found no tortoise, burrows or sign within the Study Area. In addition, no desert tortoises were observed during avian point counts, special-status plant surveys, or water resource studies. The divergence between model predictions and field survey results could be attributed to: 1) the model scale, 2) human disturbance throughout the area, which is not accounted for in either model, and 3) there are limitations of stochastic models of habitat suitability.

The models of desert tortoise suitable habitat were constructed using 1-km^2 grid cells. The model construction requires averaging environmental data over a 1-km^2 area. For variables such as slope and rocks, the data used in the model do not accurately characterize field conditions or variability due to the scale of the model. The multi-state geographic scale of the model required the use of large data sets that could be inaccurate. The data used to generate the model identified the Study Area as containing 0% rocks. Site-specific field geology studies indicate that there are numerous rocks, boulders, cobbles, and gravel throughout the Study Area. Soil conditions would not be ideal for tortoise burrowing.

The method used by Nussear et al. (2009) to predict tortoise habitat did not involve removing areas of anthropogenic impact that would no longer be suitable habitat. The Maxent modeling method developed by Phillips et al. (2006) did provide for removal of highly disturbed areas from the model output to increase model accuracy. The adjustments to the suitable habitat model for the *DRECP Baseline Biology Report* removed highly disturbed areas from the model output (CEC 2012). However, within and adjacent to the Study Area, heavily disturbed areas are predicted as suitable habitat in the adjusted model. Both the I-15 corridor and the OHV recreation area south and east of the Study Area are identified as suitable habitat after adjustments were made to the model. The I-15 highway and OHV land uses have likely resulted in fragmentation and degradation of desert tortoise habitat in the area. While historically the area may have supported higher quality suitable habitat for desert tortoise, the quality of habitat is reduced by current land use and installation of the utilities in the corridor.

There are limitations of stochastic models of habitat suitability. The models do not account for physiological processes that are important to species habitat use. The Study Area lies within a small valley wedged between the north and south Soda Mountains. The presence of Highway I-15 through the center of the valley, and high desert tortoise mortality rates along highways render the area too small to support a population of desert tortoise (Tracy 2012). Studies of tortoise presence along highways reveal that tortoise densities increase further from the highway and high-volume highways can result in decreases in tortoise sign up to 4,000 meters from highways(Hoff and Marlow 2002). Because the Study Area is bounded by mountains, tortoises have very limited usable habitat area that is not near the highway. Analysis of population dynamics, which cannot be provided by modeling alone, is required to evaluate whether desert tortoise would use the area.

The predicted habitat suitability for the Soda Mountain Study Area does not match the documented absence of desert tortoise in the area and the low likelihood of desert tortoise presence due to the site conditions. The presence of surrounding mountains, abundant rocks and cobbles, sparse vegetation, low vegetation diversity, low elevation (below 470 meters), sand and gravel soils, and level of human disturbance indicate that the habitat is fragmented and not highly suitable for desert tortoise. If desert tortoise were to occur in the area, they would be expected in low numbers.

5.1.2 Habitat Connectivity

Habitat connectivity for desert tortoise was evaluated using genetic diversity data (Hagerty et al. 2010). That analysis indicated that genetic distance is closely tied to physiographic barriers to tortoise movement and geographic distance between populations. The Study Area is located adjacent to the Baker sink, which was identified as a physiographic barrier to tortoise movement. The Soda Mountain Study Area therefore is unlikely to lie within a major corridor for tortoise movement; however, some tortoises may move through the area as evidenced by the presence of tortoise burrows and sign west of and adjacent to the Study Area.

Habitat linkages for desert tortoise were modeled in A Linkage Network for California Deserts (Penrod et al. 2012). Desert tortoise linkage areas were not identified within the Soda Mountain Study Area. Linkages for desert tortoise were identified to the south connecting the southern end of Mojave National Preserve to Twentynine Palms and to the north connecting the Kingston Mesquite Mountains to the China Lake South Range approximately 10 miles north of the Study Area. This linkage design would be consistent with documented field conditions including the presence of the I-15 highway, incised channels, and mountainous surroundings that could restrict tortoise movement.

5.2 BIGHORN SHEEP

5.2.1 Suitable Habitat

Predicted suitable habitat for bighorn sheep was identified within the southern portion of the Study Area and the Soda Mountains north and south of the Study Area (CEC 2012). The 2012 survey identified seven groups of bighorn sheep within the south Soda Mountains east of the Study Area (Abella 2012). Areas that bighorn sheep are known to occur within the south Soda Mountains were not identified as suitable habitat by the model. Suitable habitat for bighorn sheep habitat was not identified within the Study Area during field studies (URS 2009a). While suitable habitat may exist within the north Soda Mountains, field surveys did not identify a population within that area. Bighorn sheep are unlikely to occupy the Study Area (Kerr 2010; Pauli 2010; Turner 2010). Sheep likely would have used the margins of the Study Area as a movement corridor between the mountains north and south of the Study Area prior to the I-15 highway. Sheep have, however, been sighted foraging near Zzyzx Road, adjacent to the mountains (Weasma 2012). They may be able to cross through the Study Area using the culverts under the I-15 highway.

The north side of the Study Area is potentially a "transition zone" for bighorn sheep (Kerr 2010). Bighorn would likely cross I-15 at the highway culvert north of the Study Area or the overpass at Zzyzx Road. The bighorn sheep would not stay in the area for long because it does not provide any water. The Study Area is not prime habitat and there is unlikely to be a large population in the area (Kerr 2010). Bighorn sheep rely on the flat lands for food and water, and do not remain in flat areas, except for potential food sources following heavy rains or as potential migration routes (Kerr 2010). Bighorn sheep prefer to stay in the mountainous area, their natural habitat, which provides them with views of the surrounding area and vantage points (Turner 2010). These views allow the bighorn sheep to identify any potential threats in the area.

5.2.2 Habitat Connectivity

The Study Area was not identified within a linkage corridor for bighorn sheep by Penrod et al. (2012). Although there are populations of bighorn sheep in the Soda Mountains to the south, it is unlikely that populations of bighorn sheep would cross through the Study Area due largely to presence of I-15. Individual sheep have previously been seen attempting to cross I-15 or killed along I-15 near the Study Area. Each of the bighorn sheep experts contacted stated that construction of I-15 created a migration barrier for the bighorn sheep. Major interstates are typical barriers to bighorn sheep migration (Turner 2010). Heavy traffic on I-15 discourages bighorn sheep from crossing from one side to the other. If the bighorn sheep were to cross I-15, it would most likely be in the area north of the Study Area where I-15 passes through the mountain range (Turner 2010).

6 CONCLUSION

This report presents an evaluation of five studies used to predict 1) desert tortoise habitat, 2) bighorn sheep habitat, and 3) linkages for desert tortoise and bighorn sheep connectivity. The results of these studies were compared with the results of field surveys performed within an approximately 2,800-hectare (7,000-acre) area located in a valley surrounded by the Soda Mountains.

The model of suitable habitat for desert tortoise (Nussear et al. 2009) identified the Study Area as containing moderately suitable habitat (0.6 to 0.8). Protocol surveys for the Study Area did not identify any sign of desert tortoise within the Study Area. This difference in results can occur for two major reasons: 1) errors in the model input, 2) historic changes in the presence of tortoise habitat (e.g., land use changes), or 3) limitations of the model. Errors in model input could be due to improper data used in the model (i.e., the data did not identify and account for the numerous boulders or cobbles in the Study Area) and the model resolution. Field-documented conditions including low vegetation diversity and density, presence of abundant gravel and cobbles, and the low elevation of the area (below 470 meters are not conducive to supporting a tortoise population; the area would be expected to have low numbers of desert tortoise, if any (Woodman 2012). These conditions were not correctly documented in the model input due to the scale of the model (1-km^2) and the use of data that were not field verified. Historic changes in the presence of tortoises suggest that the habitat may indeed be suitable but that tortoises are not present in the Study Area for other reasons such as population processes centered on excess mortality due to I-15. These processes are not considered in niche habitat modeling. However, population processes play a large role in species presence and can affect tortoise presence, as demonstrated by decreased tortoise sign thousands of meters from high-traffic highways. There are other limitations of stochastic habitat distribution modeling including sample bias (e.g., more samples near highways/roadways) and expected error within models. Models are representations of reality, and cannot account for all conditions that affect habitat and species use of habitat.

Similarly, the model for bighorn sheep predicted suitable habitat in flatland areas of the Study Area that do not possess characteristics of bighorn sheep suitable habitat, although the areas immediately adjacent to the mountains outside the Study Area may be used periodically for foraging. The model also underestimated suitable habitat areas within the south Soda Mountains where bighorn sheep are known to occur. The flatland areas within the southern portion of the Study Area are located adjacent to I-15 and in highly disturbed areas near a gas station. While bighorn sheep could use this area temporarily, they would not be expected to stay in the area for long. The difference in results between the models and the surveys can be attributed to the same factors that impact the accuracy of desert tortoise model results, as well as the use of a lower threshold (0.236) to classify bighorn sheep habitat and the limited number of data points (32) used in the model.

The model for connectivity used by Penrod et al. in *A Linkage Network for the California Deserts*, did not identify the Study Area as part of a linkage area for desert tortoise or bighorn sheep. This model is consistent with the results of field studies and knowledge of area physiography.

7 RECOMMENDATIONS

The Essential Connectivity Area map for the Mojave Desert provided in the *California Essential Connectivity Project* (2010), which identified the Study Area within an Essential Connectivity Area, should be replaced with the maps of habitat linkages in the *Linkage Network for the California Deserts* (2012).

Due to the large geographic area that was modeled in many of the studies reviewed, fine-scale field ground-truthing was not feasible. The *Linkage Network for the California Deserts* used a regional-scale analysis and did use field ground-truthing. Ground-truthing of the data sources used to construct the model could increase the accuracy of the models applied. It would also allow for spot verification of modeled results to increase model reliability.

Field studies are usually conducted at a much finer scale than species habitat models and provide information that are not easily gained through modeling alone. Where available, field information should be used to supplement the information provided in species habitat models to provide a greater understanding of area resources and habitat use. Land use managers should collect field data from private parties so that these data can be used for future land use planning and management. Information provided in models should also be supplemented by more detailed analysis when land use changes are being considered.

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APPENDIX E-2
Draft Integrated Weed Management Plan

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Integrated Weed Management Plan

Soda Mountain Solar
San Bernardino County, CA
BLM Case Number CACA 49584

August 2013

Integrated Weed Management Plan

Soda Mountain Solar
San Bernardino County, CA
BLM Case Number CACA 49584

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	degree Fahrenheit
BLM	U.S. Bureau of Land Management
BMP	best management practice
Cal-IPC	California Invasive Plant Council
CDCA	California Desert Conservation Area
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Pesticide Regulation
CNPS	California Native Plant Society
CSESA	C.S. Ecological Surveys and Assessments
DPR	Department of Pesticide Regulation
ECA	Environmental Compliance Advisor
ECM	Environmental Compliance Manager
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FLPMA	Federal Land and Policy Management Act
GIS	geographic information system
I-15	Interstate Freeway 15
IWMP	Integrated Weed Management Plan
MOU	Memorandum of Understanding
mph	miles per hour
MSDS	Material Safety Data Sheet
MWMA	Mojave Weed Management Area
NISIC	National Invasive Species Information Center
OSHA	Occupational Safety and Health Administration
PAR	Pesticide Application Record
PEIS	Programmatic Environmental Impact Statement
PUP	Pesticide Use Proposal
PV	photovoltaic
ROW	right-of-way
SMS	Soda Mountain Solar, LLC
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Soda Mountain Solar, LLC (SMS), has proposed to construct a 350-megawatt solar photovoltaic (PV) facility (project) on land administered by the U.S. Bureau of Land Management (BLM). A right-of-way (ROW) of 4,179 acres has been requested from BLM. The BLM case number for the project is CACA 49584. The project would disturb approximately 2,600 acres of land. The project is located approximately 6 miles southwest of Baker, California, as shown in Figure 1.1-1.

The major components of the project are the following:

- PV panel arrays (North, South, and East Arrays), inverters, medium-voltage collector transformers, and ancillary equipment
- Unpaved access roads between the arrays
- 34.5-kilovolt undergrounded collector lines to connect the panel arrays to the substation
- Substation and switchyard for interconnection to the adjacent, existing transmission line
- Water wells
- Water storage tanks
- Reverse osmosis water treatment system and associated brine ponds
- Control room/office building, maintenance facility, storage warehouse, and other ancillary structures
- Temporary storage facility for materials and supplies required during construction
- Earthen berms

The project components are shown in Figure 1.1-2.

1.2 PLAN PURPOSE

Weed control is part of ROW management. This Integrated Weed Management Plan (IWMP) describes strategies for weed control at the project site. The plan addresses the following:

- Preservation of desired plant species and communities
- Prevention of new infestations of weed species that are not yet established in the area, but known to exist nearby
- Reduction or eradication of weeds that have already established on the property, according to their actual and potential impacts on the land management goals for the property and based on the ability to control them

Figure 1.1-1: Project Location

SOURCE: ESRI 2013 and Panorama Environmental, Inc. 2013

Scale: 1:1,250,000

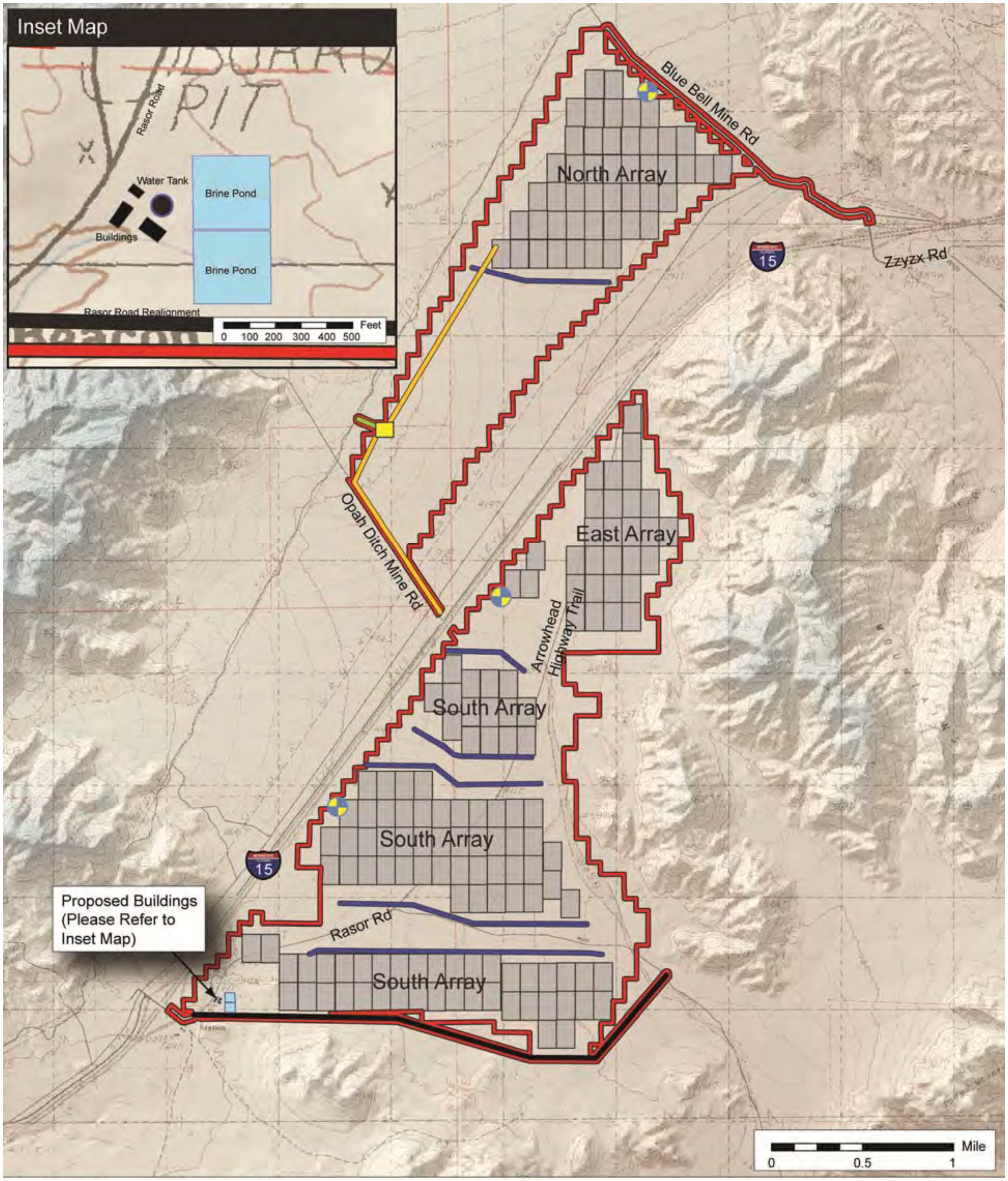
LEGEND

Proposed Project ROW

0 20 40 Miles

PANORAMA ENVIRONMENTAL, INC.

Figure 1.1-2: Project Components



SOURCE: ESRI 2013 and Panorama Environmental, Inc. 2013 — Scale: 1:55,000

- Action, which will be taken only when careful consideration indicates leaving the weed unchecked would result in more damage than controlling it with best available methods

1.3 NOXIOUS AND INVASIVE WEED DEFINITIONS

Noxious and invasive weeds addressed in this document include plant species listed as noxious weeds or invasive plants on the following federal and state lists:

- California Department of Food and Agriculture (CDFA) Noxious Weed List (CDFA 2011)
- BLM National List of Invasive Weed Species of Concern (BLM 2008)
- California Invasive Plant Council (Cal-IPC) Invasive Plant Inventory (2006)

1.3.1 California Department of Food and Agriculture Noxious Weed List

The State of California defines a "noxious weed" in Food and Agriculture Code Section 5004 as:

> …any species of plant that is, or is liable to be, troublesome, aggressive, intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate, which the director, by regulation, designates to be a noxious weed.

1.3.2 BLM National List of Invasive Weed Species of Concern

BLM maintains a list of weed species that focuses on "exotic species that are highly invasive in natural systems" (BLM 2008). The list, therefore, excludes species that threaten agriculture but that do not compromise wetlands, forestlands, or rangelands. The list does not include known invasive species that are used in range restoration, but does include invasive annual grasses that disrupt ecosystems.

1.3.3 California Invasive Plant Council's Invasive Plant Inventory

Cal-IPC maintains a list of nonnative invasive species that pose a threat to California wildlands. Cal-IPC designates each listed species as to its ecological impact, invasive potential, and distribution, as follows:

- "**High**—These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.
- "**Moderate**—These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.
- "**Limited**—These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their

reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic."

Cal-IPC assigns each species a documentation level that reflects the highest level of documentation reviewed during evaluation of each species, as follows: no information (0), anecdotal (1), observational (2), other published material (3), or reviewed scientific publications (4).

1.4 PLAN GOAL AND OBJECTIVES

The goal of the IWMP is to provide information to be used to prevent the spread of invasive species and noxious weeds during project construction and operation in order to protect biological resources from the harmful effects of weeds. The IWMP has the following objectives to reach this goal:

- **Prevention:** This objective is aimed at preventing infestation expansion and spread, and may be conducted with or without attempts to reduce infestation density. Prevention focuses on halting the spread of specific weed species until suppression or eradication can be implemented and is practical only to the extent that the spread of seeds or vegetative propagates can be prevented. Prevention also includes preventing the introduction of new weed species into the project area.
- **Eradication:** This objective is aimed at the elimination of individuals of a particular species within a specified area. This will be the goal for most weed species at the project site, and is appropriate where the weed is of considerable economic and environmental concern and the population size is manageable.
- **Suppression:** This objective is aimed at reducing current infestation density, but is not necessarily directed at reducing the total area or boundary of the infestation. This applies to many widely distributed, high-density weeds where eradication is not feasible.

1.5 MANAGEMENT ROLES AND RESPONSIBILITIES

SMS is responsible for implementing this plan. It is anticipated that SMS's contractors and other designees responsible for implementing components of this plan will include the following:

- **Contractor(s):** Contractual language will be included in construction documents and ongoing maintenance contracts to ensure that contractors, subcontractors, vendors, maintenance personnel and other parties performing either construction or ongoing maintenance or repairs at the project site abide by and implement the provisions of the IWMP. Restoration contractors, landscape contractors, and other specialists will implement specific provisions of the IWMP as independent contractors to SMS. The construction contractor will be provided a copy of the IWMP.
- **Construction Manager:** The SMS construction manager will have ultimate oversight of the construction contractor to ensure compliance with the provisions of the IWMP.
- **Environmental Compliance Adviser/Lead Monitor:** SMS will designate an environmental compliance adviser (ECA) to provide oversight of construction and

maintenance practices, including ensuring compliance with the provisions of the IWMP. The ECA will be contracted directly by SMS and will coordinate with the construction manager to ensure contractor compliance with environmental requirements for construction and with the power plant operator to ensure compliance during ongoing maintenance activities. The lead monitor will have experience in monitoring and implementing mitigation programs of similar scope and type as for the proposed project. The lead monitor will work closely with the project biologist to implement weed management measures on the project.

- **Project Biologist:** The project biologist, to be designated by the project owner, will lead the monitoring and implementation of biological mitigation measures, including measures for preventing spread of invasive species. The project biologist will have experience in monitoring and implementing mitigation programs of similar scope and type as for the proposed project. The project biologist will work with the construction manager to ensure weed control measures are coordinated with the construction schedule and to ensure weed infestations are controlled prior to soil disturbance. The project biologist will be responsible for managing and implementing weed monitoring and control efforts, as described by the following tasks:
  - Scheduling vehicle and weed monitoring for project components;
  - Verifying that vehicle inspections are conducted properly and completely;
  - Reviewing planting materials, erosion control materials, and other materials to ensure weed-free certification;
  - Ensuring that each person assigned to monitoring for weeds is qualified in plant identification;
  - Management of weed monitoring data;
  - Prioritization and implementation of control efforts;
  - Communication with the project owner and resource agencies regarding weed management needs and priorities; and
  - Preparing and submitting reports.
- **BLM:** BLM, as the administering land management agency, will provide ultimate approval of the contents of the IWMP and the compliance oversight of its provisions. BLM will provide review of work products including the IWMP, modifications or amendments to the IWMP, and subsequent reports as required by the IWMP.

2 APPLICABLE LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

2.1 FEDERAL LAWS AND REGULATIONS

2.1.1 Federal Noxious Weed Act Of 1974

The Federal Noxious Weed Act of 1974 (7 U.S.C. §§ 2801–2814) provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. It gives the Secretary of Agriculture broad powers to regulate transactions in and movement of noxious weeds. The Act states that no person may import or move any noxious weed identified in regulations of the Secretary of Agriculture into or through the United States, except in compliance with the regulations, which may require that permits be obtained. The Act also requires each federal agency to develop a management program to control undesirable plants on federal lands under the agency's jurisdiction and to establish and adequately fund such a program. The Plant Protection Act of 2000 repealed some provisions of the Federal Noxious Weed Act, including 7 U.S.C. Sections 2802 through 2813. However, Section 1, the findings and policy section, and Section 15, requiring federal land management agencies to develop management plans, were not repealed (7 U.S.C. § 2801 note; 7 U.S.C. § 2814).

2.1.2 Plant Protection Act of 2000

The Plant Protection Act of 2000, as amended (7 U.S.C. §§ 7701–7786), states that the detection, control, eradication, suppression, prevention, or retardation of the spread of plant pests or noxious weeds is necessary for the protection of the agriculture, environment, and economy of the United States. The Act defines the term "noxious weed" as any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment (7 U.S.C. § 7702). The Act specifies that the Secretary of Agriculture may prohibit or restrict the importation, entry, exportation, or movement in interstate commerce of any noxious weed if it is determined "that the prohibition or restriction is necessary to prevent the introduction into the United States or the dissemination of a plant pest or noxious weed within the United States," and authorizes the issuance of implementing regulations.

2.1.3 Noxious Weed Control and Eradication Act of 2004

The Noxious Weed Control and Eradication Act of 2004 amended the Plant Protection Act by adding a new subtitle, "Subtitle E–Noxious Weed Control and Eradication'' (7 U.S.C. §§ 7781–7786), which authorizes the Secretary of Agriculture to establish a program to provide financial and technical assistance to public and private landowners for the control or eradication of noxious weeds. The Act defines noxious weeds and removes references to statutes that were repealed upon enactment of the Plant Protection Act. The Act prohibits the movement of a federally designated noxious weed into or through the United States unless a permit is obtained for such movement and the movement is consistent with the specific conditions contained in the permit. The Act specifies that such movement, under conditions specified in the permit, may not involve a danger of dissemination of the noxious weed in the United States; otherwise, such a permit will not be issued.

2.2 STATE AND LOCAL LAWS AND REGULATIONS

2.2.1 Native Plant Protection Act

The Native Plant Protection Act (NPPA) of the Fish and Game Code (Sections 1900 through 1913) directs the California Department of Fish and Wildlife (CDFW) to carry out the California legislature's intent to "preserve, protect and enhance rare and endangered plants in this State." The NPPA gives the California Fish and Game Commission the power to designate native plants as "endangered" or "rare" and protect endangered and rare plants from take.

2.2.2 California Food and Agriculture Code

Various portions of the code pertain to weed management. Specifically, Food and Agriculture Code Section 403 states that CDFA should prevent the introduction and spread of injurious insect or animal pests, plant diseases, and weeds. Under Sections 7270 through 7224, the California Commissioner of Agriculture is granted authority to investigate and control weeds, and specifically to provide funding, research, and assistance to weed management entities, including eligible weed management areas or county Agricultural Commissioners, for the control and abatement of weeds according to an approved integrated weed management plan.

California Food and Agriculture Code Sections 5101 and 5205 provides for the certification of weed-free forage, hay, straw, and mulch. This portion of the Code recognizes that many weeds are spread through hay, straw, and mulch used for forage and ground cover. The Code allows for in-field inspection and certification of crops to ensure that live roots, rhizomes, stolons, seeds, or other propagative plant parts of weeds are not present in the crop to be harvested. Certified weed-free forage, hay, straw, and mulch are required on BLM land.

2.2.3 San Bernardino County General Plan

The San Bernardino County General Plan is the fundamental policy document for the unincorporated, privately owned lands of San Bernardino County. It was adopted by the Board of Supervisors and contains the goals, policies, and implementing actions for a variety of issues including natural and manmade hazards and natural and manmade resources. The General Plan sets the framework for decision making regarding the County's long-term development and use of resources. It also provides the rules by which land can be developed. The General Plan includes goals and policies to preserve rare and endangered species and protect areas of special habitat value (San Bernardino County Plan at II-C1-4). It also includes goals and policies to establish plans for long-term preservation and conservation of biological resources (San Bernardino County Plan at II-C1-4). Proposed development projects must be compatible with policies set forth in the Biotic Resources and Resources Conservation overlays, which identify special management for the protection of habitat that supports important flora and fauna in the unincorporated areas of the County.

2.3 CONSERVATION AND MANAGEMENT PLANS

2.3.1 Programmatic Environmental Impact Statement: Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States

BLM has prepared a Programmatic Environmental Impact Statement (PEIS) that describes vegetation treatments using herbicides for weed control in 17 western states, including California. This document is the result of extensive public involvement and outlines the specific decisions, standard operating procedures, and mitigation measures for the use of herbicides on BLM lands. The selected alternative of the PEIS identifies the active herbicidal ingredients approved for use on BLM land and the herbicidal ingredients that are not approved for use. The Record of Decision for the PEIS defers to approved land use plans the determination of areas to be treated through BLM's integrated pest management program.

The Herbicide Treatment Standard Operating Procedures of the PEIS (Appendix A) specifies management of weeds and application of pesticides on BLM land. Table A-1, Prevention Measures, specifies avoidance measures to limit weed infestation, and Table A-2, Standard Operating Procedures for Applying Herbicides, provides details on herbicide application. The procedures listed in the appendix and tables are incorporated as requirements of the IWMP that will be implemented by SMS.

2.3.2 BLM California Desert Conservation Area Plan

The California Desert Conservation Area (CDCA) comprises one of two national conservation areas established by Congress at the time of the passage of the Federal Land and Policy Management Act (FLPMA). Congress provided guidance for management of the CDCA and directed the development of the 1980 CDCA Plan (BLM 1980). The document provides no specific information on weed management, but specifies management strategies for broad areas of the CDCA.

2.3.3 Mojave Weed Management Area Memorandum of Understanding

The Mojave Weed Management Area (MWMA) was established in a Memorandum of Understanding (MOU) in 2002 as a coordinated approach among federal, state, and local agencies to improve the effectiveness of weed management efforts in the Mojave Desert. The focus of the MOU is on the exclusion, detection, eradication, and suppression of weeds, with priority placed on species listed as weeds by CDFA and other species of local significance as they are identified. The signatory agencies and organizations will cooperate in developing coordinated work plans and seeking funds to support the activities of the MWMA. In addition, public education on weed identification, prevention, and control will be a primary goal of the MWMA. The geographic scope of the MWMA includes the portion of San Bernardino County in the Mojave Desert Resource Conservation District and Death Valley National Park. The MWMA partners have pledged as part of the MOU to promote the control and prevention of weeds on both private and public lands.

3 WEED ASSESSMENT

3.1 INVENTORY OF WEED SPECIES

Noxious and invasive weed species were inventoried during botanical surveys conducted in 2009 by URS (URS 2009) and in 2012 and 2013 by C.S. Ecological Surveys and Assessments (CSESA) (CSESA 2012; CSESA 2013a).

3.1.1 Field Survey Methodology

The 2009 and 2012 surveys involved recordation of the weed species located in the project area. Point data were collected on invasive plants and noxious weeds during the 2013 spring botanical survey. The following data were collected at each “weed point”:

- Weed species
- Density of weed species
- Area of infestation

3.1.2 Survey Results: Known and Potential Weed Occurrences

Several weeds are known to occur in the project vicinity. The target list of weeds for the project site, presented in Table 3.1-1, includes noxious weeds and invasive plants identified during field surveys and noxious weeds and invasive plants with the potential to invade the project area. Figure 3.1-1 indicates the location of weed infestations and identifies areas with low, moderate, and high potential for colonization by noxious and invasive weed species.

The weed of highest concern in the general area is Sahara mustard (*Brassica tournefortii*) because it is present throughout the project area and because of its potential to spread and impact native plant communities. Other weeds of concern are also present but not widespread within and adjacent to the project area. Table 3.1-1 lists potentially occurring invasive and noxious species, and identifies which species were observed during site surveys. Each invasive or noxious species has a rating based on the Cal-IPC and CDFA rating systems, if they have been rated.

Figure 3.1-1: Invasive Species Locations (Spring 2013)

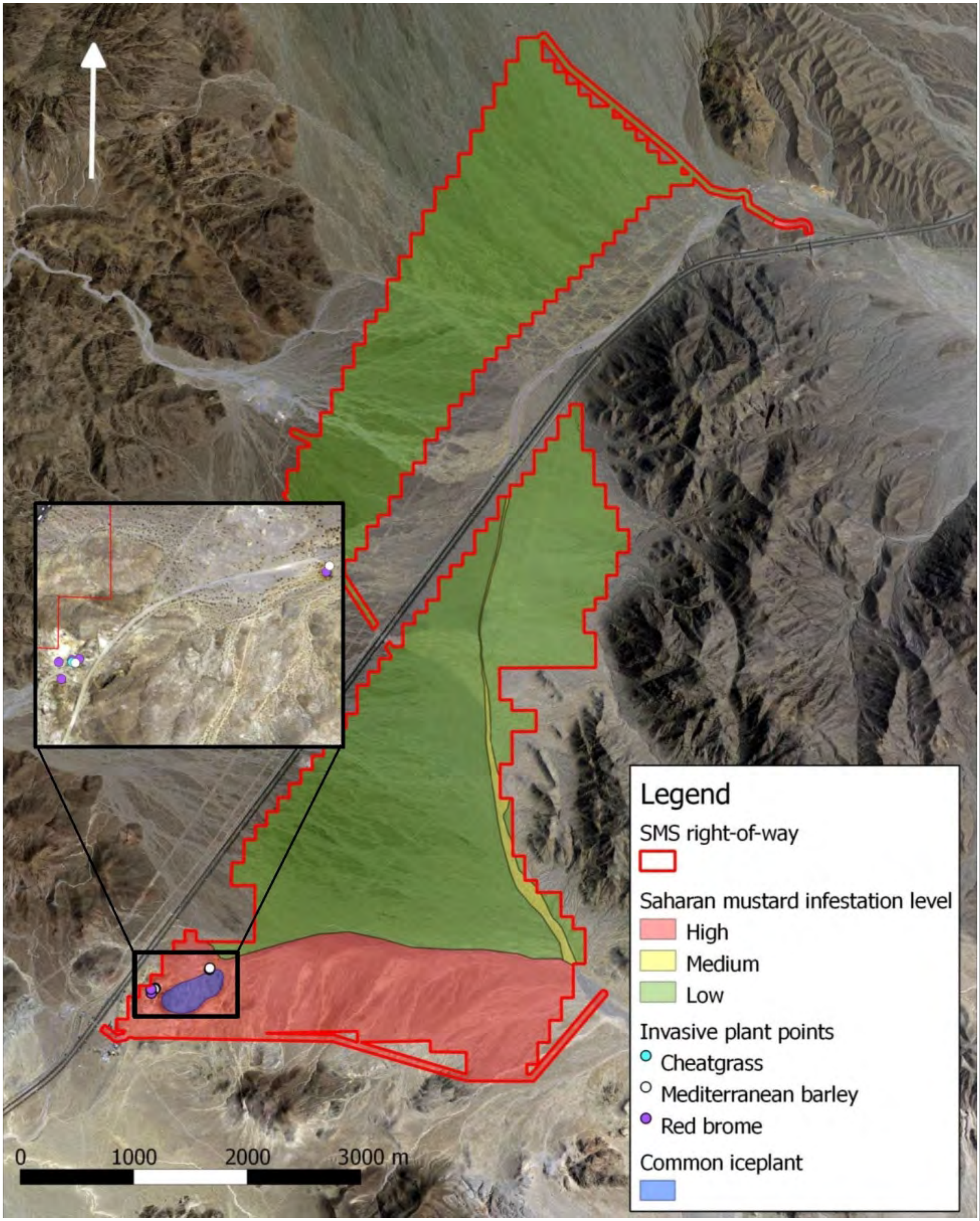


Table 3.1-1: Observed and Potentially Occurring Weeds in the SMS Project Area

Common Name (Scientific Name)	Weed List and Rating	Survey of Record	Observed or Potential for Occurrence Within Project Area
Plants Observed in Project Area			
Sahara mustard (*Brassica tournefortii*)	CAL-IPC: High Concern to Barstow BLM	URS 2009; CSESA 2012, 2013a	Observed throughout project area and approaches infestation level on loose, sandy soils; uncommon on desert pavement soils
Red brome (*Bromus madritensis* ssp. *rubens*)	Cal-IPC: High BLM List	URS 2009; CSESA 2012, 2013a	Observed on disturbed soils in southern portion of project area and can become dense in wet periods
Cheatgrass (*Bromus tectorum*)	Cal-IPC: High BLM List	CSESA 2012, 2013a	Observed on disturbed soils in southern portion of project area
Redstem filaree (*Erodium cicutarium*)	CAL-IPC: Limited	URS 2009; CSESA 2012, 2013a	Observed throughout the project area at low densities; uncommon on desert pavement soils
Mediterranean barley (*Hordeum murinum*)	CAL-IPC: Moderate	URS 2009; CSESA 2013a	Observed in the southwest corner of the southern array on disturbed soils
Crystalline iceplant (*Mesembryanthemum crystallinum*)	CAL-IPC: Moderate	URS 2009; CSESA 2012, 2013a	Observed in southwest portion of project area
Mediterranean grass (*Schismus barbatus*)	CAL-IPC: Limited Concern to Barstow BLM	URS 2009; CSESA 2012, 2013a	Observed throughout the project area; uncommon on desert pavement soils
Five-stamen taramisk (*Tamarix chinensis*)	CDFA: Noxious BLM List	CSESA 2012, 2013a	Observed at one location within the project area; several occurrences on adjacent lands
Rattail fescue (*Vulpia myuros*)	CAL-IPC: Moderate	URS 2009	Observed
Plants Not Observed in Project Area but with Some Potential to Invade Project Area			
Bassia (*Bassia hyssopifolia*)	Cal-IPC: Limited BLM List	Not observed	Could occur in drainages or disturbed areas; minor impacts to wildlands (Cal-IPC 2006)
Bermuda grass (*Cynodon dactylon*)	CDFA: Noxious Cal-IPC: Moderate BLM List	Not observed	Can be very invasive in desert washes (Cal-IPC 2006)
Kochia (*Kochia scoparia*)	Cal-IPC: Moderate	Not observed	Could occur in roadside drainages and seasonally wet areas; known to occur on saline soils
Prickly lettuce (*Lactuca serriola*)	Cal-IPC: Evaluated but not listed	Not observed	Could occur on roadsides and other disturbed areas
Alkali mallow (*Malvella leprosa*)	CDFA: Noxious	Not observed	Could occur in roadside drainages and seasonally wet areas
Annual beard grass (*Polypogon monspeliensis*)	Cal-IPC: Limited	Not observed	Could occur in ephemeral drainages and wet areas

Table 3.1-1 (*Continued*): Observed and Potentially Occurring Weeds in the SMS Project Area

Common Name (Scientific Name)	Weed List and Rating	Survey of Record	Observed or Potential for Occurrence Within Project Area
Barbed wire Russian thistle (*Salsola paulsenii*)	Cal-IPC: Limited	Not observed	Known to occur in disturbed soil in desert regions
Russian thistle (*Salsola tragus, Salsola australis*)	CDFA: Noxious Cal-IPC: Limited	Not observed	Potential habitat present on disturbed areas and loose, sandy soils
London rocket (*Sisymbrium irio*)	Cal-IPC: Moderate	Not observed	Habitat not observed on BLM lands in the project area; present on adjacent private lands
Puncture vine (*Tribulus terrestris*)	CDFA: Noxious Not listed in Cal-IPC	Not observed	Could occur in washes

Cal-IPC Overall Ratings

High — These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate — These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited — These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

BLM List: BLM National List of Invasive Weed Species of Concern

3.2 WEED RISK RATING

A Noxious Weed Risk Assessment was conducted for the project based on guidelines presented in BLM Manual 9015 Integrated Weed Management (BLM 1992). This assessment was conducted only for the species observed on BLM-managed lands within the survey area boundaries and adjacent areas. Each species was assessed and rated for the likelihood of spreading to the survey area and the consequence of establishment in the survey area. These two factors were given numeric values that were multiplied and used to determine each species' risk rating: low, moderate, or high. Table 3.2-1 provides the results of this assessment and Table 3.2-2 presents methods for containment, control, or eradication for each species.

Table 3.2-1: Weed Risk Assessment

Species	Likelihood of Spreading to Project Area[1]	Consequence of Establishment in Project Area[2]	Risk Rating[3]
Noxious Weeds (BLM and State List)			
Five-stamen tamarisk (*Tamarisk chinensis*)	5/Moderate Small population. Species present in one dry wash.	1/Low There is little suitable wash habitat within the project area.	5
Other Invasive Species (Cal-IPC List)			
Sahara mustard (*Brassica tournefortii*)	5/Moderate Moderate-density populations already present within the project area.	10/High Infestations are moderately dense. Disturbance related to the project could produce cumulative effects that would increase the extent and density of this species within and around the project area.	50
Red brome (*Bromus madritensis* ssp. *rubens*)	1/Low This species is only present within highly disturbed areas at two locations within the project area.	5/Moderate There is potential for this species to spread to disturbed ground created from project activities.	5
Cheatgrass (*Bromus tectorum*)	1/Low This species is only present within highly disturbed areas at two locations within the project area.	5/Moderate There is potential for this species to spread to disturbed ground created from project activities.	5
Redstem filaree (*Erodium cicutarium*)	5/Moderate This species is present sporadically throughout the project area at moderately low density.	5/Moderate This species has potential to spread to disturbed areas created by project activities.	25
Mediterranean barley (*Hordeum murinum*)	1/Low This species is only present within highly disturbed areas in the southwest corner of the project area.	5/Moderate This species has potential to spread to disturbed areas created by project activities.	5
Crystalline iceplant (*Mesembryanthemum crystallinum*)	5/Moderate There are large patches of this species scattered throughout the southwest portion of the project area.	1/Low This species has not germinated in 2 years. It is likely that this species will not persist even if it spreads to new areas within the project site.	5

Table 3.2-1 (*Continued*): Weed Risk Assessment

Species	Likelihood of Spreading to Project Area[1]	Consequence of Establishment in Project Area[2]	Risk Rating[3]
Mediterranean grass (*Schismus barbatus*)	5/Moderate Moderate-density populations already present within the project area.	5/Moderate Moderate potential for this species to increase in extent and density due to project-related activities.	25
London rocket (*Sisymbrium irio*)	1/Low Only found adjacent to the project area to the west on highly disturbed ground.	5/Moderate This species could spread to disturbed areas created by project activities.	5
Rattail fescue (*Vulpia myuros*)	1/Low Few locations within project area.	1/Low Unlikely to spread due to project activities.	1

Notes

1 **Likelihood of Spread to Project Area**

None (0): Noxious weed species not located within or adjacent to the project area. Project activity is not likely to result in the establishment of noxious weed species in the project area.

Low (1): Noxious weed species present in areas adjacent to but not within the project area. Project activities can be implemented and prevent the spread of noxious weeds into the project area.

Moderate (5): Noxious weed species located immediately adjacent to or within the project area. Project activities are likely to result in some areas becoming infested with noxious weed species even when preventative management actions are followed. Control measures are essential to prevent the spread on noxious weeds within the project area.

High (10): Heavy infestations of noxious weeds are located within or immediately adjacent to the project area. Project activities, even with preventative management actions are likely to result in the establishment and spread of noxious weeds on disturbed sites throughout much of the project area.

2 **Consequence of Establishment in Project Area**

Low to Non-existent (1): None. No cumulative effects expected.

Moderate (5): Possible adverse effects on site and possible expansion of infestation within project area. Cumulative effects on native plant community are likely but limited.

High (10): Obvious adverse effects within the project area and probable expansion of noxious weed infestations to areas outside the project area. Adverse cumulative effects on native plant community are probable.

3 **Risk Rating/Action**

0 = None: Proceed as planned,

1-10 = Low: Proceed as planned. Initiate control treatment on noxious weed populations that get established in the area.

25 = Moderate: Develop preventative management measures for the proposed project to reduce the risk of introduction or spread of noxious weeds into the area. Preventative management measures should include modifying the project to include seeding the area to occupy disturbed sites with desirable species. Monitor area for at least 3 consecutive years and provide for control of newly established populations of noxious weeds and follow-up treatment for previously treated infestations.

50-100 = High: Project must be modified to reduce risk level through preventative management measures including seeding with desirable species to occupy disturbed sites and controlling existing infestations of noxious weeds prior to project activity. Project must provide at least 5 consecutive years of monitoring. Projects must also provide for control of newly established populations of noxious weeds and follow-up treatment for previously treated infestations

Table 3.2-2: Management Strategy and Control Methods for Observed and Potentially Occurring Weeds at the SMS Project Site

Noxious or Invasive Weed	Management Strategy	Control Method by Observation Type
Noxious or Invasive Weeds Observed On Site		
Sahara mustard (*Brassica tournefortii*)	Monitor for occurrence in December and January, prior to seed set, and eradicate if found; continue to monitor occurrence sites to ensure complete eradication.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stand:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Red brome (*Bromus madritensis* ssp. *rubens*)	Monitor for occurrence in December and January, prior to seed set, and eradicate if found; continue to monitor occurrence sites to ensure complete eradication.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stand:** Spray with post-emergent glyphosate herbicide; after senescence, remove by hand and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Cheatgrass (*Bromus tectorum*)	Monitor for occurrence in December and January, prior to seed set, and eradicate if found; continue to monitor occurrence sites to ensure complete eradication.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stand:** Spray with post-emergent glyphosate herbicide; after senescence, remove by hand and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Redstem filaree (*Erodium cicutarium*)	No action; allow colonization as pioneer species in revegetation areas.	**N/A:** Species is too ubiquitous for control.
Mediterranean barley (*Hordeum murinum*)	Monitor for occurrence in December and January prior to seed set, and eradicate if found; continue to monitor occurrence sites to ensure complete eradication.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stand:** Spray with post-emergent glyphosate herbicide; after senescence, remove by hand and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.

Table 3.2-2 (*Continued*): Management Strategy and Control Methods for Observed and Potentially Occurring Weeds at the SMS Project Site

Noxious or Invasive Weed	Management Strategy	Control Method by Observation Type
Crystalline iceplant (*Mesembryanthemum crystallinum*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stand:** Spray with post-emergent glyphosate herbicide; after senescence, remove by hand and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Mediterranean schismus (*Schismus barbatus*)	No action; allow colonization as pioneer species in revegetation areas.	**N/A:** Species is too ubiquitous for control.
Five-stamen tamarisk (*Tamarisk chinensis*)	Eradicate existing occurrence.	**Mature Trees:** Cut trees and apply 100 percent concentrated Imazapyr to cut stem; spray new shoots. See Section 6.3.3, Chemical Methods for Weed Removal.
Noxious or Invasive Weeds Not Observed On Site		
Bassia (*Bassia hyssopifolia*)	Monitor for occurrence and eradicate if present.	**Individual Plant:** Remove entire plant (stems, flowers, and roots) by hand pulling place in appropriate containers and dispose of properly. Removal should occur prior to flowering and seed set. **Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove by hand and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Bermuda grass (*Cynodon dactylon*)	Monitor for occurrence, especially in washes, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Tocalote (*Centaurea melitensis*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Stand:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Flixweed, tansy mustard (*Descurainia sophia*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling.
Kochia (*Kochia scoparia*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Monotypic Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.

Table 3.2-2 (*Continued*): Management Strategy and Control Methods for Observed and Potentially Occurring Weeds at the SMS Project Site

Noxious or Invasive Weed	Management Strategy	Control Method by Observation Type
Prickly lettuce (*Lactuca serriola*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling.
Alkali mallow (*Malvella leprosa*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling.
Annual beard grass (*Polypogon monspeliensis*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Monotypic Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Barbed wire Russian thistle (*Salsola paulsenii*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Monotypic Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Russian thistle (*Salsola tragus*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal. **Monotypic Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
London rocket (*Sisymbrium irio*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling. **Monotypic Stands:** Spray with post-emergent glyphosate herbicide; after senescence, remove with flail mower and bag for disposal. See Section 6.3.3, Chemical Methods for Weed Removal.
Puncture vine (*Tribulus terrestris*)	Monitor for occurrence, and eradicate if found.	**Individual Plant:** Pull out entire plant and root, and bag for disposal. See Section 6.3.2, Physical Removal of Weeds, Hand Pulling.

4 WEED MANAGEMENT AREAS

Weed management will occur site-wide; however, specific areas will require unique management considerations depending on a range of factors described in this section.

4.1 DISTURBANCE OVERVIEW

The project will be designed to minimize ground disturbance and resulting environmental impacts wherever practicable. The access road off of Blue Bell Mine Road will be the main roadway used for site access to the arrays on the north side of I-15, as shown in Figure 1.1-2. Internal access roads will be used for access to different sections of the arrays. The main access route to the arrays on the south side of I-15 will be the existing Rasor Road, as shown in Figure 1.1-2. The number of service roads within the site for access and maintenance will be kept to a minimum and located to provide main routes for quick access to the site for construction, maintenance, and operations. Within the arrays access roads will be constructed between every other line of arrays for maintenance purposes. The project layout has been designed to avoid major washes and minimize surface-disturbing activities to preserve intact soil crusts on site.

4.2 DISTURBANCE TYPES

Weed management will be a project site-wide undertaking; however, some areas of the project would be disturbed only during construction ("areas of temporary disturbance during construction"), whereas some areas would be subject to disturbance during construction and then subject to continued project activities throughout the operation and maintenance phase of the project ("areas managed during operation and maintenance").

4.3 AREAS OF TEMPORARY DISTURBANCE DURING CONSTRUCTION

Temporary disturbance areas are those areas that would be disturbed during construction that would not contain permanent structures or roads or be otherwise subject to continued maintenance activities during the operations and maintenance phase of the project. Soil disturbance during construction would create habitat prone to colonization by certain invasive species in these temporarily disturbed areas. Construction activities involving movement of people and equipment through the project area could introduce weed propagules to previously weed-free areas.

Approximately 355 acres disturbed during construction would not be subject to operations and maintenance activities, as shown in Table 4.3-1. Project construction would be designed to minimize ground disturbance such that the actual acreage disturbed during construction may be less than that stated in Table 4.3-1. Temporary disturbance areas are described below and weed management measures for temporary disturbance areas (areas with no permanent facilities) are included in Section 6.

Table 4.3-1: Estimated Surface Disturbance (Acres)[1]

Component	Area of Temporary Disturbance During Construction	Area Managed During Operation and Maintenance	Total Area of Disturbance
Solar Arrays[1]	81	2,165	2,246
Substation and Switchyard	25	15	40
Operations & Maintenance Buildings, Warehouses, and Water Tank	3	1	4
Project Wells (3)	0	0	0
Reverse Osmosis Facility	1	1	2
Brine Ponds	2	4	6
Rasor Road Realignment	55	13	68
Access Roads	74	20	94
Berms	1	25	26
Collector Routes	36	0	36
Laydown Area	30	0	30
Temporary Desert Tortoise Exclusion Fence	47	0	47
TOTAL	**355**	**2,244**	**2,599**

Notes
[1] Temporary disturbance for the solar arrays includes all areas within the desert tortoise fence and a 30-foot buffer from the desert tortoise fence, exclusive of other project components. Permanent disturbance for the solar arrays includes all areas within the security fence for the solar arrays.

4.3.1 Arrays

Approximately 81 acres would be temporarily disturbed during the construction of solar panel arrays, as shown in Table 4.3-1. Vegetation would be cleared from these areas, and the areas would be graded to create flat areas for staging and storage of construction materials and equipment during array construction.

4.3.2 Other Components

Approximately 274 acres associated with other construction components would be temporarily disturbed during construction, as shown in Table 4.3-1. Construction of permanent structures (i.e., substation and switchyard, operation and maintenance buildings and facilities, wells, reverse osmosis facility, brine ponds, and berms) would require the use of adjacent temporary laydown areas. These areas would be cleared of vegetation and graded as necessary.

Temporary roadways would be necessary to access the interior of the site. These roads will generally follow existing terrain but will be covered with compacted native soils. The roads would be heavily used during construction and would have a buffer area that may also be disturbed during construction. Some existing roadways (e.g., Rasor Road and Blue Bell Mine Road) may also require improvements for use during construction, which could require a cleared buffer area on either side of the road alignment. Relocation of Rasor Road would result in temporary use of a buffer area around the proposed road alignment.

Collector routes would be trenched to install them underground, which would result in temporary disturbance of the trenching area, equipment and material storage areas, and the buffer adjacent to the trenching area.

4.4 AREAS MANAGED DURING OPERATION AND MAINTENANCE

The areas described in this section would be permanently developed, but could support weedy species within peripheral disturbed areas and beneath panel arrays and could, therefore, function as seed reservoirs for adjacent natural habitats if not managed. Weed management measures for areas with permanent facilities are included in Section 6.

Approximately 2,244 acres would contain permanent development or would be permanently managed during project operation, as shown in Table 4.3-1. Permanently developed areas are areas with permanent structures, including panel arrays and buildings, and areas that would otherwise be managed or modified during the operation and maintenance phase of the project. The layout of the project has been designed to avoid major washes and minimize surface disturbance (Figure 1.1-2).

Soil disturbance during construction will create habitat well suited to disturbance-adapted invasive species, and continual movement within the area of personnel and heavy equipment could potentially introduce weed propagules. These areas will require ongoing weed monitoring and maintenance during construction, and equipment will require cleaning at wash stations as specified below.

4.4.1 Arrays

The arrays would occupy approximately 2,165 acres during operations and maintenance, as shown in Table 4.3-1. Arrays would come on line incrementally, such that permanent disturbance areas in the array fields would be created incrementally. Array construction would proceed as follows:

- ***Year 1:*** Southern portion of South Array
- ***Year 2:*** Northern portion of South Array
- ***Year 3:*** Small portion of South Array, entire East Array, and entire North Array

During operations, equipment and personnel will continue to access the area for maintenance of the inverters and solar arrays. Precipitation and wash water runoff from the cleaning of PV panels will provide a water source that could support weed establishment and growth beneath and adjacent to panels. These areas will require continual weed management and control.

Areas that require smoothing or grading prior to panel construction would be managed for bare ground. This would require application of a pre-emergent herbicide the winter prior to construction. If new construction occurs during the germination period for target weeds a pre-emergent herbicide such as Krovar® I DF would be applied following construction or the following winter during site operation. Any weed species detected during the growing season would be either hand-pulled or treated with a glyphosate herbicide such as Round-up Pro®.

Areas that require only minimal disturbance to native soil and vegetation, such as trimming of shrubs prior to panel construction, would be allowed to revegetate. Vegetation would be trimmed to maintain clearance between the panels and ground during operation and maintenance. Any weed species detected in these areas will be either hand-pulled or treated with a glyphosate herbicide such as Round-up Pro®. The pre-emergent herbicide Krovar® I DF may be applied in these areas if the root zone of existing native vegetation can be avoided.

4.4.2 Other Components

Other permanent facilities and areas subject to activities during operations and maintenance would occupy approximately 79 acres, as shown in Table 4.3-1. The permanent disturbance area of these other facilities (i.e., substation and switchyard, operation and maintenance buildings, project wells, reverse osmosis facility, brine ponds, Rasor Road realignment, access roads, and berms) includes the area covered by the facility and, in some cases, an additional buffer from the edge of the facility (Figure 1.1-2). Any unpaved areas that are used for project operation would be subject to colonization by weeds.

5 IDENTIFICATION AND MONITORING METHODS

5.1 WEED IDENTIFICATION

Monitoring and control of weeds requires skill in plant identification, which is acquired through training and familiarization with local plants and weeds of concern. Training, using field manuals with photographs of native desert plants and common weeds, will be provided as necessary to field staff including biological monitors, weed abatement contractors, plant operators and staff, and construction workers. Online resources are available and include the following:

- **Calflora** (http://www.calflora.org/): a database of plant species known to occur in California; includes plant status (i.e., noxious weed, invasive plant, or special-status plant), blooming time, map of known occurrences and links to photos and other information.
- **University of California digital library** (http://calphotos.berkeley.edu/flora/): contains an extensive photo collection of plant species known to occur in California.
- **Cal-IPC** (http://www.cal-ipc.org): provides a current inventory of invasive plant species, management actions to control invasive species, maps of invasive plant distribution, and research on the biology and ecology of invasive plant species.
- **National Invasive Species Information Center** (http://www.invasivespeciesinfo.gov/): gateway to invasive species information; covers federal, state, local, and international sources; has information on invasive species and links to the extensive **USDA PLANTS database** (http://plants.usda.gov/), with species profiles and photographs of plants known to occur in the United States.
- **Mojave Weed Management Area** (http://www.mojavewma.org/): provides information specific to the Mojave Desert region including a copy of the MWMA Plan, a list and description of local problem weeds, and weed control and mapping projects.
- **California Native Plant Society** (http://www.cnps.org/): a database of California vegetation including rare, threatened, and endangered plants.
- **BLM Invasive and Noxious Weeds Program** (http://www.blm.gov/weeds/): maintains a website with useful information on weeds, including management strategies for the control of noxious weeds and invasive plants.
- **Center for Invasive Plant Management** (http://www.weedcenter.org/): contains links to national and state weed lists, information on the control and management of weed infestations, and techniques for inventorying and mapping weed populations.
- **California Department of Agriculture** (http://www.cdfa.ca.gov/plant/ipc/encycloweedia/encycloweedia_hp.htm): contains a list of noxious weeds as designated by the State of California, fact sheets on specific weeds, weed control projects, and current distribution of certain weed species.
- ***Weeds of California and Other Western States*** (DiTomaso and Healy 2006): contains information on the identification of noxious weeds and invasive species.

5.2 WEED MONITORING

5.2.1 Monitoring Methods

The U.S. Fish and Wildlife Service (USFWS) defines monitoring as a survey repeated through time to determine changes in the status and demographics of abiotic resources, species, habitats, or ecological communities (USFWS 2013). Periodic observation of the weeds being managed is necessary to evaluate the effectiveness of a weed control program. Weed control actions need to be modified if management objectives are not being met. Monitoring will ensure timely detection and prompt eradication of weed infestations, and is an essential part of a long-term strategy for weed management.

Construction Areas

The ECA will oversee biological monitors who will be present during site clearing and construction activities. Biological monitors will inspect construction areas, identify the presence of weeds, and inspect equipment cleaning facilities for weed seed removal. The ECA will prescribe management activities consistent with the IWMP when/if new weeds become established. Monitoring of construction areas and access routes will be conducted as necessary to insure proper weed control.

General Operations Monitoring

General site monitoring of the operating facility will be conducted by operations personnel on an ongoing basis. Weed control will be conducted, as needed, by operations personnel trained to identify weedy and native species.

Known Infestation Areas

Where infestations of weeds targeted for eradication occur and treatment is implemented, the areas will be monitored to ensure that treatments are effective and that complete eradication has been achieved. Visits to known infestation areas will continue until weeds in the area are controlled.

5.2.2 Database and Mapping

Locations of weed occurrences will be maintained during the construction and operation phases. Data would include:

- Species
- Detection date
- Growth stage
- Infestation extent
- Treatments implemented
- Results of such treatment(s)
- Current status

This will not be a requirement for previously designated ubiquitous invasive species. A geographic information system (GIS) will be used to map and store data.

The priority of infestation areas will be established based on:

- Species
- Vulnerability of the site to re-invasion
- Growth stage
- Effectiveness of treatment

Maps will also be generated for areas identified as vulnerable to weed invasions. Vulnerability will be based on:

- Presence of nearby weed propagule vectors (i.e., roads)
- Degree and extent of ground disturbance
- Proximity of other known weed infestation

6 WEED MANAGEMENT

6.1 SPECIES DESCRIPTIONS AND MANAGEMENT STRATEGY

Descriptions of the more common or troublesome weeds occurring or potentially occurring at the project are provided in this section, along with the basic weed management strategy applicable to each. Table 3.1-1 provides a complete list of the weed species of concern in this area, Table 3.2-1 provides a risk assessment for each species found on or adjacent to the project site according to BLM risk assessment ratings (BLM 1992), and Table 3.2-2 provides additional information on management strategies and control methods for observed and potentially occurring weed species. Management strategies must encompass not only eradication, but also must identify the means of eradication and the plant species to be eradicated.

Not all invasive plant species can or should be eradicated. Certain ubiquitous exotic species (e.g., *Schismus barbatus* and *Erodium cicutarium*) will initially be monitored to ensure containment of known infestations. Neither eradication nor control will be attempted because control of these aggressive colonizers is impractical. Measures needed for such control would also probably slow site rehabilitation by slowing the rate of secondary succession and surface stabilization. These species can also play a beneficial role in accelerating surface stabilization, thereby reducing soil erosion caused by sheet flow or high winds.

6.1.1 Existing Weeds

This section provides brief descriptions of the weed species of particular concern at the project site. Additional weed species are listed in Table 3.1-1.

Sahara Mustard

Sahara mustard or African mustard (*Brassica tournefortii*) was observed on the project site. This species is of particular concern to the BLM Barstow Field Office and Cal-IPC has declared this plant highly invasive (Cal-IPC 2006). This species will be eradicated whenever encountered.

Red Brome

Red brome (*Bromus madritensis* ssp. *rubens*) was observed at two general locations on the project site. This species is an introduced Eurasian grass adapted to warmer habitats that can be frequently found at the base of desert shrubs. It is widespread in the Mojave Desert and has been found at a few locations in the project area. Seeds from this species can disperse readily and across large distances. Cal-IPC has declared this plant highly invasive (Cal-IPC 2006). This species is not widespread in the project area, and existing populations should be eradicated prior to development.

Cheatgrass

Cheatgrass (*Bromus tectorum*) is among the most widely distributed invasive plant species in the western United States. It is adapted to colder steppe and woodland habitats. It is known to occur in the project vicinity, but was observed only in the northwest corner of the South Array on the project site, as shown in Figure 3.1-1. Cal- IPC has declared this plant highly invasive (Cal-IPC 2006). This species is not widespread in the project area, and existing populations should be eradicated prior to development.

Redstem Filaree

Redstem filaree or storksbill (*Erodium cicutarium),* a widespread annual species common in disturbed habitats, was observed throughout the project site. It can form dense, transient populations when conditions are suitable. It has a limited overall rating by Cal-IPC, generally because the ecological impacts of the species are considered minor. Redstem filaree is not considered feasible for general control and weed abatement measures will not be required on site due to the weed's widespread distribution.

Mediterranean Barley

Mediterranean barley (*Hordeum murinum*), a widespread annual species common in disturbed habitats, was observed only within the northwest corner of the South Array and west of the project area. This species is not yet widespread in the project area, and existing populations should be eradicated prior to development.

Mediterranean Grass

Mediterranean grass (*Schismus barbatus*) was observed on the project site. Cal-IPC has determined that this plant has a limited invasiveness rating in California (Cal-IPC 2006). BLM and other agencies recognize that because of the widespread distribution of Mediterranean grass, this species is not considered feasible to control. Weed abatement efforts for Mediterranean grass will, therefore, not be required.

Russian Thistle

Russian thistle or tumbleweed (*Salsola tragus*/*Salsola australis*) is particularly adapted to recently disturbed habitat and tends to be restricted to roadway shoulders and to sites where the soil has been recently disturbed. This species was not observed at the project site, but has been observed within 3 miles of the project site in loose, sandy, or disturbed soils. Russian thistle is listed as a noxious weed by CDFA. Cal-IPC has determined that this plant has a limited invasiveness rating in California (Cal-IPC 2006). New occurrences on the project site will be eradicated to the extent feasible.

London Rocket

London rocket (*Sisymbrium irio*) is widespread throughout the warm deserts of North America. This species was not observed at the project site, but was observed adjacent to the project site to the west. It is a common invader on disturbed sites, and Cal-IPC has declared this plant moderately invasive (Cal-IPC 2006). London rocket will be eradicated at the project site wherever it is observed.

Five-stamen Tamarisk

Five-stamen tamarisk (*Tamarix chinensis*) has been observed in the survey area. Several individuals were observed in a dry wash on the southwest portion of the project area. Tamarisk is an obligate riparian shrub/tree that is restricted to habitats where there is a perennial source of surface water or the groundwater table is high. Five-stamen tamarisk is not rated by Cal-IPC but is listed as a noxious weed with a B rating by CDFA. Known individuals of this species will be removed as necessary, and occurrences of this species will be chemically and/or mechanically treated where observed within the project area.

6.1.2 New Weeds

Weeds not identified in the descriptions above could also potentially colonize or invade the site during construction as well during operation. During construction, the ECA will be required to regularly update the list of potential weeds and identify new potential threats. This will include developing a management strategy and management methods appropriate to the plant species and nature of the potential invasion. Similarly, the facility plant manager or appropriate designee during operations will be required to continually update the potential weed list and provide monitoring and management appropriate to new species.

6.2 PREVENTATIVE MEASURES

Preventing invasive plants from colonizing new areas is far more cost-effective than eradication and control (Davies and Sheley 2007). Preventative measures taken to curb the spread of weed propagules and inhibit their germination should, therefore, include all the measures listed in Appendix A, Table B-1, "Preventative Measures," or the BLM Field Office's best management practices (BMPs) for weed control.

6.2.1 Construction

Preventative measures during construction would include:

- Worker environmental training
- Wash stations
- Removal and disposal of weed seed and pieces from worker clothing and equipment
- Infestation containment and control
- Site soil management
- Weed-free products and seed
- Site reclamation

Worker Environmental Training

Mandatory site environmental training for contractors or related personnel entering the site during construction will include weed management awareness training. Personnel affected will include contractors, subcontractors, inspection personnel, construction managers, construction personnel, and individuals bringing vehicles or equipment onto the site. Training will include weed identification and training on the impacts of weeds on agriculture, livestock, wildlife, desert ecosystems, and fire hazard. Impacts of weeds on native vegetation, wildlife, and fire activity will be discussed including an explanation of how invasive grasses provide a fine fuel understory that can spread fire from shrub to shrub and how this has historically been absent in the native desert ecosystem. Proposed measures to prevent the spread of weeds in areas currently not infested and controls on their proliferation when already present will also be explained.

Wash Stations

With the underlying principal of prevention being the most cost-effective way to deal with invasive plant species early, two wash stations, one on each side of I-15, will be set up to remove mud and dirt from construction vehicles. This will aid in preventing the spread of weed seeds into new habitats, as trucks with mud and dirt containing seeds or propagules are one of the most common ways weeds are spread to new environments. Non-construction vehicles not travelling outside paved parking areas will not be required to stop at wash stations.

Vehicles or heavy equipment will be required to remove caked-on mud and debris before entering the site. Vehicles entering from off-site locations will be required to stop for cleaning. Heavy equipment entering the site on trailers will also require cleaning. The wash-down will concentrate on tracks, feet, or tires and on the undercarriage, with special emphasis on axles, frame, cross members, motor mounts, and on and underneath steps, running boards, and front bumper/brush guard assemblies. The contractor will ensure that vehicles and equipment are free of soil and debris capable of transporting weed seeds, roots, or rhizomes before the vehicles and equipment are allowed to use access roads. Vehicle cabs will be swept out and refuse will be disposed of in covered waste receptacles. Vehicles will be reasonably dry (i.e., runoff water has slowed substantially) before leaving the wash station.

Sediment accumulated from the washing will be shoveled out daily and placed in a sealed container for disposal in an approved landfill. If removed materials exceed the capability of the wash stations, equipment will be washed elsewhere before being allowed on the site.

When vehicles and equipment are washed, a log will be kept stating the location, date and time, serial number and type of equipment, and methods used. The crewmember that washed the vehicle will sign the log. Written logs will be included in the monitoring reports.

Wash stations will be located to avoid sensitive biological resources, and will be constructed with either a concrete wash pad or a gravel pad. Silt fencing, weed-free certified hay bales, preferably of rice straw, or other means of trapping wash water sediment and seeds will be installed around the perimeter of wash stations.

Worker Clothing, Personal Effects, and Equipment

Project workers will also inspect, remove, and dispose of weed seed and plant parts found on their clothing, personal effects, and equipment. These items will be bagged and disposed of in a dumpster for deposit in an approved landfill.

Infestation Containment and Control

Areas of concern will be identified and flagged in the field by biological monitors prior to construction. Flags will remain in place during construction. The flagging will alert construction personnel that weeds are present and access into these areas will be prevented until weed management control measures have been implemented. Contractors will avoid or minimize travel through these weed-infested areas. Control measures will be implemented immediately as described in the sections below. The contractor will begin project operations in weed-free areas whenever feasible before operating in weed-infested areas. Project work in weed-infested areas will not begin until the ECA has assessed the effectiveness of weed treatments within weed-infested areas such that viable weed material is not present at the infested area.

Site Soil Management

The contractor will limit the size of ground disturbance to the minimum necessary to perform the activity safely and as designed. The contractor will also avoid creating soil conditions that promote weed germination and establishment to the greatest extent practicable. Soil conditions that promote weed germination and establishment include soil excavation/disturbance, vegetation removal, soil compaction, loss or removal of topsoil, introduction of chemical compounds, including fertilizer, and soil stockpiling.

During grading or excavation activities, the contractor will minimize transporting soil within the site to limit the potential spread of weed seeds on site. In areas where weed infestations are identified, the contractor will stockpile cleared vegetation and salvaged topsoil adjacent to the area from which they are stripped to eliminate the transport of soil-borne weed seeds, roots, or rhizomes. Such stockpiles will be covered with plastic or sprayed regularly with a dust suppressant to reduce the risk of airborne spread of weed seed and propagules.

Weed-free Products and Seed

Straw or hay bales used for sediment barrier installations, gravel mulch, and soil may carry weed seeds. The contractor will ensure that straw or hay bales used for sediment barrier installations are obtained from certified sources that are free of weed seeds. Rice straw, which contains fewer weed species adapted to desert conditions, should be used when possible for erosion control.

Gravel, mulch, and soil will be obtained from suppliers who can certify these materials are weed-free. To the greatest extent feasible, mulch will be generated from native vegetation cleared from the site. At no time will soil be imported onto the site.

Seed purchased from commercial vendors for site revegetation will be labeled in compliance with the relevant provisions of the California Agriculture Code (CDFA 2010). In addition to having the correct label, the seed should be required to be free of weeds and the label should so state.

Site Reclamation

Should the project site be closed, SMS would adhere to the Decommissioning and Site Reclamation Plan. Measures would be followed to reduce the extent of weeds that persist on the site following closure.

6.2.2 Operations

Preventative measures during operations include facility staff training and infestation containment and control.

Facility Staff Training

Mandatory site training for maintenance personnel will include weed management. Training will include weed identification and the impacts on desert ecosystems, agriculture, livestock, wildlife, and fire frequencies. The training will contain an explanation of the importance of preventing the spread of weeds in areas currently not infested and of controlling the proliferation of weeds already present.

Infestation Containment and Control

Areas of concern that contain known weed infestations or new occurrences of weeds will be identified and flagged by groundskeepers or maintenance personnel. The flagging will alert personnel that weeds are present. Access into these areas will be prevented until weed management control measures have been implemented. Immediate control measures will be implemented as described below.

6.3 ERADICATION AND CONTROL MEASURES

6.3.1 Acceptable Weed Removal Methods

Physical Removal of Weeds

Physical control methods range from manual hand-pulling of weeds to the use of hand tools to provide enough leverage to pull out the entire plant and associated root systems. Hand or power tools can also be employed to uproot, girdle, or cut plants. The Root Talon and Weed Wrench are hand-held tools designed to grip the plant stems and provide enough leverage to remove roots; they may be used to pull out woody shrubs such as tamarisk or Russian olive. The type of physical control method employed will depend upon the size and extent of weed species targeted for removal as well as the root structures of these plants. Physical removal efforts should be focused on weed species that have a single-root mass, facilitating easy removal. Hand removal by pulling is appropriate when the plants are large enough that they will not break and leave the roots structures behind to re-sprout. For localized weed control, this is the most effective method. Hand-pulling is less effective in large areas and with weed species that spread through an underground root system (e.g., Bermuda grass).

Hoeing can be employed in small areas to control patches of small weeds and weeds that have a single-root mass. Care must be employed when using this method adjacent to native plants so as to prevent damage to native plants. Hoeing must only be employed prior to a plant setting seed; otherwise, the disturbance will only serve to further disperse and promote the establishment of the weed species. Hoeing is less effective on larger weeds that can regenerate from cut roots. It should not be used on weeds approaching maturity, as seeds can mature and be released on cut plants. Hoed plant material should be bagged and removed off site.

Chemical Methods for Weed Removal

Herbicide application is a widely employed, effective control method for removing invasive weed species. One consideration is the possible inadvertent application of herbicide to adjacent native plants. Herbicide application can become a challenge when weeds are interspersed with native cover.

Permitting and Regulatory Requirements

Contractors will be required to obtain required permits from state and local authorities prior to application of herbicide. Permits may contain additional terms and conditions in addition to those of the IWMP. Only a State of California and federally certified contractor, who is also approved by BLM, will be permitted to perform herbicide applications. All applicators will have to hold and maintain a Qualified Applicator License from California Department of Pesticide Regulation

(CDPR). Herbicides will be applied in accordance with applicable laws, regulations, and permit stipulations. Only herbicides and adjuvants approved by the State of California and federal agency for use on public lands will be used within or adjacent to the project site. A list of approved herbicides and adjuvants is available in Appendix B. Due to concerns by USFWS and CDFW on potential adverse effects of herbicide applications on the desert tortoise, only herbicides with empirically proven low toxicity to test animals in the Pesticide Use Proposal (PUP) process will be used. This includes post-emergent herbicide formulations with the active ingredient glyphosate, and pre-emergent herbicide formulations with the active ingredients bromacil and/or diuron.

The *Final Programmatic EIS on Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States* lists 18 herbicides acceptable for use on BLM lands (USDI 2007). Guidelines for the use of chemical control of vegetation on BLM lands are presented in the *Chemical Pest Control Manual* (BLM, n.d.). These guidelines require submittal of a PUP and Pesticide Application Records (PARs) for the use of herbicides on BLM lands. Only herbicides and adjuvants approved by BLM, CDPR, and CDFW for use on public lands shall be used. A sample form required for the submittal of a PUP is included in Appendix C.

SMS will submit PARs for each use of herbicides on BLM lands within 24 hours of application to the BLM Barstow Field Office. BLM, in turn, will provide the San Bernardino County DPR with pesticide use reports. A sample form required for submittal of PARs is included in Appendix D. The occurrence of weeds within the project footprint, or where the weeds occur, will be reported to the BLM Barstow Field Office. The appropriate weed control procedures, including target species, timing of control, and method of control, will be determined in consultation with BLM personnel. SMS will be responsible for providing the necessary trained personnel or hiring a contractor to implement the required weed control procedures.

Classification

Herbicides are classified into four categories:

- **Pre-emergent herbicide:** herbicide that controls ungerminated seeds by inhibiting germination. Generally works on annuals that germinate from seed, but do not control perennial plants that germinate from bulbs, corms, rhizomes, stolons, or other vegetative structures.
- **Post-emergent herbicide:** herbicide that is lethal to emerged plants.
- **Selective herbicide:** herbicide that is active on some species of plants and not others, usually distinguishing between grasses (monocots) and broadleaf plants (dicots).
- **Non-selective herbicide:** herbicide lethal to any plant species to which it is applied.

Note that some herbicides have pre- and post-emergent activity.

Herbicides kill plants through either contact or systemic action. Contact herbicides are most effective against annual weeds and kill only the plant parts on which the chemical is deposited. Systemic herbicides are absorbed either by roots or foliar parts of a plant and are then translocated within the plant system to tissues that might be remote from the point of application. They are particularly effective against established perennial weeds, although they can also be effective against annual weeds.

Transport and Mixing

During the construction phase, herbicides will be transported to the project site on days they would be needed and in accordance with the following provisions:

- Only the needed quantity for that day's work will be transported.
- Concentrate will be transported in approved containers only and in a manner that will prevent tipping or spilling, and in a location that is isolated from the vehicle's driving compartment, food, clothing, and safety equipment.
- Mixing will be done off site, over a drip-catching device, and at a distance greater than 200 feet from open or flowing water, wetlands, or other sensitive resources. No herbicides will be applied at these areas unless authorized by appropriate regulatory agencies.
- Herbicide equipment and containers will be inspected for leaks daily. Disposal of spent containers will be in accordance with the herbicide label.
- During the operations phase of the project, herbicides will be stored only in cabinets of approved design and will be under lock and key.

Pre-emergent herbicides inhibit germination of annuals from seed, but generally do not control perennial plants that germinate from bulbs, corms, rhizomes, stolons, or other vegetative structures. Common pre-emergent herbicide classes include the following:

- **Dinitroaniline Type:** Examples of this class are pendimethalin (Weedgrass™), trifluralin (Treflan™), benefin (Balan™), and combinations of these. These herbicides provide for pre-emergence control of annual grasses and other annuals. They are mitotic (cell division) inhibitors and are primarily effective in inhibiting root growth of germinating seeds. Selectivity is physiological or chemical in nature. Some of these herbicides could be lost by volatilization, and should not be applied in temperatures above 90 degrees Fahrenheit (°F). These herbicides need to be watered into the soil for proper activation. Some can persist for several months.
- **Dithiopyr** (Dimension™) belongs to a new class of herbicide known as pyridines. It is a selective herbicide primarily used for pre-emergence annual grass control in established turfgrass. However, it can be used for post-emergence control of young grass seedlings. It inhibits cell division and cell growth of meristematic regions (growing points of roots and shoots). Dithiopyr is lost from soil by chemical and microbial degradation.
- **Bromacil and Diuron (Krovar® I DF):** These herbicides are within the uracil group. Herbicides in this group or category inhibit photosynthesis, the process by which all green plants convert light energy from the sun into sugars (food). Photosynthesis inhibitors are broadleaf herbicides, but also control annual grasses to some extent. These herbicides are applied to the soil prior to germination and once seeds germinate they are taken up by the roots and translocated to the leaves.

Post-emergent herbicides are herbicides applied to the foliage of a plant after a plant has sprouted or germinated. Post-emergent herbicides may be used on annual and perennial species. The most common post-emergent herbicide class is the following:

- **Glyphosates** (Roundup®): The most commonly used post-emergent, non-selective herbicides contain a family of chemicals called glyphosates (N-[phosphonomethyl] glycine). Glyphosate is a non-selective, systemic herbicide that is effective on many annual and perennial plants. It works by blocking an enzyme pathway that is important for plant protein synthesis, which is most effective if full coverage over the plants leaf is accomplished. However, because of systemic action, even partial coverage can result in plant mortality. The herbicide is typically used in conjunction with linseed oil or another surfactant, which aids in spreading an even layer across the surface of the leaves. Because glyphosate can also be lost to volatilization, it should not be applied when the temperature exceeds 90°F.

The U.S. Environmental Protection Agency (EPA) has deemed glyphosate to have a relatively low degree of oral and dermal acute toxicity (EPA 1993). It is considered to be immobile in soil and readily degraded by soil microbes to the metabolite aminomethyl phosphonic acid and then to carbon dioxide. EPA states that it is minimally toxic to birds, fish, aquatic invertebrates, and honeybees (EPA 1993). An example of a MSDS and specimen label of a glyphosate herbicide like Round-Up are included in Appendix E.

Application and Handling
Herbicide application will be based on information gathered from BLM. Before application of herbicide, SMS contractors will obtain any required permits from the local authorities. Permits may contain additional terms and conditions that go beyond the scope of this management plan.

Limitations
Only a State of California and federally certified contractor, who is also approved by BLM, will be permitted to perform herbicide applications. Herbicides will be applied in accordance with applicable laws, regulations, and permit stipulations. All herbicide applications must follow EPA label instructions.

Hand application methods (e.g., backpack spraying) that target individual plants will be used to treat small or scattered weed populations in rough terrain. Calibration checks of equipment will be conducted at the beginning of spraying and periodically throughout treatment to ensure that proper application rates are achieved.

Application of herbicides will be suspended when any of the following conditions exists:

- Wind velocity exceeds 10 miles per hour (mph) during application of liquids or 15 mph during application of granular herbicides
- Snow or ice covers the foliage of weeds
- Precipitation is occurring or is imminent
- Air temperatures exceed 90°F

Post-emergent Herbaceous and Woody Vegetation. Suggested management strategies and control methods for observed and potentially occurring weeds at the project site are provided in Table 3.2-2.

Pre-emergent Vegetation. The use of a pre-emergent herbicide can be a very valuable control method. All the weed species identified except salt cedar are annual plants. Most annuals propagate by seed and management of the seedbank is important in weed management involving annuals.

The areas of the PV solar array fields that will involve regular vehicular use and disturbance (e.g. access roads and truck filling area around well pads) will be managed for bare ground: these areas need to be cleared of vegetation before grading . Herbicide may be reapplied every winter, as determined by BLM and the resource agencies, to control germination of annual weed species. This would effectively control annual weed populations in areas of the project where this treatment is applied.

All pre-emergent herbicides should be applied prior to the expected germination period of the target weeds. No soil disturbance should occur for at least 1 month following application of these herbicides that are applied to the soil rather than to plant foliage.

Worker Safety

Site workers have the potential to come into contact with herbicides during application and during inverter servicing and solar array inspections in areas where herbicides have been used to control weeds. The following BMPs will be followed to ensure worker safety at the project site:

- All personnel working at the project site will follow all appropriate CDPR requirements regarding the use of herbicides.
- Pesticide safety training will be provided for all workers including training on how to use application equipment and specific safety precautions for each herbicide being applied.
- Personal protective equipment will be supplied for every worker.
- Decontamination supplies will be available to all workers who may be exposed to herbicides, including showers, soap, towels, and a change of clothing.
- Emergency information will be posted, including the location of the nearest medical facility and instructions on what to do in the event of an emergency.
- Emergency transportation will be provided in the event of accidental exposure.
- There will be project site communication and coordination during and following herbicide application so that herbicides do not contact anyone through drift.
- Application equipment will be checked regularly.
- The application area will remain closed for the recommended time before entering an area where herbicides have been applied, so that trucks and workers inspecting solar arrays and inverters are not exposed to herbicides.

Herbicide Spills and Cleanup

Reasonable precautions will be taken to avoid herbicide spills. In the event of a spill, immediate cleanup will be initiated. Contractors will keep spill kits in their vehicles and in herbicide storage areas to allow for quick and effective response to spills. The following items are to be included in the spill kit:

- Protective clothing and gloves
- Absorptive clay, “kitty litter,” or other commercial adsorbent

- Plastic bags and bucket
- Shovel
- Fiber brush and screw-in handle
- Dust pan
- Caution tape
- Highway flares (use on established roads only)
- Detergent

Response to herbicide spills will vary with the size and location of the spill, but general procedures include the following:

- Notify BLM
- Control traffic
- Dress the cleanup team in protective clothing
- Stop the leak(s)
- Contain the spilled material
- Clean up and remove the spilled herbicide or contaminated adsorptive material and soil
- Transport the spilled pesticide and contaminated material to an authorized disposal site

Competitive Vegetation
The use of native plants to out-compete invasive weed species is an effective, long-term weed control strategy incorporated for this project site. Following BMP measures laid out for the SMS project, a seed mix of native plant species will be distributed within temporary disturbance areas and in other disturbed areas following completion of the project. SMS would need BLM approval on any seed mix used for restoration. The proposed native seed mixture is included in the Draft Vegetation Resources Management Plan for the project (CSESA 2013b). Establishment of these species has the potential to exclude weeds so that weed control will require less effort over time.

Alteration of Soil Carbon to Nitrogen Ratios to Suppress Annual Weeds
The main target weed present on the project site is Saharan mustard. This species is a fast-growing annual species that germinates when soil moisture and soil nitrogen, in readily available forms (i.e., ammonium and nitrate), are present in the soil environment. Native desert soils are nitrogen- and moisture-limited; however, atmospheric nitrogen in dust, emissions from combustion of hydrocarbons, and airborne particulates associated with regional urbanization are increasing throughout the Mojave Desert (Allen et al. 2006). These particulates settle on surfaces such as solar panels and are concentrated in the runoff from these surfaces creating areas with increased soil nitrogen and moisture that may favor fast-growing weedy species. This concentration of nitrogen occurs along the drip lines of solar panels. It is impossible to control the addition of water from panel washing but it may be possible to control the availability of nitrogen. The current site design states that the areas under and around the solar panels will be managed for native vegetation, primarily creosote bush scrub (Sawyer et al. 2009). Because the pre-emergent herbicide Krovar® I DF is an indiscriminant herbicide, meaning that it affects all plants, it may not be used within the rooting zone of native shrub species such as creosote bush. Research has shown that soil nitrogen is highest within 1 meter of creosote bushes, and that weedy species have been observed to

germinate at higher densities within these shrub microsites (Ewing et al. 2007). Therefore, it is important to attempt to control germination of target weed species within the creosote scrub vegetation located beneath and between solar panels.

Roundup Pro® is the only post-emergent herbicide approved by BLM and CDFW for use within the SMS project area. Tests on the effectiveness of Roundup Pro® on Saharan mustard have been inconclusive (Graham et al. 2005). The unproven effectiveness of Roundup Pro® and the restrictions on the use of Krovar® I DF make control of Saharan mustard with herbicides in areas being managed for native vegetation inadequate. Hand-pulling or other mechanical methods would be unrealistic on the more than 2,000 acres located within the solar arrays; therefore, alternative methods should be investigated.

Research conducted in the eastern Mojave by the University of Nevada and the National Park Service reported virtually no germination of Saharan mustard and greatly reduced germination of several annual introduced grasses with the application of carbon to the soil environment. Carbon was applied in a sucrose solution made from simple table sugar (DeCorte 2011). Common table sugar (sucrose) is approximately 44 percent carbon (DeCorte 2011). Sugar is easily dissolved in liquid and may be applied with a hand or vehicle-mounted sprayer. The sucrose solution was applied prior to the known germination period for the target weed species (DeCorte 2011). Other research has shown that carbon applied in the form of sawdust or other wood waste products has been effective in reducing available soil nitrogen; however, application of sawdust requires tilling of the soil surface, which is not practical or desirable within the SMS project area (Wilson and Gerry 1995). Other sources of carbon to be considered include sugarbeet waste, which has approximately 55 percent carbon (Vassilvez et al. 1995), and lignin, which has approximately 61 to 64 percent carbon (NRCS 2000). Sugarbeet waste is currently used as a dust palliative under the brand name Molex®. Molex® is applied in a liquid form using vehicle-mounted sprayers. Lignin is also used as a dust palliative in liquid form.

Prior research on the addition of carbon to desert soils has only been conducted in controlled conditions or in small, 1-meter-square test plots. A research plan using in situ 0.30-acre test plots designed to test the effectiveness of carbon addition to soils as a method of suppressing Saharan mustard within the solar arrays is included in Appendix F. It is anticipated that topical carbon applied to soils may be used in place of pre-emergent herbicides in areas in which application of indiscriminant herbicides would be harmful to native vegetation. The results of this research may direct future weed management within the SMS project area and other similar projects within the Mojave region.

6.3.2 Unacceptable Weed Removal Methods

Tilling

Tilling is a weed control practice used on agricultural lands. It is inappropriate for agricultural operations for weed control purposes. Tilling is ineffective in desert landscapes, however, where the newly disturbed ground provides habitat for weed species, and tilled weeds are likely to set seed, even after burial. In addition, tilling is likely to disturb native vegetation, and will also disrupt the natural structure and chemistry of the soil, again allowing weed seeds to proliferate in the disturbed soil environment. Weed fragments that result from tilling may spread and establish both within and outside the tilled area. Tilling would, therefore, not be conducted on the project site.

Mowing

Mowing is sometimes used to reduce weed cover late in the growing season, typically after annuals have matured. This method merely cuts back the thatch that develops during the growing season and does not remove weeds. It is sometimes used as a fire control method, but will result in an aggravation of weed infestation problems rather than the removal/control of weeds. Mowing is problematic for several reasons. Mowing would severely damage existing native plants, including small individuals that may or may not be visible at the time of mowing. Mowing, which is typically done late in the spring or early summer, would result in maturation of weed seed from existing weeds after they are cut and left to desiccate, increasing weed seed in the seed bank and ensuring a robust crop of weeds in subsequent years. Native ground and shrub nesting birds could potentially use the site as a breeding ground between February and August. The Migratory Bird Treaty Act (16 U.S.C. §§ 703–12) prohibits the "take" of migratory birds, and protects eggs, nests, and feathers, unless permitted. Take is defined in part as "pursue, hunt, take, capture, kill, or attempt to take, capture, or kill any migratory bird, any part, nest, or eggs of any such bird." Hence, mowing activity during the breeding season would potentially violate this federal law. Mowing would not be conducted on the project site.

7 MONITORING AND REPORTING

Monitoring will be performed each year during construction and operation, and annually for not less than 5 years following project decommissioning (BLM 1992). The purpose of monitoring will be to determine if weed populations identified during baseline surveys have increased in density or spread as a result of project development and if any additional weed species have established within the project area, and to determine the success of weed control, containment, and eradication measures.

Annual reports will be compiled during construction and operation to assess the effectiveness of weed management and to determine if additional monitoring or control measures are necessary. Annual reports will be submitted for the duration of the monitoring period after project decommissioning. The IWMP will be considered successful if no weed patches or statistically significant elevated weed densities are detected in the project area that can be attributed to project activities.

7.1 DATA COLLECTION AND REPORTING

Implementation of the IWMP will adhere to the data collection and reporting guidelines described below.

7.1.1 Construction Reports

During the project construction phases, ongoing reporting on noxious weed management will be included in construction weed monitoring reports. Construction weed monitoring reports will include the following information:

- Survey findings on location, type, extent, and density of noxious weeds. These data will include mapping and photographs, as appropriate, as well as textual and tabular data content to fully describe conditions on the project site. A copy of completed "Weed Record Data Sheets" for the reporting period will be included as an appendix.
- Management efforts, including date, location, type of treatment implemented, and results. Ongoing evaluation of success of treatment will be included.
- Information on implementation and success of preventative measures, including status of equipment wash facilities and summary data of use and data on the worker environmental training program, including participants.
- Summary description of restoration efforts undertaken, and their current status.

7.1.2 Long-term Monitoring Reports

Long-term monitoring reports will be focused on the success of weed abatement and revegetation efforts implemented during the operations and maintenance portion of the project.

Noxious weed management measures will be included in these reports. The reports will include the following:

- Survey findings on location, type, extent, and density of noxious weeds. These data will include mapping and photographs, as appropriate, as well as textual and tabular data content to fully describe conditions on the project site.
- Management efforts, including date of efforts, location, types of treatment implemented, and results. Ongoing evaluation of success of treatment will be included.
- The reports will also include a complete description of restoration efforts and status at meeting performance criteria.

7.2 REPORTING PERIODS

7.2.1 Construction Reports

Monthly records are anticipated from the ECA and the monitoring team during construction. These records will be summarized in an annual report describing information relevant to noxious weed management.

A single post-construction report will be produced after each phase of construction is completed at the project site, with a section summarizing the overall results of noxious weed management and weed status at the site. PARs will be provided to the BLM Barstow Field Office, CDFW, and USFWS on a monthly basis for review and approval.

7.2.2 Long-term Monitoring Reports

Annual Weed Management Reports will be produced for the duration of the monitoring period. These annual monitoring reports will be submitted to BLM's Barstow Field Office, CDFW, and USFWS for review and approval.

8 IMPACTS OF PROPOSED APPLICATION OF HERBICIDES AND RECOMMENDED BEST MANAGEMENT PRACTICES

8.1 GLYPHOSATE

8.1.1 Resources that Would Not Be Impacted by Application of Glyphosate

Project-related application of glyphosate would have no impact on the following resources:

- Air Quality
- Cultural Resources
- Environmental Justice
- Native American Cultural Values
- Recreation
- Social and Economic Values
- Visual Resources
- Soils

8.1.2 Invasive Weeds

A glyphosate herbicide, such as Roundup Pro®, is proposed for application to stands of weed species as identified in Table 3.2-2. Glyphosate is proposed as an effective means of controlling invasive weeds where there is a clump or stand of weeds. This would substantially aid in the control of weed species on the site in situations where hand-pulling and mechanical means of eradication are often ineffective. The proposed use of glyphosate would reduce the level of invasive species within the project area. Glyphosate would only be applied within areas managed by the project that are within or adjacent to the disturbance footprint. The use of a glyphosate herbicide on weed infestations within areas of proposed disturbance would reduce the likelihood that invasive species would enter adjacent areas where native vegetation is not being disturbed by project activities. Glyphosates are non-selective, systemic herbicides. Application is proposed on a spot treatment basis to remove infestations of weeds and the herbicide would not be applied in areas of native vegetation through implementation of Weed-1. Therefore, application of glyphosates would not affect the native vegetation communities in the area.

8.1.3 Waste, Hazardous or Solid

Glyphosate is hazardous according to the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR 1910.1200. Herbicides would only be handled and applied by individuals who are certified by the CDPR as Qualified Applicators (refer to Weed-2). Applicators of glyphosates may be exposed to the material and will follow all state and federal regulations as well as application guidelines. Glyphosate would be handled and stored in accordance with the product MSDS (Appendix E). The product would be applied on limited areas and small quantities would be stored on site. Due to the small quantities of material on site, there would be low environmental hazard from a potential accidental spill or release of material. If an accidental release were to occur the product would be cleaned up in accordance with the methods defined in the product MSDS and a site-specific plan defining BMPs for the project area. Glyphosate containers would be reused or disposed of in a landfill approved for pesticide disposal.

8.1.4 Water Quality

Glyphosate is approved by CDPR for application in aquatic environments because of the low toxicity to fish and aquatic species; however, glyphosate is a known groundwater contaminant. EPA has set a maximum concentration limit of 0.7 milligram per liter (mg/L) in drinking water. This standard was set to protect human health under the Clean Water Act. The BLM PEIS for *Vegetation Treatments Using Herbicide* states:

> Glyphosate is unlikely to enter waters through surface runoff or subsurface flow because it binds strongly to soils, except when the soil itself is washed away by runoff; even then, it remains bound to soil particles and generally unavailable (Rueppel et al. 1977 and Malik et al. 1989 cited in Tu et al. 2001). More recent studies found solution-phase glyphosate in 36% of 154 stream samples, while its degradation product, aminomethylphosphonic acid, was detected in 69% of the samples. The highest measured concentration of glyphosate was 8.7 μg/L, well below the USEPA's maximum concentration limit of 700 μg/L.

The washes within the project area are ephemeral and glyphosate would not be applied when it is raining (refer to BMP Weed-3,). The herbicide would, therefore, bind to the target plants or soil and would not affect water quality.

8.1.5 Wildlife/Special-status Species

Application of glyphosate would not affect wildlife or special-status species. Due to concerns of USFWS and CDFW on the potential adverse effects of herbicide applications on the desert tortoise, only herbicides with empirically proven low toxicity to test animals in the PUP process will be used on the project site. Glyphosate herbicides have proven low toxicity to test animals. As an addition precaution glyphosate would only be applied within the project footprint, in areas that are fenced from desert tortoise. Eradication of weed populations within the project area would reduce the spread of noxious weeds to areas of native vegetation and thereby improve wildlife habitat in the surrounding area by protecting the habitat from weed infestation.

8.1.6 Vegetation/Special-status Species

There are no special-status plant species in areas where glyphosate application is proposed. Glyphosate would only be applied in proposed disturbance areas where existing vegetation will be removed or compromised by construction activities. Selective application of this herbicide would, therefore, not result in additional impacts to native vegetation. Application of glyphosate may decrease the spread of invasive weeds to areas of native vegetation by improving control of invasive weeds and seed sources within the project area.

No special-status plant species have been observed within the project area during focused surveys (URS 2009; CSESA 2012; CSESA 2013). If a special-status plant species were to occur within the project area it would not be affected by the application of glyphosate. Glyphosate is only proposed for selective application in areas with monotypic stands of invasive weeds. Glyphosate would not be applied to areas containing special-status plant species or within 100 feet of Emory's crucifixion thorn (Weed-1).

8.2 BROMACIL AND DIURON MIXTURE

8.2.1 Resources that Would Not Be Impacted by Application of Bromacil and Diuron

Project-related application of bromacil and diuron would have no impact on the following resources:

- Air Quality
- Cultural Resources
- Environmental Justice
- Native American Cultural Values
- Recreation
- Social and Economic Values
- Visual Resources
- Soils

8.2.2 Invasive Weeds

A bromacil and diuron herbicide, such as Krovar® I DF, is proposed for application to certain areas to prevent emergence of weed species. Krovar® I DF is proposed as an effective means of controlling certain annual plants in areas that would be managed for bare ground (areas of the PV solar array fields that require removal of existing vegetation prior to panel construction and other construction areas requiring removal of native vegetation). Bromacil is a broad-spectrum, non-selective herbicide. Diuron is a broad-spectrum herbicide. The plants that could be treated with Krovar® I DF at the project site include:

- Species present:
  - Cheatgrass
  - Redstem filaree
  - Sahara mustard
- Species with potential to invade:
  - Bermuda grass
  - Kochia
  - Prickly lettuce
  - Puncture vine
  - Russian thistle

The herbicide will be re-applied every winter to areas managed for bare ground in order to control germination of these annual weed species. This would effectively prevent the emergence of annual weed populations in areas of the project where this treatment is applied. The herbicide would not be applied outside of the bare ground areas through implementation of Weed-1. Native vegetation communities outside the project area would, therefore, not be affected.

8.2.3 Waste, Hazardous or Solid

Bromacil and diuron are hazardous substances under 29 CFR 1910.1200 (SCBT 2009, SCBT 2011). Herbicides would be handled and applied only by individuals who are certified by the CDPR as Qualified Applicators (refer to Weed-2). Applicators of Krovar® I DF may be exposed to the material and will follow all state and federal regulations as well as application guidelines. Krovar® I DF will be handled and stored in accordance with the product MSDS (Appendix E). The product would be applied on limited areas, and small quantities would be stored on site. There would be a low possibility for an accidental spill to occur. Any spill would be localized and minor due to the small quantities of materials on site. The product would be cleaned up in accordance with the methods defined in the product MSDS and a site-specific plan defining BMPs for the project area if an accident would occur. Krovar® I DF containers would be reused or disposed of in a landfill approved for pesticide disposal.

8.2.4 Water Quality

Both active ingredients in Krovar® I DF pose an environmental hazard to groundwater.

Bromacil is a known groundwater contaminant. EPA has set a maximum concentration limit of 0.09 mg/L in drinking water. This standard was set to protect human health under the Clean Water Act. The BLM PEIS for *Vegetation Treatments Using Herbicide* states that "[t]he environmental hazards section of current product labels includes a groundwater advisory warning users not to apply bromacil in areas with permeable soils in order to protect water quality. . . . Bromacil . . . will remain dissolved in the water column and has a high potential to leach into the groundwater." Bromacil has a high potential to run off in surface water (BPA 2000a).

Diuron is a known groundwater contaminant and is a chemical contaminant candidate on the Drinking Water Contaminant Candidate List (EPA 2012). Diuron has a moderate potential of leaching into groundwater. There is a high potential for diuron to run off in surface water (BPA 2000b).

Krovar® I DF would not be applied in washes per Weed-5 to reduce the potential for impacts to water quality. The groundwater in the project area is greater than 100 feet below ground surface; therefore, the use of Krovar® I DF would not impact groundwater quality.

8.2.5 Wildlife/Special-status Species

Application of bromacil could affect wildlife species. Only herbicides with empirically proven low toxicity to test animals in the PUP process will be used on the project site due to concerns of

USFWS and CDFW regarding the potential adverse effects of herbicide applications on the desert tortoise.

The BLM PEIS for *Vegetation Treatments Using Herbicide* states that bromacil poses a moderate risk to large mammalian herbivores in foraging areas when applied at the highest allowed rate of application, but that the use of buffer zones would likely protect them from off-site drift or surface runoff. Of the weeds on site or that could invade the site and that could be treated with a bromacil solution, the highest allowed rate of application is only needed to control Bermuda grass; therefore, Weed-1 would preclude the use of Krovar® I DF to control Bermuda grass. All other applications pose low to no risk to animals.

The BLM PEIS for *Vegetation Treatments Using Herbicide* states that diuron poses a moderate risk to large mammalian herbivores from foraging at typical application rates. Diuron would only be used within fenced areas, which are inaccessible to large mammalian herbivores; therefore, any plants with spray on them would not be accessible to large mammalian herbivores.

At the maximum application rate, diuron poses a moderate risk to pollinating insects from direct spray and to small mammalian herbivores and large avian herbivores from ingesting contaminated food items. Diuron also poses a high risk to large mammalian herbivores at the maximum rate of application from ingestion of food items. Of the weeds on site or that could invade the site and that could be treated with a diuron solution, the highest allowed rate of application is only needed to control Bermuda grass. Weed-1 would preclude the use of Krovar® I DF to control Bermuda grass.

8.2.6 Vegetation/Special-status Species

There are no special-status plant species in areas where Krovar® I DF application is proposed. Krovar® I DF would only be applied in proposed disturbance areas where existing vegetation will be removed or compromised by construction activities. Selective application of this herbicide would, therefore, not result in additional impacts to native vegetation. Application of Krovar® I DF may decrease the spread of invasive weeds to areas of native vegetation by improving control of invasive weeds and seed sources within the project area.No special-status plant species have been observed within the project area during focused surveys (URS 2009; CSESA 2012; CSESA 2013). Krovar® I DF would not be applied to areas containing special-status plant species (Weed-1).

8.3 IMAZAPYR

8.3.1 Resources that Would Not Be Impacted by Application of Imazapyr

Project-related application of imazapyr would have no impact on the following resources:

- Air Quality
- Cultural Resources
- Environmental Justice
- Native American Cultural Values

- Recreation
- Social and Economic Values
- Visual Resources
- Soils

8.3.2 Invasive Weeds

An imazapyr herbicide, such as Alligare Imazapyr 4 SL, is proposed for application to tamarisk stumps to control tamarisk. Imazapyr is a post-emergent, non-selective herbicide. The herbicide will be applied to cut stumps to ensure no regrowth of the plant. This would effectively control tamarisk in areas of the project where treatment is applied. The herbicide would not be applied to any plants other than tamarisk stumps per Weed-1. Native vegetation communities outside the project area would, therefore, not be affected.

8.3.3 Waste, Hazardous or Solid

Herbicides would only be handled and applied by individuals who are certified by the CDPR as Qualified Applicators (refer to Weed-2). Applicators of imazapyr may be exposed to the material and will follow all state and federal regulations as well as application guidelines. Imazapyr would be handled and stored in accordance with the product MSDS (Appendix E). The product would be applied on limited areas and small quantities would be stored on site. Due to the small quantities of material on site, there would be low environmental hazard from a potential accidental spill or release of material. If an accidental release were to occur the product would be cleaned up in accordance with the methods defined in the product MSDS and a site-specific plan defining BMPs for the project area. Imazapyr containers would be reused or disposed of in a landfill approved for pesticide disposal.

8.3.4 Water Quality

Imazapyr is not known to be a groundwater contaminant. It has a moderate potential to leach into groundwater. There is a high potential for imazapyr to run off in surface water. Imazapyr would be applied to tamarisk that are located in a dry wash. The wash receives runoff during high precipitation events. The herbicide would be applied directly to tamarisk stumps such that there would be no herbicide spread to soil where it could run off or have the potential to reach groundwater. There would be no impact to water quality.

8.3.5 Wildlife/Special-status Species

Application of imazapyr would not affect wildlife or special-status species. Only herbicides with empirically proven low toxicity to test animals in the PUP process will be used on the project site. Imazapyr has proven low toxicity to test animals. As an additional precaution imazapyr would be applied directly to tamarisk stumps by hand-painting. Eradication of weed populations within the project area would reduce the spread of noxious weeds to areas of native vegetation and thereby improve wildlife habitat in the surrounding area by protecting the habitat from weed infestation.

8.3.6 Vegetation/Special-status Species

Imazapyr would be applied only to tamarisk stumps. The only population of tamarisk is within a wash that is dominated by cheesebush scrub vegetation. There are no special-status plant species in the area where imazapyr application is proposed. Imazapyr would be applied directly to tamarisk stumps and there will be no herbicide spread to adjacent soil or plants. Herbicide will not be applied within 48 hours of a predicted precipitation event (50 percent or greater probability). Selective application of this herbicide would, therefore, not result in additional impacts to native vegetation. Application of imazapyr may decrease the spread of invasive weeds to areas of native vegetation by improving control of invasive weeds and seed sources within the project area.

No special-status plant species have been observed within the project area during focused surveys (URS 2009; CSESA 2012; CSESA 2013). If a special-status plant species were to occur within the project area it would not be affected by the application of imazapyr. Imazapyr is only proposed for selective application to the tamarisk stumps. Imazapyr would not be applied to areas containing special-status plant species (Weed-1).

8.4 BEST MANAGEMENT PRACTICES

Weed 1: Herbicides shall not be applied systemically over the entire project area. Herbicides shall be applied in focused treatments in areas of identified infestations where there is a clump or monotypic stand of invasive weeds. Krovar® I DF shall be applied only to areas maintained as bare ground and shall not be applied at maximum rates allowed on the label. Herbicides shall not be applied within 100 feet of a special-status plant or Emory's crucifixion thorn.

Weed 2: Only a State of California and federally certified contractor (i.e., Qualified Applicator), who is also approved by BLM, will be permitted to perform herbicide applications. Herbicides will be applied in accordance with applicable laws, regulations, and permit stipulations. All herbicide applications must follow EPA label instructions.

Weed 3: Herbicides shall not be applied during rain events, or within 48 hours of a forecast rain event with a 50 percent or greater chance of precipitation.

Weed 4: Herbicide storage containers shall be disposed of in a landfill that is approved for pesticide disposal.

Weed-5: Krovar® I DF shall not be applied in washes.

Weed-6: Krovar® I DF shall not be applied at maximum application rates.

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Appendix A: Herbicide Treatment Standard Operation Procedures of the PEIS

APPENDIX B

HERBICIDE TREATMENT STANDARD OPERATING PROCEDURES

This section identifies standard operating procedures (SOPs) that will be followed by the U.S. Department of the Interior Bureau of Land Management (USDI BLM) under all alternatives to ensure that risks to human health and the environment from herbicide treatment actions will be kept to a minimum. Standard operating procedures are the management controls and performance standards required for vegetation management treatments. These practices are intended to protect and enhance natural resources that could be affected by future vegetation treatments.

Prevention of Weeds and Early Detection and Rapid Response

Once weed populations become established, infestations can increase and expand in size. Weeds colonize highly disturbed ground and invade plant communities that have been degraded, but are also capable of invading intact communities. Therefore, prevention, early detection, and rapid response are the most cost-effective methods of weed control. Prevention, early detection, and rapid response strategies that reduce the need for vegetative treatments for noxious weeds should lead to a reduction in the number of acres treated using herbicides in the future by reducing or preventing weed establishment.

As stated in the BLM's *Partners Against Weeds: An Action Plan for the BLM*, prevention and public education are the highest priority weed management activities. Priorities are as follows:

- Priority 1: Take actions to prevent or minimize the need for vegetation control when and where feasible, considering the management objectives of the site.
- Priority 2: Use effective nonchemical methods of vegetation control when and where feasible.
- Priority 3: Use herbicides after considering the effectiveness of all potential methods or in combination with other methods or controls.

Prevention is best accomplished by ensuring the seeds and vegetatively reproductive plant parts of new weed species are not introduced into new areas.

The BLM is required to develop a noxious weed risk assessment when it is determined that an action may introduce or spread noxious weeds or when known habitat exists. If the risk is moderate or high, the BLM may modify the project to reduce the likelihood of weeds infesting the site, and to identify control measures to be implemented if weeds do infest the site.

To prevent the spread of weeds, the BLM takes actions to minimize the amount of existing non-target vegetation that is disturbed or destroyed during project or vegetation treatment actions (Table B-1). During project planning, the following steps are taken:

- Incorporate measures to prevent introduction or spread of weeds into project layout, design, alternative evaluation, and project decisions.
- During environmental analysis for projects and maintenance programs, assess weed risks, analyze potential treatment of high-risk sites for weed establishment and spread, and identify prevention practices.
- Determine prevention and maintenance needs, to include the use of herbicides if needed, at the onset of project planning.
- Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.

During project development, weed infestations are prioritized for treatment in project operating areas and along access routes. Weeds present on or near the site are identified, a risk assessment is completed, and weeds are controlled as necessary. Project staging areas are weed free, and travel through weed infested areas is avoided or minimized. Examples of prevention actions to be followed during project activities include cleaning all equipment and clothing before entering the project site; avoiding soil disturbance and the creation of other soil conditions that promote weed germination and establishment; and using weed-free seed, hay, mulch, gravel, soil, and mineral materials on public lands where there is a state or county program in place.

Conditions that enhance invasive species abundance should be addressed when developing mitigation and prevention plans for activities on public lands. These conditions include excessive disturbance associated with road maintenance, poor grazing management, and high levels of recreational use. If livestock grazing is managed to maintain the vigor of native perennial plants, particularly grasses, the chance of weeds invading rangeland is much less. By carefully managing recreational use and educating the public on the potential impacts of recreational activities on vegetation, the amount of damage to native vegetation and soil can be minimized at high use areas, such as campgrounds and off-highway vehicle (OHV) trails. Early detection in recreation areas is focused on roads and trails, where much of the weed spread occurs.

The BLM participates in the National Early Warning and Rapid Response System for Invasive Plants (Figure B-1). The goal of this System to minimize the establishment and spread of new invasive species through a coordinated framework of public and private processes by:

- Early detection and reporting of suspected new plant species to appropriate officials;
- Identification and vouchering of submitted specimens by designated specialists;
- Verification of suspected new state, regional, and national plant records;
- Archival of new records in designated regional and plant databases;
- Rapid assessment of confirmed new records; and
- Rapid response to verified new infestations that are determined to be invasive.

Herbicide Treatment Planning

BLM Manual 9011 (*Chemical Pest Control*) outlines the policies, and BLM Handbook H-9011-1 (*Chemical Pest Control*) outlines the procedures, for use of herbicides on public lands. As part of policy, the BLM is required to thoroughly evaluate the need for chemical treatments and their potential for impact on the environment. The BLM is required to use only U.S. Environmental Protection Agency (USEPA)-registered herbicides that have been properly evaluated under National Environmental Policy Act (NEPA), and to carefully follow label directions and additional BLM requirements.

An operational plan is developed and updated for each herbicide project. The plan includes information on project specifications, key personnel responsibilities, and communication, safety, spill response, and emergency procedures. For application of herbicides not approved for aquatic use, the plan should also specify minimum buffer widths between treatment areas and water bodies. Recommended widths are provided in BLM Handbook H-9011-1 (*Chemical Pest Control*), but actual buffers are site and herbicide active ingredient specific, and are determined based on a scientific analysis of environmental factors, such as climate, topography, vegetation, and weather; timing and method of application; and herbicide risks to humans and non-target species. Table B-2 summarizes important SOPs that should be used when applying herbicides to help protect resources of concern on public lands.

Revegetation

Disturbed areas may be reseeded or planted with desirable vegetation when the native plant community cannot recover and occupy the site sufficiently.

Determining the need for revegetation is an integral part of developing a vegetation treatment. The most important component of the process is determining whether active (seeding/planting) or passive (natural recovery) revegetation is appropriate.

U.S. Department of the Interior policy states, "Natural recovery by native plant species is preferable to planting or seeding, either of natives or non-natives. However, planting or seeding should be used only if necessary to prevent unacceptable erosion or resist competition from non-native invasive species" (620 Departmental Memorandum 3 2004). This policy is reiterated in the USDI *Burned Area Emergency Stabilization and Rehabilitation* Manual, the BLM *Burned Area Emergency Stabilization and Rehabilitation* Manual (BLM H-1742-1), and the *Interagency Burned Area Rehabilitation Guidebook*.

TABLE B-1
Prevention Measures

BLM Activity	Prevention Measure
Project Planning	• Incorporate prevention measures into project layout and design, alternative evaluation, and project decisions to prevent the introduction or spread of weeds. • Determine prevention and maintenance needs, including the use of herbicides, at the onset of project planning. • Before ground-disturbing activities begin, inventory weed infestations and prioritize areas for treatment in project operating areas and along access routes. • Remove sources of weed seed and propagules to prevent the spread of existing weeds and new weed infestations. • Pre-treat high-risk sites for weed establishment and spread before implementing projects. • Post weed awareness messages and prevention practices at strategic locations such as trailheads, roads, boat launches, and public land kiosks. • Coordinate project activities with nearby herbicide applications to maximize the cost-effectiveness of weed treatments.
Project Development	• Minimize soil disturbance to the extent practical, consistent with project objectives. • Avoid creating soil conditions that promote weed germination and establishment. • To prevent weed germination and establishment, retain native vegetation in and around project activity areas and keep soil disturbance to a minimum, consistent with project objectives. • Locate and use weed-free project staging areas. Avoid or minimize all types of travel through weed-infested areas, or restrict travel to periods when the spread of seeds or propagules is least likely. • Prevent the introduction and spread of weeds caused by moving weed-infested sand, gravel, borrow, and fill material. • Inspect material sources on site, and ensure that they are weed-free before use and transport. Treat weed-infested sources to eradicate weed seed and plant parts, and strip and stockpile contaminated material before any use of pit material. • Survey the area where material from treated weed-infested sources is used for at least 3 years after project completion to ensure that any weeds transported to the site are promptly detected and controlled. • Prevent weed establishment by not driving through weed-infested areas. • Inspect and document weed establishment at access roads, cleaning sites, and all disturbed areas; control infestations to prevent weed spread within the project area. • Avoid acquiring water for dust abatement where access to the water is through weed-infested sites. • Identify sites where equipment can be cleaned. Clean equipment before entering public lands. • Clean all equipment before leaving the project site if operating in areas infested with weeds. • Inspect and treat weeds that establish at equipment cleaning sites. • Ensure that rental equipment is free of weed seed. • Inspect, remove, and properly dispose of weed seed and plant parts found on workers' clothing and equipment. Proper disposal entails bagging the seeds and plant parts and incinerating them.
Revegetation	• Include weed prevention measures, including project inspection and documentation, in operation and reclamation plans. • Retain bonds until reclamation requirements, including weed treatments, are completed, based on inspection and documentation. • To prevent conditions favoring weed establishment, reestablish vegetation on bare ground caused by project disturbance as soon as possible using either natural recovery or artificial techniques. • Maintain stockpiled, uninfested material in a weed-free condition.

TABLE B-1 (Cont.)
Prevention Measures

BLM Activity	Prevention Measure
Revegetation (Cont.)	• Revegetate disturbed soil (except travel ways on surfaced projects) in a manner that optimizes plant establishment for each specific project site. For each project, define what constitutes disturbed soil and objectives for plant cover revegetation. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching, as necessary. • Where practical, stockpile weed-seed-free topsoil and replace it on disturbed areas (e.g., road embankments or landings). • Inspect seed and straw mulch to be used for site rehabilitation (for wattles, straw bales, dams, etc.) and certify that they are free of weed seed and propagules. • Inspect and document all limited term ground-disturbing operations in noxious weed infested areas for at least 3 growing seasons following completion of the project. • Use native material where appropriate and feasible. Use certified weed-free or weed-seed-free hay or straw where certified materials are required and/or are reasonably available. • Provide briefings that identify operational practices to reduce weed spread (for example, avoiding known weed infestation areas when locating fire lines). • Evaluate options, including closure, to regulate the flow of traffic on sites where desired vegetation needs to be established. Sites could include road and trail rights-of-way (ROW), and other areas of disturbed soils.

In addition to these handbooks and policy, use of native and non-native seed in revegetation and restoration is guided by BLM Manual 1745 (*Introduction, Transplant, Augmentation and Reestablishment of Fish, Wildlife and Plants)*. This manual states that native species shall be used, unless it is determined through the NEPA process that: 1) suitable native species are not available; 2) the natural biological diversity of the proposed management area will not be diminished; 3) exotic and naturalized species can be confined within the proposed management area; 4) analysis of ecological site inventory information indicates that a site will not support reestablishment of a species that historically was part of the natural environment; or 5) resource management objectives cannot be met with native species.

When natural recovery is not feasible, revegetation can be used to stabilize and restore vegetation on disturbed sites and to eliminate or reduce the conditions that favor invasive species. Reseeding or replanting may be required when there is insufficient vegetation or seed stores to naturally revegetate the site.

To ensure revegetation success, there must be adequate soil for root development and moisture storage, which provides moisture to support the new plants. Chances for revegetation success are improved by selecting seed with high purity and percentage germination; selecting native species or cultivars adapted to the area; planting at proper depth, seeding rate, and time of the year for the region; choosing the appropriate planting method; and, where feasible, removing competing vegetation. Planting mixtures are adapted for the treatment area and site uses. A combination of forbs, perennial grasses, and shrubs is typically used on rangeland sites, while shrubs and trees might be favored for riparian and forestland sites. A mixture of several native plant species and types or functional groups enhances the value of the site for fish and wildlife and improves the health and aesthetic character of the site. Mixtures can better take advantage of variable soil, terrain, and climatic conditions, and thus are more likely to withstand insect infestations and survive adverse climatic conditions.

The USDI BLM Native Seed program was developed in response to Congressional direction to supply native plant material for emergency stabilization and longer-term rehabilitation and restoration efforts. The focus of the program is to increase the number of native plant species for which seed is available and the total amount of native seed available for these efforts. To date, the program has focused on native plant material needs of emergency stabilization and burned area rehabilitation in the Great Basin, but is expanding to focus on areas such as western Oregon, the Colorado Plateau, and most recently the Mojave Desert. The Wildland Fire Management Program funds and manages the effort.

The National Seed Warehouse is a storage facility for the native seed supply. Through a Memorandum of

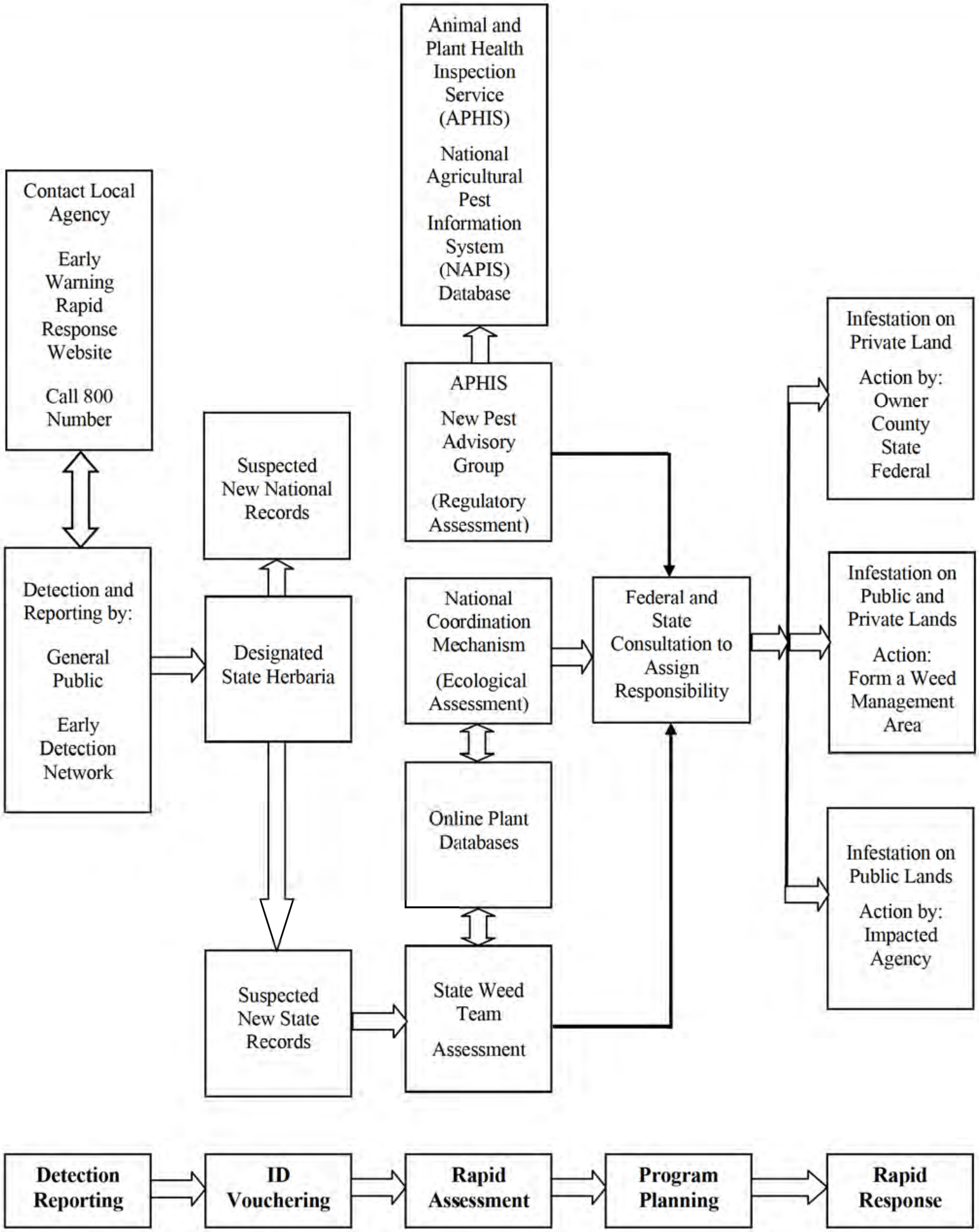

Figure B-1. National Early Warning and Rapid Response System for Invasive Plants.

Understanding with the BLM Idaho State Director, each state (Idaho, Oregon, Nevada, Utah and Colorado) can reserve an annual seed supply for purchase based on a reasonable projection of annual acreage to be stabilized or rehabilitated over a 5-year period.

The Great Basin Restoration Initiative (GBRI) grew out of concern for the health of the Great Basin after the wildfires of 1999. The goal of GBRI is to implement treatments and strategies to maintain functioning ecosystems and to proactively restore degraded ones at strategic locations. Native plants are emphasized in restoration projects where their use is practical and the potential for success is satisfactory. Monitoring is recommended to measure treatment success. To increase the availability of native plants, especially native forbs, the GBRI has established a collaborative native plant project, the Great Basin Native Plant Selection and Increase Project, to increase native plant availability and the technology to successfully establish these plants. This project is supported by funding from the BLM's Native Plant Initiative.

The BLM will follow the following SOPs when revegetating sites:

- Cultivate previously disturbed sites to reduce the amount of weed seeds in the soil seedbank.
- Revegetate sites once work is completed or soon after a disturbance.
- When available, use native seed of known origin as labeled by state seed certification programs.
- Use seed of non-native cultivars and species only when locally adapted native seed is not available or when it is unlikely to establish quickly enough to prevent soil erosion or weed establishment.
- Use seed that is free of noxious and invasive weeds, as determined and documented by a seed inspection test by a certified seed laboratory.
- Limit nitrogen fertilizer applications that favor annual grass growth over forb growth in newly seeded areas, especially where downy brome (cheatgrass) and other invasive annuals are establishing.
- Use clean equipment, free of plants and plant parts, on revegetation projects to prevent the inadvertent introduction of weeds into the site.
- Where important pollinator resources exist, include native nectar and pollen producing plants in the seed mixes used in restoration and reclamation projects. Include non-forage plant species in seed mixes for their pollinator/host relationships as foraging, nesting, or shelter species. Choose native plant species over manipulated cultivars, especially of forbs and shrubs, since natives tend to have more valuable pollen and nectar resources than cultivars. Ensure that bloom times for the flowers of the species chosen match the activity times for the pollinators. Maintain sufficient litter on the soil surfaces of native plant communities for ground-nesting bees.
- Where feasible, avoid grazing by domestic and wild animals on treatment sites until vegetation is well established. Where total rest from grazing is not feasible, efforts should be made to modify the amount and/or season of grazing to promote vegetation recovery within the treatment area. Reductions in grazing animal numbers, permanent or temporary fencing, changes in grazing rotation, and identification of alternative forage sources are examples of methods that could be used to remove, reduce or modify grazing impacts during vegetation recovery.

Special Precautions

Special Status Species

Federal policies and procedures for protecting federally-listed threatened and endangered plant and animal species, and species proposed for listing, were established by the Endangered Species Act of 1973 and regulations issued pursuant to the Act. The purposes of the Act are to provide mechanisms for the conservation of threatened and endangered species and their habitats. Under the Act, the Secretary of the Interior is required to determine which species are threatened or endangered and to issue recovery plans for those species.

Section 7 of the Act specifically requires all federal agencies to use their authorities in furtherance of the Act to carry out programs for the conservation of listed species, and to ensure that no agency action is likely to jeopardize the continued existence of a listed species or adversely modify critical habitat. Policy and guidance (BLM Manual 6840; *Special Status Species*) also stipulates that species proposed for listing must be managed at the same level of protection as listed species.

The BLM state directors may designate special status in cooperation with their respective state. These special status species must receive, at a minimum, the same level of protection as federal candidate species. The BLM will also carry out management for the conservation of state-listed species, and state laws protecting these species will apply to all BLM programs and actions to the extent that they are consistent with Federal Land Policy and Management Act (FLPMA) and other federal laws.

The BLM consulted with the U.S. Fish and Wildlife Service (UFWS) and National Marine Fisheries Service (NMFS) during development of the *Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS) as required under Section 7 of the Endangered Species Act. As part of this process, the BLM prepared a formal consultation package that included a description of the program; species listed as threatened or endangered, species proposed for listing, and critical habitats that could be affected by the program; and a Biological Assessment (BA) that evaluated the likely impacts to listed species, species proposed for listing, and critical habitats from the proposed vegetation treatment program. Over 300 species were evaluated in the BA. The BA also provides broad guidance at a programmatic level for actions that will be taken by the BLM to avoid adversely impacting species or critical habitat.

Before any vegetation treatment or ground disturbance occurs, BLM policy requires a survey of the project site for species listed or proposed for listing, or special status species. This is done by a qualified biologist and/or botanist who consults the state and local databases and visits the site at the appropriate season. If a proposed project may affect a proposed or listed species or its critical habitat, the BLM consults with the USFWS and/or NMFS. A project with a "may affect, likely to adversely affect" determination requires formal consultation and receives a Biological Opinion from the USFWS and/or NMFS. A project with a "may affect, not likely to adversely affect" determination requires informal consultation and receives a concurrence letter from USFWS and/or NMFS, unless that action is implemented under the authorities of the alternative consultation agreement pursuant to counterpart regulations established for *National Fire Plan* projects.

Wilderness Areas

Wilderness areas, which are designated by Congress, are defined by the Wilderness Act of 1964 as places "where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." The BLM manages 175 Wilderness Areas encompassing over 7.2 million acres.

Activities allowed in wilderness areas are identified in wilderness management plans prepared by the BLM. The BLM does not ordinarily treat vegetation in wilderness areas, but will control invasive and noxious weeds when they threaten lands outside wilderness area or are spreading within the wilderness and can be controlled without serious adverse impacts to wilderness values.

Management of vegetation in a wilderness area is directed toward retaining the natural character of the environment. Tree and shrub removal is usually not allowed, except for fire, insect, or disease control. Reforestation is generally prohibited except to repair damage caused by humans in areas where natural reforestation is unlikely. Only native species and primitive methods, such as hand planting, are allowed for reforestation.

Tools and equipment may be used for vegetation management when they are the minimum amount necessary for the protection of the wilderness resource. Motorized tools may only be used in special or emergency cases involving the health and safety of wilderness visitors, or the protection of wilderness values.

Habitat manipulation using mechanical or chemical means may be allowed to protect threatened and endangered species and to correct unnatural conditions, such as weed infestations, resulting from human influence.

The BLM also manages a total of 610 Wilderness Study Areas (WSAs) encompassing nearly 14.3 million acres. These are areas that have been determined to have wilderness characteristics worthy of consideration for wilderness designation. The BLM's primary goals in WSAs are to manage them so as to not impair their wilderness values and to maintain their suitability for preservation as wilderness until Congress makes a determination on their future.

In WSAs, the BLM must foster a natural distribution of native species of plants and animals by ensuring that ecosystems and processes continue to function naturally.

Cultural Resources

The effects of BLM actions on cultural resources are addressed through compliance with the National Historic Preservation Act, as implemented through a national Programmatic Agreement (*Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act*) and state-specific protocol agreements with State Historic Preservation Officers (SHPOs). The BLM's responsibilities under these authorities are addressed as early in the vegetation management project planning process as possible.

The BLM meets its responsibilities for consultation and government-to-government relationships with Native American tribes by consulting with appropriate tribal representatives prior to taking actions that affect tribal interests. The BLM's tribal consultation policies are detailed in BLM Manual 8120 (*Tribal Consultation Under Cultural Resource Authorities)* and Handbook H-8120-1 (*Guidelines for Conducting Tribal Consultation).* The BLM consulted with Native American tribes and Alaska Native groups during development of the PEIS. Information gathered on important tribal resources and potential impacts to these resources from herbicide treatments is presented in the analysis of impacts.

When conducting vegetation treatments, field office personnel consult with relevant parties (including tribes, native groups, and SHPOs), assess the potential of the proposed treatment to affect cultural and subsistence resources, and devise inventory and protection strategies suitable to the types of resources present and the potential impacts to them.

Herbicide treatments, for example, are unlikely to affect buried cultural resources, but might have a negative effect on traditional cultural properties comprised of plant foods or materials significant to local tribes and native groups. These treatments require inventory and protection strategies that reflect the different potential of each treatment to affect various types of cultural resources.

Impacts to significant cultural resources are avoided through project redesign or are mitigated through data recovery, recordation, monitoring, or other appropriate measures. When cultural resources are discovered during vegetation treatment, appropriate actions are taken to protect these resources.

TABLE B-2
Standard Operating Procedures for Applying Herbicides

Resource Element	Standard Operating Procedure
Guidance Documents	BLM Handbook H-9011-1 (*Chemical Pest Control*); and manuals 1112 (*Safety*), 9011 (*Chemical Pest Control*), 9012 (*Expenditure of Rangeland Insect Pest Control Funds*), 9015 (*Integrated Weed Management)*, and 9220 (*Integrated Pest Management*).
General	• Prepare operational and spill contingency plan in advance of treatment. • Conduct a pretreatment survey before applying herbicides. • Select herbicide that is least damaging to the environment while providing the desired results. • Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures. • Apply the least amount of herbicide needed to achieve the desired result. • Follow herbicide product label for use and storage. • Have licensed applicators apply herbicides. • Use only USEPA-approved herbicides and follow product label directions and "advisory" statements. • Review, understand, and conform to the "Environmental Hazards" section on the herbicide product label. This section warns of known pesticide risks to the environment and provides practical ways to avoid harm to organisms or to the environment. • Consider surrounding land use before assigning aerial spraying as a treatment method and avoid aerial spraying near agricultural or densely populated areas. • Minimize the size of application area, when feasible. • Comply with herbicide-free buffer zones to ensure that drift will not affect crops or nearby residents/landowners. • Post treated areas and specify reentry or rest times, if appropriate. • Notify adjacent landowners prior to treatment. • Keep a copy of Material Safety Data Sheets (MSDSs) at work sites. MSDSs are available for review at http://www.cdms.net/. • Keep records of each application, including the active ingredient, formulation, application rate, date, time, and location. • Avoid accidental direct spray and spill conditions to minimize risks to resources. • Consider surrounding land uses before aerial spraying. • Avoid aerial spraying during periods of adverse weather conditions (snow or rain imminent, fog, or air turbulence). • Make helicopter applications at a target airspeed of 40 to 50 miles per hour (mph), and at about 30 to 45 feet above ground. • Take precautions to minimize drift by not applying herbicides when winds exceed >10 mph (>6 mph for aerial applications), or a serious rainfall event is imminent. • Use drift control agents and low volatile formulations. • Conduct pre-treatment surveys for sensitive habitat and special status species within or adjacent to proposed treatment areas. • Consider site characteristics, environmental conditions, and application equipment in order to minimize damage to non-target vegetation. • Use drift reduction agents, as appropriate, to reduce the drift hazard to non-target species. • Turn off applied treatments at the completion of spray runs and during turns to start another spray run. • Refer to the herbicide product label when planning revegetation to ensure that subsequent vegetation would not be injured following application of the herbicide. • Clean OHVs to remove seeds.

TABLE B-2 (Cont.)
Standard Operating Procedures for Applying Pesticides

Resource Element	Standard Operating Procedure
Air Quality See Manual 7000 (*Soil, Water, and Air Management*)	• Consider the effects of wind, humidity, temperature inversions, and heavy rainfall on herbicide effectiveness and risks. • Apply herbicides in favorable weather conditions to minimize drift. For example, do not treat when winds exceed 10 mph (>6 mph for aerial applications) or rainfall is imminent. • Use drift reduction agents, as appropriate, to reduce the drift hazard. • Select proper application equipment (e.g., spray equipment that produces 200- to 800-micron diameter droplets [spray droplets of 100 microns and less are most prone to drift]). • Select proper application methods (e.g., set maximum spray heights, use appropriate buffer distances between spray sites and non-target resources).
Soil See Manual 7000 (*Soil, Water, and Air Management*)	• Minimize treatments in areas where herbicide runoff is likely, such as steep slopes when heavy rainfall is expected. • Minimize use of herbicides that have high soil mobility, particularly in areas where soil properties increase the potential for mobility. • Do not apply granular herbicides on slopes of more than 15% where there is the possibility of runoff carrying the granules into non-target areas.
Water Resources See Manual 7000 (*Soil, Water, and Air Management*)	• Consider climate, soil type, slope, and vegetation type when developing herbicide treatment programs. • Select herbicide products to minimize impacts to water. This is especially important for application scenarios that involve risk from active ingredients in a particular herbicide, as predicted by risk assessments. • Use local historical weather data to choose the month of treatment. Considering the phenology of the target species, schedule treatments based on the condition of the water body and existing water quality conditions. • Plan to treat between weather fronts (calms) and at appropriate time of day to avoid high winds that increase water movements, and to avoid potential stormwater runoff and water turbidity. • Review hydrogeologic maps of proposed treatment areas. Note depths to groundwater and areas of shallow groundwater and areas of surface water and groundwater interaction. Minimize treating areas with high risk for groundwater contamination. • Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body. • Do not rinse spray tanks in or near water bodies. Do not broadcast pellets where there is danger of contaminating water supplies. • Maintain buffers between treatment areas and water bodies. Buffer widths should be developed based on herbicide- and site-specific criteria to minimize impacts to water bodies. • Minimize the potential effects to surface water quality and quantity by stabilizing terrestrial areas as quickly as possible following treatment.
Wetlands and Riparian Areas	• Use a selective herbicide and a wick or backpack sprayer. • Use appropriate herbicide-free buffer zones for herbicides not labeled for aquatic use based on risk assessment guidance, with minimum widths of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications.
Vegetation See Handbook H-4410-1 (*National Range Handbook*), and manuals 5000 (*Forest Management*) and 9015 (*Integrated Weed Management*)	• Refer to the herbicide label when planning revegetation to ensure that subsequent vegetation would not be injured following application of the herbicide. • Use native or sterile species for revegetation and restoration projects to compete with invasive species until desired vegetation establishes. • Use weed-free feed for horses and pack animals. Use weed-free straw and mulch for revegetation and other activities. • Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. Consider adjustments in the existing grazing permit, to maintain desirable vegetation on the treatment site.

TABLE B-2 (Cont.)
Standard Operating Procedures for Applying Pesticides

Resource Element	Standard Operating Procedure
Pollinators	• Complete vegetation treatments seasonally before pollinator foraging plants bloom. • Time vegetation treatments to take place when foraging pollinators are least active both seasonally and daily. • Design vegetation treatment projects so that nectar and pollen sources for important pollinators and resources are treated in patches rather than in one single treatment. • Minimize herbicide application rates. Use typical rather than maximum rates where there are important pollinator resources. • Maintain herbicide free buffer zones around patches of important pollinator nectar and pollen sources. • Maintain herbicide free buffer zones around patches of important pollinator nesting habitat and hibernacula. • Make special note of pollinators that have single host plant species, and minimize herbicide spraying on those plants (if invasive species) and in their habitats.
Fish and Other Aquatic Organisms See manuals 6500 (*Wildlife and Fisheries Management*) and 6780 (*Habitat Management Plans*)	• Use appropriate buffer zones based on label and risk assessment guidance. • Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used, and use spot rather than broadcast or aerial treatments. • Use appropriate application equipment/method near water bodies if the potential for off-site drift exists. • For treatment of aquatic vegetation, 1) treat only that portion of the aquatic system necessary to achieve acceptable vegetation management, 2) use the appropriate application method to minimize the potential for injury to desirable vegetation and aquatic organisms, and 3) follow water use restrictions presented on the herbicide label.
Wildlife See manuals 6500 (*Wildlife and Fisheries Management*) and 6780 (*Habitat Management Plans*)	• Use herbicides of low toxicity to wildlife, where feasible. • Use spot applications or low-boom broadcast operations where possible to limit the probability of contaminating non-target food and water sources, especially non-target vegetation over areas larger than the treatment area. • Use timing restrictions (e.g., do not treat during critical wildlife breeding or staging periods) to minimize impacts to wildlife.
Threatened, Endangered, and Sensitive Species See Manual 6840 (*Special Status Species*)	• Survey for special status species before treating an area. Consider effects to special status species when designing herbicide treatment programs. • Use a selective herbicide and a wick or backpack sprayer to minimize risks to special status plants. • Avoid treating vegetation during time-sensitive periods (e.g., nesting and migration, sensitive life stages) for special status species in area to be treated.
Livestock See Handbook H-4120-1 (*Grazing Management*)	• Whenever possible and whenever needed, schedule treatments when livestock are not present in the treatment area. Design treatments to take advantage of normal livestock grazing rest periods, when possible. • As directed by the herbicide product label, remove livestock from treatment sites prior to herbicide application, where applicable. • Use herbicides of low toxicity to livestock, where feasible. • Take into account the different types of application equipment and methods, where possible, to reduce the probability of contamination of non-target food and water sources. • Avoid use of diquat in riparian pasture while pasture is being used by livestock. • Notify permittees of the herbicide treatment project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment. • Notify permittees of livestock grazing, feeding, or slaughter restrictions, if necessary. • Provide alternative forage sites for livestock, if possible.

TABLE B-2 (Cont.)
Standard Operating Procedures for Applying Pesticides

Resource Element	Standard Operating Procedure
Wild Horses and Burros	• Minimize using herbicides in areas grazed by wild horses and burros. • Use herbicides of low toxicity to wild horses and burros, where feasible. • Remove wild horses and burros from identified treatment areas prior to herbicide application, in accordance with herbicide product label directions for livestock. • Take into account the different types of application equipment and methods, where possible, to reduce the probability of contaminating non-target food and water sources.
Cultural Resources and Paleontological Resources See handbooks H-8120-1 (*Guidelines for Conducting Tribal Consultation*) and H-8270-1 (*General Procedural Guidance for Paleontological Resource Management*), and manuals 8100 (*The Foundations for Managing Cultural Resources*), 8120 (*Tribal Consultation Under Cultural Resource Authorities*), and 8270 (*Paleontological Resource Management*) See also: *Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act*	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the *Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act* and state protocols or 36 Code of Federal Regulations Part 800, including necessary consultations with State Historic Preservation Officers and interested tribes. • Follow BLM Handbook H-8270-1 (*General Procedural Guidance for Paleontological Resource Management*) to determine known Condition I and Condition 2 paleontological areas, or collect information through inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected by herbicide treatments. • Work with tribes to minimize impacts to these resources. • Follow guidance under Human Health and Safety in the PEIS in areas that may be visited by Native peoples after treatments.
Visual Resources See handbooks H-8410-1 (*Visual Resource Inventory*) and H-8431-1 (*Visual Resource Contrast Rating*), and manual 8400 (*Visual Resource Management*)	• Minimize the use of broadcast foliar applications in sensitive watersheds to avoid creating large areas of browned vegetation. • Consider the surrounding land use before assigning aerial spraying as an application method. • Minimize off-site drift and mobility of herbicides (e.g., do not treat when winds exceed 10 mph; minimize treatment in areas where herbicide runoff is likely; establish appropriate buffer widths between treatment areas and residences) to contain visual changes to the intended treatment area. • If the area is a Class I or II visual resource, ensure that the change to the characteristic landscape is low and does not attract attention (Class I), or if seen, does not attract the attention of the casual viewer (Class II). • Lessen visual impacts by: 1) designing projects to blend in with topographic forms; 2) leaving some low-growing trees or planting some low-growing tree seedlings adjacent to the treatment area to screen short-term effects; and 3) revegetating the site following treatment. • When restoring treated areas, design activities to repeat the form, line, color, and texture of the natural landscape character conditions to meet established Visual Resource Management (VRM) objectives.

TABLE B-2 (Cont.)
Standard Operating Procedures for Applying Pesticides

Resource Element	Standard Operating Procedure
Wilderness and Other Special Areas See handbooks H-8550-1 (*Management of Wilderness Study Areas (WSAs)*), and H-8560-1 (*Management of Designated Wilderness Study Areas*), and Manual 8351 (*Wild and Scenic Rivers*)	• Encourage backcountry pack and saddle stock users to feed their livestock only weed-free feed for several days before entering a wilderness area. • Encourage stock users to tie and/or hold stock in such a way as to minimize soil disturbance and loss of native vegetation. • Revegetate disturbed sites with native species if there is no reasonable expectation of natural regeneration. • Provide educational materials at trailheads and other wilderness entry points to educate the public on the need to prevent the spread of weeds. • Use the "minimum tool" to treat noxious and invasive vegetation, relying primarily on the use of ground-based tools, including backpack pumps, hand sprayers, and pumps mounted on pack and saddle stock. • Use chemicals only when they are the minimum method necessary to control weeds that are spreading within the wilderness or threaten lands outside the wilderness. • Give preference to herbicides that have the least impact on non-target species and the wilderness environment. • Implement herbicide treatments during periods of low human use, where feasible. • Address wilderness and special areas in management plans. • Maintain adequate buffers for Wild and Scenic Rivers (¼ mile on either side of river, ½ mile in Alaska).
Recreation See Handbook H-1601-1 (*Land Use Planning Handbook, Appendix C*)	• Schedule treatments to avoid peak recreational use times, while taking into account the optimum management period for the targeted species. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas. • Adhere to entry restrictions identified on the herbicide product label for public and worker access. • Post signs noting exclusion areas and the duration of exclusion, if necessary. • Use herbicides during periods of low human use, where feasible.
Social and Economic Values	• Consider surrounding land use before selecting aerial spraying as a method, and avoid aerial spraying near agricultural or densely-populated areas. • Post treated areas and specify reentry or rest times, if appropriate. • Notify grazing permittees of livestock feeding restrictions in treated areas, if necessary, as per herbicide product label instructions. • Notify the public of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment. • Control public access until potential treatment hazards no longer exist, per herbicide product label instructions. • Observe restricted entry intervals specified by the herbicide product label. • Notify local emergency personnel of proposed treatments. • Use spot applications or low-boom broadcast applications where possible to limit the probability of contaminating non-target food and water sources, especially vegetation over areas larger than the treatment area. • Consult with Native American tribes and Alaska Native groups to locate any areas of vegetation that are of significance to the tribes and Native groups and that might be affected by herbicide treatments. • To the degree possible within the law, hire local contractors and workers to assist with herbicide application projects and purchase materials and supplies, including chemicals, for herbicide treatment projects through local suppliers. • To minimize fears based on lack of information, provide public educational information on the need for vegetation treatments and the use of herbicides in an integrated pest management program for projects proposing local use of herbicides.

TABLE B-2 (Cont.)
Standard Operating Procedures for Applying Pesticides

Resource Element	Standard Operating Procedure
Rights-of-way	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment. • Use only herbicides that are approved for use in ROW areas.
Human Health and Safety	• Establish a buffer between treatment areas and human residences based on guidance given in the HHRA, with a minimum buffer of ¼ mile for aerial applications and 100 feet for ground applications, unless a written waiver is granted. • Use protective equipment as directed by the herbicide product label. • Post treated areas with appropriate signs at common public access areas. • Observe restricted entry intervals specified by the herbicide product label. • Provide public notification in newspapers or other media where the potential exists for public exposure. • Have a copy of MSDSs at work site. • Notify local emergency personnel of proposed treatments. • Contain and clean up spills and request help as needed. • Secure containers during transport. • Follow label directions for use and storage. • Dispose of unwanted herbicides promptly and correctly.

Appendix B: Approved Herbicides

	Herbicides Approved for Use on BLM Lands*				
				Update September 30, 2010	
ACTIVE INGREDIENT	**STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS**	**TRADE NAME**	**MANUFACTURER**	**EPA REG. NUMBER**	**CA REG. ** **
Bromacil	AK, AZ, CA, CO, ID, MT, ND,	Bromacil 80DF	Alligare, LLC	81927-4	Y
	NE, NM, NV, OK, SD, TX, UT,	Hyvar X	DuPont Crop Protection	352-287	Y
	WA, WY	Hyvar XL	DuPont Crop Protection	352-346	Y
Bromacil +	AK, AZ, CA, CO, ID, MT, ND,	Bromacil/Diuron 40/40	Alligare, LLC	81927-3	Y
Diuron	NE, NM, NV, OK, SD, TX, UT,	Krovar I DF	DuPont Crop Protection	352-505	Y
	WA, WY	Weed Blast Res. Weed Cont.	Loveland Products Inc.	34704-576	N
		DiBro 2+2	Nufarm Americas Inc.	228-227	Y
		DiBro 4+4	Nufarm Americas Inc.	228-235	N
		DiBro 4+2	Nufarm Americas Inc.	228-386	N
		Weed Blast 4G	SSI Maxim	34913-19	N
Chlorsulfuron	AK, AZ, CA, CO, ID, MT, ND,	Alligare Chlorsulfuron	Alligare, LLC	81927-43	N
	NE, NM, NV, OK, SD, TX, UT,	Telar DF	DuPont Crop Protection	352-522	Y
	WA, WY	Telar XP	DuPont Crop Protection	352-654	Y
		NuFarm Chlorsulf SPC 75 WDG Herbicide	Nufarm Americas Inc.	228-672	N
		Chlorsulfuron E-Pro 75 WDG	Nufarm Americas Inc.	79676-72	N
Clopyralid	AK, AZ, CA, CO, ID, MT, ND,	Spur	Albaugh, Inc.	42750-89	N
	NE, NM, NV, OK, SD, TX, UT,	Pyramid R&P	Albaugh, Inc.	42750-94	N
	WA, WY	Clopyralid 3	Alligare, LLC	42750-94-81927	Y
		Cody Herbicide	Alligare, LLC	81927-28	Y
		Reclaim	Dow AgroSciences	62719-83	N
		Stinger	Dow AgroSciences	62719-73	Y
		Transline	Dow AgroSciences	62719-259	Y
		CleanSlate	Nufarm Americas Inc.	228-491	Y

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Clopyralid +	AK, AZ, CA, CO, ID, MT, ND,	Commando	Albaugh, Inc.	42750-92	N
2,4-D	NE, NM, NV, OK, SD, TX, UT,	Curtail	Dow AgroSciences	62719-48	N
	WA, WY	Cutback	Nufarm Americas Inc.	71368-72	N
2,4-D	AK, AZ, CA, CO, ID, MT, ND,	Agrisolution 2,4-D LV6	Agriliance, L.L.C.	1381-101	N
	NE, NM, NV, OK, OR, SD, TX,	Agrisolution 2,4-D Amine 4	Agriliance, L.L.C.	1381-103	N
	UT, WA, WY	Agrisolution 2,4-D LV4	Agriliance, L.L.C.	1381-102	N
		2,4-D Amine 4	Albaugh, Inc./Agri Star	42750-19	Y
		2,4-D LV 4	Albaugh, Inc./Agri Star	42750-15	Y
		Solve 2,4-D	Albaugh, Inc./Agri Star	42750-22	Y
		2,4-D LV 6	Albaugh, Inc./Agri Star	42750-20	N
		Five Star	Albaugh, Inc./Agri Star	42750-49	N
		D-638	Albaugh, Inc./Agri Star	42750-36	N
		Alligare 2,4-D Amine	Alligare, LLC	81927-38	N
		2,4-D LV6	Helena Chemical Company	4275-20-5905	N
		2,4-D Amine	Helena Chemical Company	5905-72	N
		2,4-D Amine 4	Helena Chemical Company	42750-19-5905	N
		Opti-Amine	Helena Chemical Company	5905-501	N
		Barrage HF	Helena Chemical Company	5905-529	N
		HardBall	Helena Chemical Company	5905-549	N
		Unison	Helena Chemical Company	5905-542	N
		Clean Amine	Loveland Products Inc.	34704-120	N
		Low Vol 4 Ester Weed Killer	Loveland Products Inc.	34704-124	N
		Low Vol 6 Ester Weed Killer	Loveland Products Inc.	34704-125	N
		Saber	Loveland Products Inc.	34704-803	N
		Salvo	Loveland Products Inc.	34704-609	N
		Savage DS	Loveland Products Inc.	34704-606	Y
		Aqua-Kleen	Nufarm Americas Inc.	71368-4	N
		Aqua-Kleen	Nufarm Americas Inc.	228-378	N
		Esteron 99C	Nufarm Americas Inc.	62719-9-71368	N
		Weedar 64	Nufarm Americas Inc.	71368-1	Y
		Weedone LV-4	Nufarm Americas Inc.	228-139-71368	Y
		Weedone LV-4 Solventless	Nufarm Americas Inc.	71368-14	Y

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
2,4-D - cont.	AK, AZ, CA, CO, ID, MT, ND,	Weedone LV-6	Nufarm Americas Inc.	71368-11	Y
	NE, NM, NV, OK, OR, SD, TX,	Formula 40	Nufarm Americas Inc.	228-357	Y
	UT, WA, WY	2,4-D LV 6 Ester	Nufarm Americas Inc.	228-95	Y
		Platoon	Nufarm Americas Inc.	228-145	N
		WEEDstroy AM-40	Nufarm Americas Inc.	228-145	Y
		Hi-Dep	PBI Gordon Corp.	2217-703	N
		2,4-D Amine	Setre (Helena)	5905-72	N
		Barrage LV Ester	Setre (Helena)	5905-504	N
		2,4-D LV4	Setre (Helena)	5905-90	N
		2,4-D LV6	Setre (Helena)	5905-93	N
		Clean Crop Amine 4	UAP-Platte Chem. Co.	34704-5 CA	Y
		Clean Crop Low Vol 6 Ester	UAP-Platte Chem. Co.	34704-125	N
		Salvo LV Ester	UAP-Platte Chem. Co.	34704-609	N
		2,4-D 4# Amine Weed Killer	UAP-Platte Chem. Co.	34704-120	N
		Clean Crop LV-4 ES	UAP-Platte Chem. Co.	34704-124	N
		Savage DS	UAP-Platte Chem. Co.	34704-606	Y
		Cornbelt 4 lb. Amine	Van Diest Supply Co.	11773-2	N
		Cornbelt 4# LoVol Ester	Van Diest Supply Co.	11773-3	N
		Cornbelt 6# LoVol Ester	Van Diest Supply Co.	11773-4	N
		Amine 4	Wilbur-Ellis Co.	2935-512	N
		Lo Vol-4	Wilbur-Ellis Co.	228-139-2935	N
		Lo Vol-6 Ester	Wilbur-Ellis Co.	228-95-2935	N
		Base Camp Amine 4	Wilbur-Ellis Co.	71368-1-2935	N
		Broadrange 55	Wilbur-Ellis Co.	2217-813-2935	N
		Agrisolution 2,4-D LV6	Winflied Solutions, LLC	1381-101	N
		Agrisolution 2,4-D Amine 4	Winfield Solutions, LLC	1381-103	N
		Agrisolution 2,4-D LV4	Winfield Solutions, LLC	1381-102	N
Dicamba	AK, AZ, CA, CO, ID, MT, ND,	Dicamba DMA	Albaugh, Inc./Agri Star	42750-40	N
	NE, NM, NV, OK, OR, SD, TX,	Vision	Albaugh, Inc.	42750-98	N
	UT, WA, WY	Cruise Control	Alligare, LLC	42750-40-81927	N
		Banvel	Arysta LifeScience N.A. Corp.	66330-276	Y
		Clarity	BASF Corporation	7969-137	Y

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Dicamba - cont.	AK, AZ, CA, CO, ID, MT, ND,	Rifle	Loveland Products Inc.	34704-861	Y
	NE, NM, NV, OK, OR, SD, TX,	Banvel	Micro Flo Company	51036-289	Y
	UT, WA, WY	Diablo	Nufarm Americas Inc.	228-379	Y
		Vanquish Herbicide	Nufarm Americas Inc.	228-397	Y
		Vanquish	Syngenta	100-884	N
		Sterling Blue	Winfield Solutions, LLC	7969-137-1381	Y
Dicamba +	AK, AZ, CA, CO, ID, MT, ND,	Range Star	Albaugh, Inc./Agri Star	42750-55	N
2,4-D	NE, NM, NV, OK, OR, SD, TX,	Weedmaster	BASF Ag. Products	7969-133	Y
	UT, WA, WY	Outlaw	Helena Chemical Company	5905-574	N
		Rifle-D	Loveland Products Inc.	34704-869	N
		KambaMaster	Nufarm Americas Inc.	71368-34	N
		Veteran 720	Nufarm Americas Inc.	228-295	Y
		Weedmaster	Nufarm Americas Inc.	71368-34	N
		Brash	Winfield Solutions, LLC	1381-202	N
Dicamba +	AZ, CO, ID, MT, ND, NE, NM,	Distinct	BASF Corporation	7969-150	N
Diflufenzopyr	NV, OK, SD, TX, UT, WA, WY	Overdrive	BASF Corporation	7969-150	N
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), the aerial application of this herbicide is prohibited.					
Diquat	AK, AZ, CA, CO, ID, MT, ND, NE,	Alligare Diquat	Alligare, LLC	81927-35	Y
	NM, NV, OK, SD, TX, UT, WA, WY	NuFarm Diquat SPC 2 L Herbicide	Nufarm Americas Inc.	228-675	N
		Diquat SPC 2 L Herbicide	Nufarm Americas Inc.	79676-75	Y
		Diquat E-Ag 2L	Nufarm Americas Inc.	79676-75	Y
		Reward	Syngena Professional Products	100-1091	Y
Diuron	AK, AZ, CA, CO, ID, MT, ND,	Diuron 80DF	Agriliance, L.L.C.	9779-318	N
	NE, NM, NV, OK, SD, TX, UT,	Diuron 80DF	Alligare, LLC	81927-12	Y
	WA, WY	Karmex DF	DuPont Crop Protection	352-692	Y
		Karmex XP	DuPont Crop Protection	352-692	Y
		Karmex IWC	DuPont Crop Protection	352-692	Y

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Diuron - cont.	AK, AZ, CA, CO, ID, MT, ND,	Direx 4L	DuPont Crop Protection	352-678	Y
	NE, NM, NV, OK, SD, TX, UT,	Direx 80DF	Griffin Company	1812-362	Y
	WA, WY	Direx 4L	Griffin Company	1812-257	Y
		Diuron 4L	Loveland Products Inc.	34704-854	Y
		Diuron 80 WDG	Loveland Products Inc.	34704-648	N
		Diuron 4L	Makteshim Agan of N.A.	66222-54	N
		Diuron 80WDG	UAP-Platte Chem. Co.	34704-648	N
		Vegetation Man. Diuron 80 DF	Vegetation Man., LLC	66222-51-74477	N
		Diuron-DF	Wilbur-Ellis	00352-00-508-02935	N
		Diuron 80DF	Winfield Solutions, LLC	9779-318	N
Fluridone	AK, AZ, CA, CO, ID, MT, ND,	Avast!	SePRO	67690-30	Y
	NE, NM, NV, OK, SD, TX, UT,	Sonar AS	SePRO	67690-4	Y
	WA, WY	Sonar Precision Release	SePRO	67690-12	Y
		Sonar Q	SePRO	67690-3	Y
		Sonar SRP	SePRO	67690-3	Y
Glyphosate	AK, AZ, CA, CO, ID, MT, ND,	Aqua Star	Albaugh, Inc./Agri Star	42750-59	Y
	NE, NM, NV, OK, OR, SD, TX,	Forest Star	Albaugh, Inc./Agri Star	42570-61	Y
	UT, WA, WY	GlyStar Gold	Albaugh, Inc./Agri Star	42750-61	Y
		Gly Star Original	Albaugh, Inc./Agri Star	42750-60	Y
		Gly Star Plus	Albaugh, Inc./Agri Star	42750-61	Y
		Gly Star Pro	Albaugh, Inc./Agri Star	42750-61	Y
		Glyphosate 4 PLUS	Alligare, LLC	81927-9	Y
		Glyphosate 5.4	Alligare, LLC	81927-8	Y
		Glyfos	Cheminova	4787-31	Y
		Glyfos PRO	Cheminova	67760-57	Y
		Glyfos Aquatic	Cheminova	4787-34	Y
		ClearOut 41 Plus	Chem. Prod. Tech., LLC	70829-3	N
		Accord Concentrate	Dow AgroSciences	62719-324	Y
		Accord SP	Dow AgroSciences	62719-322	Y
		Accord XRT	Dow AgroSciences	62719-517	Y
		Accord XRT II	Dow AgroSciences	62719-556	Y

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Glyphosate - cont.	AK, AZ, CA, CO, ID, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WA, WY	Glypro	Dow AgroSciences	62719-324	Y
		Glypro Plus	Dow AgroSciences	62719-322	Y
		Rodeo	Dow AgroSciences	62719-324	Y
		Mirage	Loveland Products Inc.	34704-889	Y
		Mirage Plus	Loveland Products Inc.	34704-890	Y
		Aquamaster	Monsanto	524-343	Y
		Roundup Original	Monsanto	524-445	Y
		Roundup Original II	Monsanto	524-454	Y
		Roundup Original II CA	Monsanto	524-475	Y
		Honcho	Monsanto	524-445	Y
		Honcho Plus	Monsanto	524-454	Y
		Roundup PRO	Monsanto	524-475	Y
		Roundup PRO Concentrate	Monsanto	524-529	Y
		Roundup PRO Dry	Monsanto	524-505	Y
		Roundup PROMAX	Monsanto	524-579	Y
		Aqua Neat	Nufarm Americas Inc.	228-365	Y
		Credit Xtreme	Nufarm Americas Inc.	71368-81	Y
		Foresters	Nufarm Americas Inc.	228-381	Y
		Razor	Nufarm Americas Inc.	228-366	Y
		Razor Pro	Nufarm Americas Inc.	228-366	Y
		GlyphoMate 41	PBI/Gordon Corporation	2217-847	Y
		AquaPro Aquatic Herbicide	SePRO Corporation	62719-324-67690	Y
		Rattler	Setre (Helena)	524-445-5905	Y
		Buccaneer	Tenkoz	55467-10	Y
		Buccaneer Plus	Tenkoz	55467-9	Y
		Mirage Herbicide	UAP-Platte Chem. Co.	524-445-34704	Y
		Mirage Plus Herbicide	UAP-Platte Chem. Co.	524-454-34704	Y
		Glyphosate 4	Vegetation Man., LLC	73220-6-74477	Y
		Agrisolutions Cornerstone	Winfield Solutions, LLC	1381-191	Y
		Agrisolutions Cornerstone Plus	Winfield Solutions, LLC	1381-192	Y
		Agrisolutions Rascal	Winfield Solutions, LLC	1381-191	N
		Agrisolutions Rascal Plus	Winfield Solutions, LLC	1381-192	N

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Glyphosate +	AK, AZ, CA, CO, ID, MT, ND,	Landmaster BW	Albaugh, Inc./Agri Star	42570-62	N
2,4-D	NE, NM, NV, OK, OR, SD, TX,	Campaign	Monsanto	524-351	N
	UT, WA, WY	Landmaster BW	Monsanto	524-351	N
Hexazinone	AK, AZ, CA, CO, ID, MT, ND,	Velpar ULW	DuPont Crop Protection	352-450	N
	NE, NM, NV, OK, SD, TX, UT,	Velpar L	DuPont Crop Protection	352-392	Y
	WA, WY	Velpar DF	DuPont Crop Protection	352-581	Y
		Pronone MG	Pro-Serve	33560-21	N
		Pronone 10G	Pro-Serve	33560-21	Y
		Pronone 25G	Pro-Serve	33560-45	N
Hexazinone +	AK, AZ, CO, ID, MT, ND, NE,	Westar	DuPont Crop Protection	352-626	Y
Sulfometuron methyl	NM, NV, OK, SD, TX, UT, WA, WY	Oustar	DuPont Crop Protection	352-603	Y
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), the aerial application of these herbicides is prohibited.					
Imazapic	AZ, CO, ID, MT,ND, NE, NM,	Panoramic 2SL	Alligare, LLC	66222-141-81927	N
	NV, OK, SD, TX, UT, WA, WY	Plateau	BASF	241-365	N
Imazapic +	AZ, CO, ID, MT,ND, NE, NM,	Journey	BASF	241-417	N
Glyphosate	NV, OK, SD, TX, UT, WA, WY				
Imazapyr	AK, AZ, CA, CO, ID, MT, ND,	Imazapyr 2SL	Alligare, LLC	81927-23	N
	NE, NM, NV, OK, SD, TX, UT,	Imazapyr 4SL	Alligare, LLC	81927-24	N
	WA, WY	Ecomazapyr 2SL	Alligare, LLC	81927-22	N
		Arsenal Railroad Herbicide	BASF	241-273	N
		Chopper	BASF	241-296	Y
		Arsenal Applicators Conc.	BASF	241-299	N
		Arsenal	BASF	241-346	N
		Arsenal PowerLine	BASF	241-431	N
		Stalker	BASF	241-398	N
		Habitat	BASF	241-426	Y

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Imazapyr - cont.	AK, AZ, CA, CO, ID, MT, ND,	Polaris	Nufarm Americas Inc.	228-534	Y
	NE, NM, NV, OK, SD, TX, UT,	Polaris AC	Nufarm Americas Inc.	241-299-228	Y
	WA, WY	Polaris AC	Nufarm Americas Inc.	228-480	Y
		Polaris AQ	Nufarm Americas Inc.	241-426-228	Y
		Polaris RR	Nufarm Americas Inc.	241-273-228	N
		Polaris SP	Nufarm Americas Inc.	228-536	Y
		Polaris SP	Nufarm Americas Inc.	241-296-228	Y
		Polaris Herbicide	Nufarm Americas Inc.	241-346-228	N
		SSI Maxim Arsenal 0.5G	SSI Maxim Co., Inc.	34913-23	N
		Ecomazapyr 2 SL	Vegetation Man., LLC	74477-6	N
		Imazapyr 2 SL	Vegetation Man., LLC	74477-4	N
		Imazapyr 4 SL	Vegetation Man., LLC	74477-5	N
Imazapyr +	AK, AZ, CA, CO, ID, MT, ND, NE,	Mojave 70 EG	Alligare, LLC	74477-9-81927	N
Diuron	NM, NV, OK, SD, TX, UT, WA, WY	Sahara DG	BASF	241-372	N
		Imazuron E-Pro	Etigra, LLC	79676-54	N
		SSI Maxim Topsite 2.5G	SSI Maxim Co., Inc.	34913-22	N
Imazapyr +	AK, AZ, CA, CO, ID, MT, ND,	Lineage Clearstand	DuPont Crop Protection	352-766	N
Metsulfuron methyl	NE, NM, NV, OK, SD, TX, UT,				
	WA, WY				
Imazapyr +	AK, AZ, CA, CO, ID, MT, ND,	Lineage HWC	DuPont Crop Protection	352-765	N
Sulfometuron methyl +	NE, NM, NV, OK, SD, TX, UT,	Lineage Prep	DuPont Crop Protection	352-767	N
Metsulfuron methyl	WA, WY				
NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), the aerial application of these herbicides is prohibited.					
Metsulfuron methyl	AK, AZ, CO, ID, MT, ND, NE,	MSM 60	Alligare, LLC	81927-7	N
	NM, NV, OK, SD, TX, UT, WA,	Escort DF	DuPont Crop Protection	352-439	N
	WY	Escort XP	DuPont Crop Protection	352-439	N
		Patriot	Nufarm Americas Inc.	228-391	N

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Metsulfuron methyl - cont.	AK, AZ, CO, ID, MT, ND, NE,	PureStand	Nufarm Americas Inc.	71368-38	N
	NM, NV, OK, SD, TX, UT, WA,	Metsulfuron Methyl DF	Vegetation Man., L.L.C.	74477-2	N
	WY				
Metsulfuron methyl +	AK, AZ, CO, ID, MT, ND, NE,	Cimarron Extra	DuPont Crop Protection	352-669	N
Chlorsulfuron	NM, NV, OK, SD, TX, UT, WA,	Cimarron Plus	DuPont Crop Protection	352-670	N
	WY				
Metsulfuron methyl +	AK, AZ, CO, ID, MT, ND, NE, NM	Cimarron MAX	DuPont Crop Protection	352-615	N
Dicamba + 2,4-D	NV, OK, SD, TX, UT, WA, WY				
Picloram	AZ, CO, ID, MT, ND, NE, NM,	Triumph K	Albaugh, Inc.	42750-81	N
	NV, OK, OR, SD, TX, UT, WA,	Triumph 22K	Albaugh, Inc.	42750-79	N
	WY	Picloram K	Alligare, LLC	42750-81-81927	N
		Picloram K	Alligare, LLC	81927-17	N
		Picloram 22K	Alligare, LLC	42750-79-81927	N
		Picloram 22K	Alligare, LLC	81927-18	N
		Grazon PC	Dow AgroSciences	62719-181	N
		OutPost 22K	Dow AgroSciences	62719-6	N
		Tordon K	Dow AgroSciences	62719-17	N
		Tordon 22K	Dow AgroSciences	62719-6	N
		Trooper 22K	Nufarm Americas Inc.	228-535	N
Picloram +	AZ, CO, ID, MT, ND, NE, NM,	GunSlinger	Albaugh, Inc.	42750-80	N
2,4-D	NV, OK, OR, SD, TX, UT, WA,	Picloram + D	Alligare, LLC	42750-80-81927	N
	WY	Picloram + D	Alligare, LLC	81927-16	N
		Tordon 101M	Dow AgroSciences	62719-5	N
		Tordon 101 R Forestry	Dow AgroSciences	62719-31	N
		Tordon RTU	Dow AgroSciences	62719-31	N
		Grazon P+D	Dow AgroSciences	62719-182	N
		HiredHand P+D	Dow AgroSciences	62719-182	N
		Pathway	Dow AgroSciences	62719-31	N
		Trooper 101	Nufarm Americas Inc.	228-561	N

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Picloram + 2,4-D - cont.	AZ, CO, ID, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WA, WY	Trooper P + D	Nufarm Americas Inc.	228-530	N
Picloram + 2,4-D + Dicamba	AZ, CO, ID, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WA, WY	Trooper Extra	Nufarm Americas Inc.	228-586	N
Sulfometuron methyl	AK, AZ, CA, CO, ID, MT, ND, NE, NM, NV, OK, SD, TX, UT WA, WY	SFM 75	Alligare, LLC	81927-26	Y
		Oust DF	DuPont Crop Protection	352-401	N
		Oust XP	DuPont Crop Protection	352-601	Y
		SFM E-Pro 75EG	Etigra, LLC	79676-16	Y
		Spyder	Nufarm Americas Inc.	228-408	Y
		SFM 75	Vegetation Man., L.L.C.	72167-11-74477	Y

NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), the aerial application of these herbicides is prohibited.

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Sulfometuron methyl + Chlorsulfuron	AK, AZ, CA, CO, ID, MT, ND, NE, NM, NV, OK, SD, TX, UT WA, WY	Landmark XP	DuPont Crop Protection	352-645	Y

NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), the aerial application of this herbicide is prohibited.

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Sulfometuron methyl + Metsulfuron methyl	AK, AZ, CA, CO, ID, MT, ND, NE, NM, NV, OK, SD, TX, UT WA, WY	Oust Extra	DuPont Crop Protection	352-622	N

NOTE: In accordance with the Record of Decision for the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS), the aerial application of this herbicide is prohibited.

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Tebuthiuron	AZ, CA, CO, ID, MT, ND, NE,	Alligare Tebuthiuron 80 WG	Alligare, LLC	81927-37	Y
	NM, NV, OK, SD, TX, UT, WA,	Alligare Tebuthiuron 20 P	Alligare, LLC	81927-41	Y
	WY	Spike 20P	Dow AgroSciences	62719-121	Y
		Spike 80DF	Dow AgroSciences	62719-107	Y
		SpraKil S-5 Granules	SSI Maxim Co., Inc.	34913-10	Y
Tebuthiuron +	AZ, CA, CO, ID, MT, ND, NE,	SpraKil SK-13 Granular	SSI Maxim Co., Inc.	34913-15	Y
Diuron	NM, NV, OK, SD, TX, UT, WA,	SpraKil SK-26 Granular	SSI Maxim Co., Inc.	34913-16	Y
	WY				
Triclopyr	AK, AZ, CA, CO, ID, MT, ND,	Triclopyr 4EC	Alligare, LLC	72167-53-74477	Y
	NE, NM, NV, OK, SD, TX, UT	Triclopyr 3	Alligare, LLC	81927-13	Y
	WA, WY	Triclopry 4	Alligare, LLC	81927-11	Y
		Element 3A	Dow AgroSciences	62719-37	Y
		Element 4	Dow AgroSciences	62719-40	Y
		Forestry Garlon XRT	Dow AgroSciences	62719-553	Y
		Garlon 3A	Dow AgroSciences	62719-37	Y
		Garlon 4	Dow AgroSciences	62719-40	Y
		Garlon 4 Ultra	Dow AgroSciences	62719-527	Y
		Remedy	Dow AgroSciences	62719-70	Y
		Remedy Ultra	Dow AgroSciences	62719-552	Y
		Pathfinder II	Dow AgroSciences	62719-176	Y
		Relegate	Nufarm Americas Inc.	228-521	Y
		Relegate RTU	Nufarm Americas Inc.	228-522	Y
		Tahoe 3A	Nufarm Americas Inc.	228-384	Y
		Tahoe 3A	Nufarm Americas Inc.	228-518	Y
		Tahoe 3A	Nufarm Americas Inc.	228-520	Y
		Tahoe 4E	Nufarm Americas Inc.	228-385	Y
		Tahoe 4E Herbicide	Nufarm Americas Inc.	228-517	Y
		Renovate 3	SePRO Corporation	62719-37-67690	Y
		Renovate OTF	SePRO Corporation	67690-42	Y
		Ecotriclopyr 3 SL	Vegetation Man., LLC	72167-49-74477	N
		Triclopyr 3 SL	Vegetation Man., LLC	72167-53-74477	N

ACTIVE INGREDIENT	STATES WITH APPROVAL BASED UPON CURRENT EIS/ROD & COURT INJUNCTIONS	TRADE NAME	MANUFACTURER	EPA REG. NUMBER	CA REG. **
Triclopyr + 2,4-D	AK, AZ, CA, CO, ID, MT, ND, NE, NM, NV, OK, SD, TX, UT, WA, WY	Everett	Alligare, LLC	81927-29	Y
		Crossbow	Dow AgroSciences	62719-260	Y
		Candor	Nufarm Americas Inc.	228-565	Y
Triclopyr + Clopyralid	AK, AZ, CA, CO, ID, MT, ND, NE, NM, NV, OK, SD, TX, UT, WA, WY	Prescott Herbicide	Alligare, LLC	81927-30	Y
		Redeem R&P	Dow AgroSciences	62719-337	Y
		Brazen	Nufarm Americas Inc.	228-564	Y

*** Refer to the complete label prior to considering the use of any herbicide formulation. Label changes can impact the intended use through, such things as, creation or elimination of Special Local Need (SLN) or 24 (c) registrations, changes in application sites, rates and timing of application, county restrictions, etc.**

**** Just because a herbicide has a Federal registration, and is approved under the current EIS, it may or may not be registered for use in California. This column identifies those formulations for which there is a California registration.**

Appendix C: Pesticide Use Proposal Form Sample

Example California BLM Pesticide Use Proposal

FIELD OFFICE ____________ **COUNTY** ________________ PROPOSAL NUMBER:
REFERENCE NUMBER:

LOCATION:

____

DURATION OF PROPOSAL:

____

I. PESTICIDE APPLICATION (including mixtures and surfactants):

	Trade Names	Common Names	EPA Registration No.	Manufacturer	Formulations (Liquid or Granular)	Method of Application
1						
2						
3						

MAXIMUM RATE OF APPLICATION:	
USE UNIT ON LABEL:	**POUNDS ACID EQUIVALENT/ACRE:**
1.	1.
2.	2.

INTENDED RATE OF APPLICATION:

APPLICATION DATES:

NUMBER OF APPLICATIONS:

II. PEST (List specific pest(s) and reason(s) for application):

III. MAJOR DESIRED PLANT SPECIES PRESENT:

IV. TREATMENT SITE: (Describe land type or use, size, stage of growth of target species, slope and soil type).

ESTIMATED ACRES

V. SENSITIVE ASPECTS AND PRECAUTIONS: (Describe sensitive areas [e.g., marsh, endangered, threatened, candidate and sensitive species habitat] and distance to treatment site. List measures taken to avoid impact to sensitive areas).

VI. NON-TARGET VEGETATION: (Describe the impacts, cumulative impacts, and mitigations to non-target vegetation that will be lost as a result of this chemical application).

VII. INTEGRATED PEST MANAGEMENT: (Describe how this chemical application fits into your overall integrated pest management program for the treatment area.)

Originator: Date:

Company Name: Date:

Phone:

Certified Pesticide Applicator:
(Name)

(Signature) Date:

Field Office Pesticide/Noxious Weed Coordinator:
(Name)

(Signature) Date:

APPROVALS:

____ Date:
BLM Assistant Field Manager Renewable Resources
(Signature)

APPROVALS (State Office Use Only):

____ Date:
BLM State Pesticide Coordinator
(Signature)

____ Date:
Deputy State Director, Natural Resources, Lands and Planning
(Signature)

_ CONCUR OR APPROVED
_ NOT CONCUR OR DISAPPROVED
_ CONCUR OR APPROVED WITH MODIFICATIONS

Appendix D: Pesticide Application Record Form Sample

Example California BLM Pesticide Application Records Form

1. General Information
   a. Project Name: ______________________________
   b Operator: ______________________________
   c. Pesticide Use Proposal Number: ______________________________
   d. Reference Number: ______________________________

2. Name of Applicator or Employee(s) Applying the Pesticide:

____

____

3. Date(s) of Application: __________ __________ __________
(MONTH, DAY, YEAR)

4. Time Frame of Application: ______________________________

5. Location of Application: T ______, R______, and Sec. _______ County __ __________________

6. Type of Equipment Used: ______________________________

____

7. Pesticide(s) Used: ______________________________

Company or Manufacturer's Name: ______________________________

____

Trade Name: ______________________________

____

Type of Formulation: Liquid ____/ Granular ____/

8. Rate of Application Used:
a. Active Ingredient per Acre______________________________
b. Volume of Formulation per Acre______________________________

9. Treatment Area
a. Actual Area Treated: ______________________________
b. Total Project Area: ______________________________

10. Primary Pest(s) Involved: ______________________________

____

11. Stage of Pest Development: ______________________________

____

12. Site Treated: ____/ Native Vegetation ____/ Seeded Vegetation ____/ Other

13. Weather Conditions:

a. Wind velocity: __________ b. Wind direction __________ c. Temperature __________

14. Monitoring Record (IF INSUFFICIENT SPACE-CONTINUE ON BACK):

This record is required and must be completed, except for monitoring within 24 hours after completion of application of pesticides. This record must be maintained for minimum of 10 years.

Appendix E: Example Herbicide Labels and Material Safety Data Sheets

DuPont™ Krovar® I DF

herbicide

TABLE OF CONTENTS

DuPont®

DuPont™ Krovar® I DF

herbicide

Dispersible Granules

		By Weight
Active Ingredients		80%
Bromacil [5-bromo-3-sec-butyl-6-methyluracil]	40%	
Diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea]	40%	
Other Ingredients		20%
TOTAL		100%

EPA Reg. No. 352-505 EPA Est. No. ____________

Nonrefillable Container

Net: ______________

OR

Refillable Container

Net: ______________

KEEP OUT OF REACH OF CHILDREN

CAUTION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

For medical emergencies involving this product, call toll free 1-800-441-3637.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION: Harmful if swallowed or if absorbed through skin. Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some of the materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Pilots, flaggers and groundboom applicators must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks

In addition to the above PPE, groundboom applicators must also wear: chemical-resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride.

Mixers, loaders, other applicators, and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Chemical resistant gloves made of any waterproof material such as polyethylene or polyvinylchloride.
- A NIOSH approved dust/mist filtering respirator with any N, R, P, or HE filter or with approval number prefix TC-21C.
- Chemical resistant apron when mixing, loading, or cleaning equipment or spills.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

See 'Engineering Control Statement' for additional requirements.

ENGINEERING CONTROL STATEMENT

When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

Pilots must use an enclosed cockpit that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)].

Flaggers supporting aerial applications must use an enclosed cab that meets the definition in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(5)] for dermal protection.

USER SAFETY RECOMMENDATIONS

Users should: Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet.

Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

Bromacil is known to leach through soil and has been found in ground water as a result of normal field use. Users are advised not to apply in areas where soils are permeable, particularly where ground water is used for drinking water. Consult with the pesticide state lead agency for information regarding soil permeability and aquifer vulnerability in your area.

PRODUCT INFORMATION

DuPont™ KROVAR® I DF is a dispersible granule to be mixed in water and applied as a spray for selective control of weeds in citrus and for non-crop weed control.

KROVAR® I DF controls many annual weeds and, at the highest rates allowed by this label, it controls certain perennial weeds.

Moisture is necessary to move the herbicide into the root zone of weeds. Best results are obtained if treatment is made to moist soil, and moisture is supplied by rainfall or sprinkler irrigation within two weeks after application. Weed control symptoms are slow to appear and may not become apparent until the herbicide has been carried into the root zone of the weeds by moisture. The degree and duration of control will vary with the amount of herbicide applied, soil texture, rainfall, and other soil and water management practices.

USE PRECAUTIONS AND RESTRICTIONS

KROVAR® I DF is not to be used in any recreational areas or around homes.

Injury to or loss of desirable trees or other plants may result from failure to observe the following:

Do not apply (except as recommended for crop use), or drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots. Do not use on lawns, walks, driveways, tennis courts or similar areas. Do not use in home fruit plantings nor in citrus orchards interplanted to other trees or desirable plants. Prevent drift of dry powder or spray to desirable plants. Keep from contact with fertilizers, insecticides, fungicides and seeds.

Do not apply this product through any type of irrigation system.

Do not graze cattle in treated areas.

Treated areas may be planted to citrus trees one year after last application. Do not replant to other crops within two years after last application as injury may result.

NOTE: Additional Precautions

Avoid storage of pesticides near well sites.

Calibrate sprayers only with clean water away from the well site.

Measure out only enough KROVAR® I DF for the job at hand.

Avoid over-filling the spray tank.

Do not discharge excess material as a point source.

Dilute and agitate excess spray solution and apply at labeled rates.

CROP ROTATION BIOASSAY

In sites where KROVAR® I DF has been used, a field bioassay should be completed prior to planting any desired crop. In arid climates (10 inches of rainfall or less) or areas where drought conditions have prevailed for one or more years, a field bioassay must be completed prior to planting any desired crop.

A successful field bioassay means growing to maturity a test strip of the crop(s) intended for production. The test strip should cross the entire field including knolls and low areas.

The results from the bioassay may require the two-year crop rotation interval to be extended.

SPRAY PREPARATION

Mixing in water - Fill tank 1/2 full with water. Start agitation system, add KROVAR® I DF and continue adding water. Add separately each additional component of any tank-mix while adding water. Continue agitation throughout.

Mixing in liquid fertilizer - A fertilizer solution may be used in the spray mixture. Small quantities should be tested for compatibility by the following procedures before full scale mixing.

1. Put 1 pint fertilizer solution in a quart jar.
2. Mix 2 teaspoonfuls KROVAR® I DF with 2 tablespoons of water; mix thoroughly and add to fertilizer solution.
3. Close jar and shake well.
4. If other herbicides are used in the mixture, premix 2 teaspoons of dry materials or 1 teaspoon of liquids with 2 tablespoons of water; add to KROVAR® I DF-fertilizer solution mixture.
5. Close jar and shake well.
6. Watch mixture for several seconds; check again in 30 minutes.
7. If mixture does not separate, foam, gel or become lumpy, it may be used.

Provided the above procedure shows the mixture to be compatible, prepare the tank mixture as follows: Add the fertilizer solution to the spray tank first; with agitator running, add the required amount of KROVAR® I DF and thoroughly mix.

Mixing with other herbicides - Determine the tank mixture partner(s) compatibility with KROVAR® I DF by following the directions above. For Step 1 above, use 1 pint of water instead of the liquid fertilizer. Provided the above procedure shows the mixture to be compatible, KROVAR® I DF may be used in this tank mixture.

SPRAY TANK CLEAN OUT

Thoroughly clean all traces of DuPont™ KROVAR® I DF from application equipment immediately after use. Flush the tank, pump, hoses, and boom with several changes of water after removing nozzle tips and screens (clean these parts separately). Dispose of the equipment wash water by applying it to a use-site listed on this label.

RESISTANCE

When herbicides that affect the same biological site of action are used repeatedly over several years to control the same weed species in the same field, naturally-occurring resistant biotypes may survive a correctly applied herbicide treatment, propagate, and become dominant in that field. Adequate control of these resistant weed biotypes cannot be expected. If weed control is unsatisfactory, it may be necessary to retreat the problem area using a product affecting a different site of action.

To better manage herbicide resistance through delaying the proliferation and possible dominance of herbicide resistant weed biotypes, it may be necessary to change cultural practices within and between crop seasons such as using a combination of tillage, retreatment, tank-mix partners and/or sequential herbicide applications that have a different site of action. Weed escapes that are allowed to go to seed will promote the spread of resistant biotypes.

It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes. Consult your agricultural dealer, consultant, applicator, and/or appropriate state agricultural extension service representative for specific alternative cultural practices or herbicide recommendations available in your area.

INTEGRATED PEST MANAGEMENT

This product may be used as part of an Integrated Pest Management (IPM) program that can include biological, cultural, and genetic practices aimed at preventing economic pest damage. IPM principles and practices include field scouting or other detection methods, correct target pest identification, population monitoring, and treating when target pest populations reach locally determined action thresholds. Consult your state cooperative extension service, professional consultants or other qualified authorities to determine appropriate action treatment threshold levels for treating specific pest/crop systems in your area.

DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling. DuPont™ KROVAR® I DF herbicide must only be used in accordance with instructions on this label. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Use of this product in certain portions of California, Oregon, and Washington is subject to the January 22, 2004 Order for injunctive relief in Washington Toxics Coalition et al vs EPA, Co1-132C (W.D. W.A.). For information, please refer to www.epa.gov/espp/wtc/.

AGRICULTURAL USES

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment(PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

Coveralls.
Chemical Resistant Gloves made of any Waterproof material.
Shoes plus socks.

APPLICATION INFORMATION

Apply KROVAR® I DF with a properly calibrated fixed-boom power sprayer as a band or broadcast treatment. Apply any time of year provided overhead moisture (rainfall or sprinkler irrigation) is available to activate the herbicide, preferably just before or just after weeds have germinated.

All use rates of KROVAR® I DF are expressed for broadcast treatments. For band treatments, use proportionately less.

Use sufficient spray volume (minimum of 10 gallons per acre) to provide uniform coverage of the treated area and to allow proper dispersion and suspension of the product in the spray tank. Continuous agitation in the spray tank is required to keep the product in suspension. Agitate spray tank contents by mechanical or hydraulic means. If a by-pass or return line is used, it should terminate at a bottom of tank to minimize foaming. Do not use air agitation.

Best results are obtained if KROVAR® I DF is applied to bare ground. If weeds are present at application, tank mixtures with foliar active herbicides are recommended (see Tank Mixtures section of label). If dense populations of hard-to-kill weed species are present, control of these weeds prior to application of KROVAR® I DF is recommended.

TANK MIXTURES

KROVAR® I DF may be tank mixed with other suitable herbicides registered for use in citrus. Refer to the tank mixture partner label(s) for any additional use information or restrictions. Follow the label guidelines that are the most restrictive.

KROVAR® I DF may also be tank mixed with appropriate adjuvants used with herbicides in citrus.

NOTE: If there is no prior use experience with the tank mixture combination, a compatibility test should be performed prior to adding the products into the spray tank. See SPRAY PREPARATION section of the label for further information.

When using DuPont™ KROVAR® I DF alone or in combination, thoroughly re-agitate the spray tank contents if allowed to settle.

WEEDS CONTROLLED

Annuals

Barnyardgrass	*Echinochloa crus-galli*
Brome, downy (cheatgrass)	*Bromus tectorum*
Chickweed, common	*Stellaria media*
Chickweed, mouseear	*Cerastium vulgatum*
Clovers (annual)	*Trifolium spp.*
Filaree	*Erodium spp.*
Fleabane, flaxleaved (hairy)	*Conyza bonariensis*
Foxtail	*Setaria spp.*
Goatweed	*Scoparia dulcis*
Groundsel	*Senecio spp.*
Horseweed (marestail)	*Conyza candadensis*
Johnsongrass	*Sorghum halepense*
Junglerice	*Echinochloa colona*
Kochia	*Kochia scoparia*
Lambsquarter	*Chenopodium album*
Lettuce, wild	*Lactuca serriola*
Mustard, wild	*Brassica kaber*
Natalgrass (red top)	*Rhynchelytrum repens*
Nightshade (annual)	*Solanum spp.*
Pigweed	*Amaranthus spp.*
Pineappleweed	*Matricaria matricariodes*
Puncturevine, common	*Tribulus terrestris*
Purslane, common	*Portulaca oleracea*
Pusley, Florida	*Richardia scraba*
Ragweed, common	*Ambrosia artemisifolia*
Sandbur (sandspur)	*Cenchrus spp.*
Shepherdspurse	*Capsella bursa-pastoris*
Sowthistle, annual	*Sonchus oleraceus*
Spanishneedles	*Bidens pilosa*
Thistle, Russian	*Salsola australis*

Perennials (At maximum rates and repeat treatments)

Balsamapple vine (seedling)	*Momordica charantia*
Bermudagrass	*Cynodon dactylon*
Drymary	*Drymaria spp.*
Guineagrass	*Panicum maximum*
Milkweed vine (strangler)	*Morrenia odorata*
Quackgrass	*Agropyron repens*
Vines (seedlings)	

NOTE: Use the highest rates allowed by this label for best control of perennial weeds listed on this label. Partial control of perennial weeds can result with only a single treatment of KROVAR® I DF. Repeat applications are required (in season and/or annually) for best control of the perennial weeds on this label. Control of perennials may be improved by cultivation prior to treatment, otherwise, avoid working the soil as long as weed control continues or else effectiveness of the treatment may be reduced.

CITRUS

Apply KROVAR® I DF as a band or broadcast treatment beneath and/or between trees. Aerial application is prohibited in citrus.

Avoid contact of citrus foliage and fruit with spray or mist. Avoid overlapping and shut off spray boom while starting, turning, slowing or stopping as injury to trees may result.

Temporary yellowing of citrus leaves may occur following treatment. As injury to citrus trees may result, do not use on soils with less than 1% organic matter. Do not use on poorly drained soils, gravelly soils or thinly covered or exposed sub-soils.

Do not treat trees planted in irrigation furrows. Do not treat diseased or stressed citrus trees.

Do not use in citrus groves inter-planted with other trees or desirable plants or in areas where roots of desirable plants or trees may extend, as injury may result.

For all states listed below, when making multiple applications, do not apply at less than 60 day intervals to trees less than 4 years old and 80 days to trees 4 years old or greater. A maximum of two applications of product per year is allowed. Thoroughly clean all traces of KROVAR® I DF from application equipment immediately after use. Flush tank, pump, hoses and boom with several changes of water after removing nozzle tips and screens (clean these parts separately.)

CALIFORNIA, ARIZONA

Trees Established for at least Three Years: Best results occur when applied in late fall or early winter, but before winter annuals become well established. Application should be made after the first fall or early winter rains have settled the soil.

For the initial treatment, apply 4-5 pounds KROVAR® I DF per acre on coarse soils containing 1-2% organic matter and 5-6 pounds per acre on fine soils, or soils with organic matter of 2 1/2% or more. Alternatively, apply 3-4 pounds per acre in the fall and repeat at 2-4 pounds per acre in the spring. Do not exceed 6 pounds per acre per year.

Use the highest rate allowed by this label where groundsel or puncturevine are known to be a problem. These rates will also suppress low density stands of bermudagrass and yellow nutsedge. Repeat annually for best treatment effect.

FLORIDA

USE RESTRICTIONS

The use of KROVAR® I DF (bromacil + diuron) is prohibited for weed control in non-bedded citrus groves located on any permeable, better drained soil identified in the intended site of application. Permeable, better drained soils which occur in citrus producing areas of the state include soils unnamed and characteristic of quartzipsamments, and the following soil series classifications:

Adamsville	Dade	Orsino
Archbold	Florahome	Palm Beach
Astatula	Fort Meade	Paola
Bahiahonda	Gainesville	Satellite
Broward	Lake	St. Augustine
Canaveral	Lakewood	St. Lucie
Candler	Neilhurst	Tavares
Cocoa	Orlando	

APPLICATION INSTRUCTIONS

Apply KROVAR® I DF as a band treatment only using a properly calibrated fixed-boom power sprayer. **Do not use Trunk to Trunk.** All use rates of KROVAR® I DF are expressed for broadcast treatments. For band treatments, use proportionately less.

Use sufficient spray volume (minimum of 10 gallons per acre) to provide uniform coverage of the treated area and to allow proper dispersion and suspension of the product in the spray tank. Continuous agitation in the spray tank is required to keep the product in suspension.

Do not apply more than 16 pounds of KROVAR® I DF per treated acre per year. This amount corresponds to 6.4 pounds of bromacil and 6.4 pounds of diuron, the active ingredients in KROVAR® I DF .

The maximum allowable use rate for bromacil is 6.4 pounds per treated acre per year inclusive of all bromacil formulations. The maximum allowable use rate for diuron is 6.4 pounds per treated acre per year inclusive of all diuron formulations.

Multiple applications may improve control of “hard-to-kill” weed species.

Trees Established Less Than One Year: For control of annual weeds, apply 2-4 pounds of DuPont™ KROVAR® I DF per treated acre to maintain weed control. Do not apply more than 6 pounds per treated acre during any 6 month period nor more than 8 pounds per treated acre during the first year.

Trees Established One to Three Years: For control of annual weeds, apply 2-4 pounds of KROVAR® I DF per treated acre. A second application may be made when needed to maintain weed control, but do not exceed 8 pounds per treated acre per year.

Trees Established Three or More Years: Apply 4-8 pounds per treated acre to maintain weed control. Do not apply more than 16 pounds of KROVAR® I DF per treated acre per year.

LOUISIANA

Trees Established for at least Three Years: Make a single application of 2 to 4 pounds per acre on coarser soils (sands, loamy sands, sandy loams) and 4 to 6 pounds per acre on finer soils (silt loams, clay loams, or soils with organic matter of 2 1/2% or more); use the highest rate allowed by this label for maximum suppression of perennials. Alternatively, make two applications per year at rates of 2 pounds per acre on coarser soils and 3 pounds per acre on finer soils; make the second application when needed to maintain weed control. Do not apply more than 6 pounds per acre per year.

TEXAS

Trees Established Less than One Year: Apply 2-4 pounds KROVAR® I DF per acre to maintain weed control. Do not apply at less than 60-day intervals. Do not apply more than 6 pounds per acre per year.

Trees Established One or Two Years: Apply 2-4 pounds KROVAR® I DF per acre. A second application may be made when needed to maintain weed control, but do not exceed 6 pounds per acre per year.

Trees Established Three or More Years: Make one to two applications per year to maintain weed control. Use 2-4 pounds per acre on coarser soils (sands, loamy sands, sandy loams) and 4-6 pounds per acre on finer soils (silt loams, clay loams, or soils with organic matter of 2 1/2 % or more). Use the higher rate for maximum suppression of perennials. Do not use more than 6 pounds per acre per year.

NON-AGRICULTURAL USES

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Noncrop weed control is not within the scope of the Worker Protection Standard.

Do not enter or allow others to enter the treated area until sprays have dried.

USE RESTRICTIONS - STATE OF FLORIDA

In the state of Florida the use of KROVAR® I DF (bromacil + diuron) is prohibited in the counties of Hardee, Highland, Polk, Orange and Lake. For Non-Agricultural Usage in all other areas of the state, do not apply more than 16 pounds per acre per year of KROVAR® I DF. This amount corresponds to 6.4 pounds of bromacil and 6.4 pounds of diuron, the active ingredients in KROVAR® I DF. The maximum allowable use rate for bromacil is 6.4 pounds per acre per year inclusive of all bromacil formulations.

APPLICATION INFORMATION

KROVAR® I DF is recommended for general weed control as follows: uncultivated non-agricultural areas (such as, airports, highway, railroad and utility rights-of-way, sewage disposal areas); uncultivated agricultural areas (non-crop producing, which includes: farmyards, fuel storage areas, fence rows, barrier strips); industrial sites (outdoor, such as, lumberyards, pipeline and tank farms).

Apply KROVAR® I DF using a properly calibrated fixed-boom power sprayer. Use sufficient spray volume (minimum of 10 gallons per acre) to provide uniform coverage of the treated area and to allow proper dispersion and suspension of the product in the spray tank. All rates of KROVAR® I DF are expressed for broadcast treatments. For band treatments, use proportionately less.

A maximum of 12 pounds active ingredient bromacil per acre per year is allowed. A maximum of 12 pounds active ingredient diuron is allowed per acre per year in areas of high rainfall or dense vegetation. A maximum of 8 pounds of active ingredient diuron is allowed in all other areas. Apply a maximum of two applications per year. The minimum retreatment interval is 90 days.

Combination with other herbicides broadens the spectrum of weeds controlled. In addition, total vegetation control can be achieved with higher rates of KROVAR® I DF plus residual-type companion herbicides. To improve the control of emerged weeds, add surfactant at 0.25% by volume.

Note: Applications may also be made using a handgun sprayer. Use a spray volume of at least 40 gallons per acre to insure uniform coverage. For small areas, a hand sprayer or sprinkling may be used.

NON-CROP WEED CONTROL

APPLICATION TIMING

Apply DuPont™ KROVAR® I DF as a preemergence spray prior to or during the rainy season when weeds are actively germinating or growing. Moisture is required to activate and move KROVAR® I DF into the root zone of weeds for preemergence control. For best preemergence control, apply prior to rainfall and weed germination.

In arid regions of the Western U.S., to insure adequate moisture for activation and even dispersion of the herbicide in the soil profile, KROVAR® I DF should be applied several weeks prior to the Fall freeze or shortly after Spring thaw to coincide with periods of higher seasonal moisture probability. Do not treat frozen or saturated soils, or soils that are non-receptive to percolation.

Do not apply to sites which have roots of desirable plants growing into the treatment zone as plant injury or death may occur. Do not apply to hard or impervious soils, water saturated soils or to any surface that does not allow the herbicide to be moved into the soil horizon with moisture. Unusually heavy rainfall shortly after application may move the product off-target to the lowest surrounding point and cause plant injury or death.

If herbicide treated soil is disturbed by any physical or mechanical means, the herbicide barrier is disrupted and the likelihood of non-performance may increase. For best performance results, make sure the treatment area is stable after the application for the desired weed control period.

APPLICATION RATES

Apply KROVAR® I DF at the rates indicated by weed type. When applied at lower rates, KROVAR® I DF provides short-term control of weeds listed; when applied at higher rates, weed control is extended.

WEEDS CONTROLLED

KROVAR® I DF effectively controls the following broadleaf weeds and grasses when applied at the rates shown.

Broadleaf Weeds--6-8 pounds per acre

Clovers (annual)	*Trifolium spp.*
Fiddleneck	*Amsinckia intermedia*
Filaree	*Erodium spp.*
Knapweed, diffuse	*Centaurea diffusa*
Lambsquarter, common	*Chenopodium album*
Lettuce, prickly	*Lactuca serriola*
Mustards	*Brassica spp.*
Pigweed	*Amaranthus spp.*
Ragweed	*Ambrosia spp.*
Sunflower, common	*Helianthus annuus*
Thistle, Russian	*Salsola iberica*

Broadleaf Weeds--8-12 pounds per acre

Carrot, wild	*Daucus carota*
Dandelion, common	*Taraxacum officinale*
Dock, curly	*Rumex crispus*
Knapweed, spotted	*Centaurea maculosa*
Knotweed, prostrate	*Polygonum aviculare*
Kochia	*Kochia scoparia*
Marestail, common (horseweed)	*Conyza canadensis*
Parsnip, wild	*Pastinaca sativa*
Plantain	*Plantago spp.*
Puncturevine	*Tribulus terrestris*
Spurge	*Euphorbia spp.*
Thistle, milk	*Silybum marianum*
Yarrow, common	*Achillea millefolium*

Broadleaf Weeds--12-16 pounds per acre

Cinquefoil, common	*Potentilla canadensis*
Goldenrod	*Solidago spp.*
Milkweed, common	*Asclepias syriaca*

Grasses--6-8 pounds per acre

Barley, foxtail	*Hordeum jubatum*
Brome	*Bromus spp.*
Cheat	*Bromus secalinus*
Cupgrass, Prairie	*Eriochloa contracta*
Foxtail	*Setaria spp.*
Oat, wild	*Avena fatua*
Ryegrass, Italian	*Lolium multiflorum*
Quackgrass	*Agropyron repens*
Wheatgrass, intermediate	*Agropyron intermedium*

Grasses--8-12 pounds per acre

Bahiagrass	*Paspalum notatum*
Crabgrass	*Digitaria spp.*
Goosegrass	*Eleusine indica*
Rye	*Secale cereale*
Vaseygrass	*Paspalum urvillei*

Grasses--12-16 pounds per acre

Bluegrass	*Poa spp.*
Dropseed, sand *	*Sporobolus cryptandrus*
Fescue	*Festuca spp.*
Saltgrass*	*Distichlis spp.*

*Note: Best control of Saltgrass and Sand Dropseed is achieved from a Spring application prior to plant green-up.

For control of hard-to-kill perennials such as bermudagrass (Cynodon dactylon), bouncingbet (Saporaria officinalis), dogbane (Apocynum spp.), Johnsongrass (Sorghum halepense), and nutsedge (Cyperus spp.) apply 19 - 30 pounds per acre (except Florida).

For extended control of annual weeds and partial control of perennials such as bermudagrass and nutsedge, apply 10-18 pounds* per acre. Use the higher KROVAR® I DF rates on adsorptive soils (high in organic matter or carbon). Best results occur when application is made just before weed emergence or in the early stages of weed growth.

Retreating: Apply 4 to 6 pounds per acre when annual weeds and grasses reappear on sites where weed growth has been controlled.

Small Areas: 1/4 cupful of KROVAR® I DF per 200 sq. ft. is approximately 15 pounds per acre.

TANK MIXTURES

KROVAR® I DF may be tank mixed with other suitable herbicides registered for non-agricultural use. Refer to the tank mixture partner label(s) for any additional use information or restrictions. Follow the label guidelines that are the most restrictive.

KROVAR® I DF may also be tank mixed with appropriate adjuvants used with herbicides for non-agricultural use.

NOTE: If there is no prior use experience with the tank mixture combination, a compatibility test should be performed prior to adding the products into the spray tank. See SPRAY PREPARATION section of the label for further information.

When using KROVAR® I DF alone or in combination, thoroughly re-agitate the spray tank contents if allowed to settle.

SPECIAL USES

UNDER ASPHALT AND CONCRETE PAVEMENT

APPLICATION INFORMATION

DuPont™ KROVAR® I DF can be used to control weeds under asphalt and concrete pavement, such as that used in parking lots, highway shoulders, median strips, roadways, and other industrial sites.

KROVAR® I DF should only be used in an area that has been prepared according to good constructions practices. Use sufficient water to insure uniform coverage, generally 100 gal per acre. Agitate the tank continuously to keep KROVAR® I DF in suspension.

APPLICATION TIMING

KROVAR® I DF should be applied immediately before paving to avoid lateral movement of the herbicide as a result of soil movement due to rainfall or mechanical means.

APPLICATION RATES

Apply KROVAR® I DF at 17 to 30 pounds per acre. Use a higher rate for hard to control weeds and/or for longer term weed control.

TANK MIXTURES

To control a broader spectrum of weeds, or for an extended period of weed control, a tank mixture of KROVAR® I DF at 7 to 15 pounds per acre plus DuPont™ OUST® XP at 4 to 8 ounces per acre may be used .

IMPORTANT PRECAUTIONS-UNDER ASPHALT ONLY

- Do not use KROVAR® I DF under pavement in residential properties such as driveways, or in recreational areas, including jogging or bike paths, tennis courts, or golf cart paths.
- Desirable plants may be injured if their roots extend into treated areas or if planted in treated areas.

SPRAY DRIFT MANAGEMENT

The interaction of many equipment and weather-related factors determines the potential for spray drift. The applicator is responsible for considering all these factors when making application decisions.

AVOIDING SPRAY DRIFT IS THE RESPONSIBILITY OF THE APPLICATOR.

IMPORTANCE OF DROPLET SIZE

The most effective way to reduce drift potential is to apply large droplets (>150 - 200 microns). The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. The presence of sensitive species nearby, the environmental conditions, and pest pressure may affect how an applicator balances drift control and coverage. APPLYING LARGER DROPLETS REDUCES DRIFT POTENTIAL, BUT WILL NOT PREVENT DRIFT IF APPLICATIONS ARE MADE IMPROPERLY OR UNDER UNFAVORABLE ENVIRONMENTAL CONDITIONS! See **Wind**, **Temperature and Humidity**, and **Surface Temperature Inversions** sections of this label.

CONTROLLING DROPLET SIZE - GENERAL TECHNIQUES

- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Use the lower spray pressures recommended for the nozzle. Higher pressure reduces droplet size and does not improve canopy penetration. WHEN HIGHER FLOW RATES ARE NEEDED, USE A HIGHER-CAPACITY NOZZLE INSTEAD OF INCREASING PRESSURE.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles.

CONTROLLING DROPLET SIZE - AIRCRAFT

- **Number of Nozzles** - Use the minimum number of nozzles with the highest flow rate that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is emitted backwards, parallel to the airstream will produce larger droplets than other orientations.
- **Nozzle Type** - Solid stream nozzles (such as disc and core with swirl plate removed) oriented straight back produce larger droplets than other nozzle types.

BOOM LENGTH AND HEIGHT

- **Boom Length (aircraft)** - The boom length should not exceed 3/4 of the wing length, using shorter booms decreases drift potential. For helicopters use a boom length and position that prevents droplets from entering the rotor vortices.
- **Boom Height (aircraft)** - Application more than 10 ft above the canopy increases the potential for spray drift.
- **Boom Height (ground)** Setting the boom at the lowest height which provides uniform coverage reduces the exposure of droplets to evaporation and wind. The boom should remain level with the crop and have minimal bounce.

WIND

Drift potential increases at wind speeds of less than 3 mph (due to variable direction and inversion potential) or more than 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given wind speed. AVOID APPLICATIONS DURING GUSTY OR WINDLESS CONDITIONS.

NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they effect spray drift.

TEMPERATURE AND HUMIDITY

When making applications in hot and dry conditions, set up equipment to produce larger droplets to reduce effects of evaporation.

SURFACE TEMPERATURE INVERSIONS

Drift potential is high during a surface temperature inversion. Surface inversions restrict vertical air mixing, which causes small suspended droplets to remain close to the ground and move laterally in a concentrated cloud. Surface inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates a surface inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

SHIELDED SPRAYERS

Shielding the boom or individual nozzles can reduce the effects of wind. However, it is the responsibility of the applicator to verify that the shields are preventing drift and not interfering with uniform deposition of the product.

SENSITIVE AREAS

The pesticide should only be applied when the potential for drift to adjacent sensitive areas (eg., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (eg., when wind is blowing away from the sensitive areas).

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Pesticide Storage: Store product in original container only. Store in a cool, dry place.

Pesticide Disposal: Waste resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Container Handling: Refer to the Net Contents section of this product's labeling for the applicable "Nonrefillable Container" or "Refillable Container" designation.

Nonrefillable Plastic and Metal Containers (Capacity Equal to or Less Than 50 Pounds): Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities

Nonrefillable Plastic and Metal Containers (Capacity Greater Than 50 Pounds): Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Plastic and Metal Containers, e.g., Intermediate Bulk Containers [IBC] (Size or Shape Too Large to be Tipped, Rolled or Turned Upside Down): Nonrefillable container. Do not reuse or refill this container. Clean container promptly after emptying the contents from this container into application equipment or mix tank and before final disposal using the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Paper or Plastic Bags, Fiber Sacks including Flexible Intermediate Bulk Containers (FIBC) or Fiber Drums With Liners: Nonrefillable container. Do not reuse or refill this container. Completely empty paper or plastic bag, fiber sack or drum liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Then offer for recycling if available or dispose of empty paper or plastic bag, fiber sack or fiber drum and liner in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances.

Refillable Fiber Drums With Liners: Refillable container (fiber drum only). *Refilling Fiber Drum:* Refill this fiber drum with DuPont™ KROVAR® I DF containing bromacil and diuron only. Do not reuse this fiber drum for any other purpose. Cleaning before refilling is the responsibility of the refiller. Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. *Disposing of Fiber Drum and/or Liner:* Do not reuse this fiber drum for any other purpose other than refilling (see preceding). Cleaning the container (liner and/or fiber drum) before final disposal is the responsibility of the person disposing of the container. Offer the liner for recycling if available or dispose of liner in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. If drum is contaminated and cannot be reused, dispose of it in the manner required for its liner. To clean the fiber drum before final disposal, completely empty the fiber drum by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Then offer the fiber drum for recycling if available or dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances.

All Other Refillable Containers: Refillable container. *Refilling Container:* Refill this container with KROVAR® I DF containing bromacil and diuron only. Do not reuse this container for any other purpose. Cleaning before refilling is the responsibility of the refiller. Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn out threads and closure devices. If damage is found, do not use the container, contact DuPont at the number below for instructions. Check for leaks after refilling and before transporting. If leaks are found, do not reuse or transport container, contact DuPont at the number below for instructions. *Disposing of Container:* Do not reuse this container for any other purpose other than refilling (see preceding). Cleaning the container before final disposal is the responsibility of the person disposing of the container. To clean the container before final disposal, use the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Outer Foil Pouches of Water Soluble Packets (WSP): Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available or, dispose of the empty outer foil pouch in the trash as long as WSP is unbroken. If the outer pouch contacts the formulated product in any way, the pouch must be triple rinsed with clean water. Add the rinsate to the spray tank and dispose of the outer pouch as described previously.

Do not transport if this container is damaged or leaking. If the container is damaged, leaking or obsolete, or in the event of a major spill, fire or other emergency, contact DuPont at 1-800-441-3637, day or night.

NOTICE TO BUYER: Purchase of this material does not confer any rights under patents of countries outside of the United States.

SL - 1539 042210 04-14-10

LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read this Limitation of Warranty and Liability Before Buying or Using This Product. If the Terms Are Not Acceptable, Return the Product at Once, Unopened, and the Purchase Price Will Be Refunded.

It is impossible to eliminate all risks associated with the use of this product. Such risks arise from weather conditions, soil factors, off target movement, unconventional farming techniques, presence of other materials, the manner of use or application, or other unknown factors, all of which are beyond the control of DuPont. These risks can cause: ineffectiveness of the product, crop injury, or injury to non-target crops or plants. WHEN YOU BUY OR USE THIS PRODUCT, YOU AGREE TO ACCEPT THESE RISKS.

DuPont warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for the purpose stated in the Directions for Use, subject to the inherent risks described above, when used in accordance with the Directions for Use under normal conditions.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, DUPONT MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR OF MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, IN NO EVENT SHALL DUPONT OR SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT. BUYER'S OR USER'S BARGAINED-FOR EXPECTATION IS CROP PROTECTION. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER AND THE EXCLUSIVE LIABILITY OF DUPONT OR SELLER, FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY OR CONTRACT, NEGLIGENCE, TORT OR STRICT LIABILITY), WHETHER FROM FAILURE TO PERFORM OR INJURY TO CROPS OR OTHER PLANTS, AND RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT, OR AT THE ELECTION OF DUPONT OR SELLER, THE REPLACEMENT OF THE PRODUCT.

To the extent consistent with applicable law that allows such requirement, DuPont or its Ag Retailer must have prompt notice of any claim so that an immediate inspection of buyer's or user's growing crops can be made. Buyer and all users shall promptly notify DuPont or a DuPont Ag Retailer of any claims, whether based on contract, negligence, strict liability, other tort or otherwise, or be barred from any remedy.

This Limitation of Warranty and Liability may not be amended by any oral or written agreement.

For product information call: 1-888-6-DUPONT

Internet address: www.dupont.com/ag/us

DuPont™ Krovar® I DF Herbicide

Version 2.5

Revision Date 07/27/2012 Ref. 130000023993

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DuPont™ Krovar® I DF Herbicide
Tradename/Synonym	:	DPX-M2574 B10048033 Bromacil: [5-Bromo-3-sec-butyl-6-methyluracil] Diuron: [3-(3,4-Dichlorophenyl)-1,1-dimethylurea]
MSDS Number	:	130000023993
Product Use	:	Herbicide
Manufacturer	:	DuPont 1007 Market Street Wilmington, DE 19898
Product Information	:	1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency	:	1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency	:	CHEMTREC: 1-800-424-9300 (outside the U.S. 1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Caution

Harmful if swallowed or absorbed through the skin . Causes moderate eye irritation. Avoid contact with skin, eyes and clothing.

Potential Health Effects

This section includes potential acute adverse effects which could occur if this material is not used according to the label.

Skin	:	May cause: slight irritation, Discomfort.
Eyes	:	May cause: Irritation with discomfort, pain, redness, or visual impairment.

Ingestion

Diuron : May cause: Abnormal decrease in number of red blood cells (anaemia) which could produce tiredness, rapid heartbeat, dizziness, pale skin, leg cramps, shortness of breath

Repeated exposure

Diuron : Adverse effects from repeated exposure may include: Bladder damage altered blood chemistry

Quartz : DuPont has classified this material as a known human carcinogen.

Target Organs

Diuron : Blood Urinary system Bladder

Carcinogenicity

Material	IARC	NTP	OSHA
Quartz	1	X	

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Bromacil	314-40-9	40 %
Diuron	330-54-1	40 %
Other Ingredients		20 %

Present as an impurity in the clay component of this product:

Quartz		<1 %

SECTION 4. FIRST AID MEASURES

Skin contact	:	Take off all contaminated clothing immediately. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
Eye contact	:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
Inhalation	:	Move to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for treatment advice.
Ingestion	:	Call a physician or poison control centre immediately. Have person sip a glass of water if able to swallow. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person.
General advice	:	Have the product container or label with you when calling a poison control center or doctor, or going for treatment. For medical emergencies involving this product, call toll free 1-800-441-3637. See Label for Additional Precautions and Directions for Use.

SECTION 5. FIREFIGHTING MEASURES

Flammable Properties		
Flash point	:	no data available
Ignition temperature	:	420 °C (788 °F)
Lower explosion limit/ lower flammability limit	:	0.135 g/l
Fire and Explosion Hazard	:	Dust may form explosive mixture in air.

Suitable extinguishing media	:	Water spray, Foam, Dry chemical, Carbon dioxide (CO_2)
Unsuitable extinguishing media	:	High volume water jet, (contamination risk)
Firefighting Instructions	:	In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment. Prevent fire extinguishing water from contaminating surface water or the ground water system. Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. (on small fires) If area is heavily exposed to fire and if conditions permit, let fire burn itself out since water may increase the area contaminated. Cool containers / tanks with water spray. Control Runoff.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Spill Cleanup	:	Shovel or sweep up. Scoop into bags or boxes with plastic or aluminium shovel. Never return to container for reuse. If spill area is on ground near valuable plants or trees, remove top 2 inches of soil after initial cleanup.
Accidental Release Measures	:	Prevent material from entering sewers, waterways, or low areas. Follow applicable Federal, State/Provincial and Local laws/regulations.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel)	:	Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/PPE immediately if material gets inside. Wash thoroughly and put on clean clothing. Remove personal protective equipment immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Storage	:	Do not contaminate water, other pesticides, fertilizer, food or feed in storage. Store in original container. Store in a cool, dry place. Keep out of the reach of children.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls	:	Ensure adequate ventilation. When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS. Refer to the product label for additional Engineering Controls.
Personal protective equipment		
Skin and body protection	:	Pilots, flaggers and groundboom applicators must wear: Long sleeved shirt and long pants Shoes plus socks Groundboom applicators must wear: Chemical resistant gloves made of any waterproof material Mixers, loaders, applicators and other handlers must wear: Long sleeved shirt and long pants Shoes plus socks Chemical resistant gloves made of any waterproof material Polyvinylchloride A NIOSH approved dust/mist filtering respirator with any N, R, P, or HE filter or with approval number prefix TC-21C. Chemical resistant apron when mixing, loading, or cleaning equipment or spills.
Protective measures	:	Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Exposure Guidelines

Exposure Limit Values

Bromacil

PEL:	(OSHA)	1 ppm	10 mg/m3	8 hr. TWA
TLV	(ACGIH)		10 mg/m3	TWA

AEL *	(DUPONT)	10 mg/m3	8 & 12 hr. TWA

Diuron

TLV	(ACGIH)	10 mg/m3	TWA
AEL *	(DUPONT)	1 mg/m3	8 & 12 hr. TWA Total dust.

Quartz

PEL:	(OSHA)	2.4 millions of particles per cubic foot of air	TWA Respirable.
		Remarks	The exposure limit is calculated from the equation, 250/(%SiO2+5), using a value of 100% SiO2. Lower percentages of SiO2 will yield higher exposure limits.
PEL:	(OSHA)	0.1 mg/m3	TWA Respirable.
		Remarks	The exposure limit is calculated from the equation, 10/(%SiO2+2), using a value of 100% SiO2. Lower percentages of SiO2 will yield higher exposure limits.
PEL:	(OSHA)	0.3 mg/m3	TWA Total dust.
		Remarks	The exposure limit is calculated from the equation, 30/(%SiO2+2), using a value of 100% SiO2. Lower values of % SiO2 will give higher exposure limits.
TLV	(ACGIH)	0.025 mg/m3	TWA Respirable fraction.
AEL *	(DUPONT)	0.02 mg/m3	8 hr. TWA Respirable dust.
AEL *	(DUPONT)	0.01 mg/m3	12 hr. TWA Respirable dust.

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Form	:	solid, granules
Color	:	brown
Odor	:	none
Bulk density	:	0.51 - 0.64 g/ml
Water solubility	:	dispersible

SECTION 10. STABILITY AND REACTIVITY

Stability	:	Stable at normal temperatures and storage conditions.
Incompatibility	:	None reasonably foreseeable.
Hazardous reactions	:	Hazardous polymerisation does not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

DuPont™ Krovar® I DF Herbicide

Inhalation 4 h LC50	:	> 5.2 mg/l , rat
Dermal LD50	:	> 2,000 mg/kg , rabbit
Oral LD50	:	2,300 mg/kg , rat
Skin irritation	:	slight irritation, rabbit
Eye irritation	:	slight irritation, rabbit
Sensitisation	:	Animal test did not cause sensitization by skin contact., guinea pig

Bromacil

Repeated dose toxicity :

The following effects occurred at levels of exposure that significantly exceed those expected under labeled usage conditions.

Oral

rat

Liver effects, Organ weight changes, Thyroid effects, Reduced body weight gain

Inhalation
rat

Increased liver weight, altered blood chemistry

Carcinogenicity : The following effects occurred at levels of exposure that significantly exceed those expected under labeled usage conditions.

An increased incidence of tumours was observed in laboratory animals.

Mutagenicity : Did not cause genetic damage in cultured bacterial cells.
Genetic damage in cultured mammalian cells was observed in some laboratory tests but not in others.
Did not cause genetic damage in animals.

Reproductive toxicity : Animal testing showed no reproductive toxicity.

Teratogenicity : Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity.

Diuron

Repeated dose toxicity :

The following effects occurred at levels of exposure that significantly exceed those expected under labeled usage conditions.

Oral
rat

Red blood cell destruction causing abnormal decrease in number of red blood cells (anaemia), Spleen effects, bone marrow changes, Kidney effects, Bladder effects, Reduced body weight gain

Oral
dog

Red blood cell destruction causing abnormal decrease in number of red blood cells (anaemia), Spleen effects, bone marrow changes,

		Reduced body weight gain
		Inhalation rat
		Red blood cell destruction causing abnormal decrease in number of red blood cells (anaemia), Spleen effects
Carcinogenicity	:	The following effects occurred at levels of exposure that significantly exceed those expected under labeled usage conditions. An increased incidence of tumours was observed in laboratory animals.
Mutagenicity	:	Overall weight of evidence indicates that the substance is not mutagenic.
Reproductive toxicity	:	Animal testing did not show any effects on fertility.
Teratogenicity	:	Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity.

Quartz

Repeated dose toxicity	:	Inhalation Fluid retention in lungs (pulmonary oedema), lung effects, Inflammation, Chronic lung disease, Fibrosis

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity

Bromacil

96 h LC50	:	Lepomis macrochirus (Bluegill sunfish) 127 mg/l
96 h LC50	:	Oncorhynchus mykiss (rainbow trout) 36 mg/l
72 h ErC50	:	Pseudokirchneriella subcapitata (green algae) 0.017 mg/l
NOEC	:	Algae 0.001 mg/l

48 h EC50	:	Daphnia magna (Water flea) 119 mg/l

Diuron

96 h LC50	:	Oncorhynchus mykiss (rainbow trout) 17.4 mg/l
72 h EC50	:	Algae 0.018 mg/l
72 h NOEC	:	Algae 0.01 mg/l
48 h EC50	:	Daphnia magna (Water flea) 1.4 mg/l

Additional ecological information : Environmental Hazards: Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate. See product label for additional application instructions relating to environmental precautions.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal : Do not contaminate water, food or feed by disposal. Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Container Disposal : Refer to the product label for instructions.

In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

SECTION 14. TRANSPORT INFORMATION

IATA_C	UN number	:	3077
	Proper shipping name	:	Environmentally hazardous substance, solid, n.o.s. (Diuron, Bromacil)
	Class	:	9
	Packing group	:	III
	Labelling No.	:	9MI
IMDG	UN number	:	3077

Proper shipping name	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Diuron, Bromacil)
Class	:	9
Packing group	:	III
Labelling No.	:	9
Marine Pollutant	:	yes (Diuron, Bromacil)

Not regulated by DOT in single packages containing less than 100 pounds Diuron.

SECTION 15. REGULATORY INFORMATION

SARA 313 Regulated Chemical(s)	:	Bromacil , Diuron
Title III hazard classification	:	Acute Health Hazard: Yes Chronic Health Hazard: Yes Fire: No Reactivity/Physical hazard: No Pressure: No
CERCLA Reportable Quantity	:	250 lbs Based on the percentage composition of this chemical in the product.: Diuron
EPA Reg. No.	:	352-505 In the United States this product is regulated by the US Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read and follow all label directions. This product is excluded from listing requirements under EPA/TSCA.
California Prop. 65	:	WARNING! This product contains a chemical or chemicals known to the State of California to cause cancer.
PA Right to Know Regulated Chemical(s)	:	Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Bromacil , Diuron , Kaolin , Sodium sulphate , Silica gel,

precipitated, crystalline-free

SECTION 16. OTHER INFORMATION

		NFPA	HMIS
Health	:	1	1
Flammability	:	1	1
Reactivity/Physical hazard	:	0	0

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Contact person : DuPont Crop Protection, Wilmington, DE, 19898, Phone: 1-888-638-7668

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.

Appendix F: Test Plots for Carbon Addition to Soils for Suppression of Saharan Mustard

TEST PLOTS FOR EVALUATING ALTERNATIVE WEED SUPPRESSION

OVERVIEW

As a part of an integrated approach to weed management, information on the use of test plots evaluating the non-chemical control of target weed species, particularly Saharan mustard, are included in this Integrated Weed Management Plan (IWMP). Data from the in-situ test plots will be used to evaluate the effectiveness and practicality of controlling Saharan mustard by increasing the carbon-to-nitrogen ratio in the soil environment, thereby reducing the amount of available nitrogen. Reduced nitrogen limits the germination and growth of fast-growing, weedy species that typically require more available nitrogen than slower-growing, native species.

Background and Need for Alternative Control of Saharan Mustard in the Mojave Desert

Native desert soils are nitrogen- and moisture-limited; however, atmospheric nitrogen in dust and emissions from combustion of hydrocarbons and airborne particulates associated with regional urbanization are increasing throughout the Mojave Desert (Allen et al. 2006). These particulates settle on surfaces such as solar panels and are concentrated in the runoff from these surfaces, creating areas with increased soil nitrogen and moisture that may favor the growth of fast-growing, weedy species. This concentration of nitrogen occurs along the drip lines of the solar panels. It is not possible to control the addition of water from panel washing but it may be possible to control the availability of nitrogen in the underlying soil.

The areas under and around the solar panels will be managed for the support of native vegetation, which is primarily creosote bush scrub (Sawyer et al. 2009). Because the pre-emergent herbicide Krovar® I DF is an indiscriminant herbicide, meaning that it affects all plants, it may not be used within the rooting zone of native shrub species such as creosote bush. Research has shown that soil nitrogen is highest within 1 meter of creosote bushes, and that weedy species have been observed to germinate at higher densities within these shrub microsites (Ewing et al. 2007). Therefore, it is important to attempt to control germination of target weed species within the creosote scrub vegetation located beneath and between solar panels.

Roundup Pro® is the only post-emergent herbicide approved by the U.S. Bureau of Land Management and the California Department of Fish and Wildlife for use within the project area. Tests on the effectiveness of Roundup Pro® on Saharan mustard have been inconclusive (Graham et al. 2005). The unproven effectiveness of Roundup Pro® and the restrictions on the use of Krovar® I DF make control of Saharan mustard with herbicides within areas with native creosote scrub vegetation inadequate. Hand-pulling or other mechanical methods would be impractical on the more than 2,000 acres located within the solar array area; therefore, alternative methods should be investigated.

Background on Carbon Addition to Desert Soils

Research conducted in the eastern Mojave Desert by the University of Nevada and the National Park Service reported virtually no germination of Saharan mustard and greatly reduced germination of several annual introduced grasses with the application of carbon to the soil environment. The carbon was applied in a sucrose solution made from simple table sugar (DeCorte 2011). Common table sugar (sucrose) is approximately 44 percent carbon. Sugar is easily dissolved in liquid and can be applied with a hand or vehicle-mounted sprayer. The sucrose solution was applied prior to the known germination period for the target weed species (DeCorte 2011). Other research has shown that carbon applied in the form of sawdust or other wood waste products has been effective in reducing available soil nitrogen (Wilson and Gerry 1995); however, application of sawdust requires tilling of the soil surface, which is not practical or desirable within the project area. Other sources of carbon to be considered include sugar beet waste, which has approximately 55 percent carbon (Vassilvez et al. 1995), and lignin, which has approximately 61 to 64 percent carbon (NRCS 2000). Sugar beet waste is currently used as a dust palliative under the brand name Molex®, which is applied in liquid form. Lignin, also used as a dust palliative in liquid form, may also provide a source of carbon to the soil environment. These products may be applied using backpack or vehicle-mounted sprayers. The rate at which Molex® and lignin infiltrate into the soil, and their availability to soil microbes, has not been tested. These factors may affect the rate at which microbes use readily available forms of nitrogen, thus affecting the rate of change in readily available nitrogen in the soil environment.

Determining the Amount, Source, and Method of Carbon Application

The amount of carbon needed to reduce available soil nitrogen depends on many factors. In the eastern Mojave Desert the addition of 1,263 grams of carbon per square meter, 10 times the level of carbon in the local soil, resulted in the virtual elimination of Saharan mustard establishment, possibly indicating that the suppression of Saharan mustard requires a lower level of carbon than was applied (DeCorte 2011). Other research has shown that high levels of carbon addition have resulted in suppression of all annual species, both native and introduced.

Soils within the treatment or test areas should be sampled for carbon, nitrogen, and available nitrogen in the form of ammonium and nitrate. Based on these results carbon should be added at two rates: high (10 times initial level in soil) and low (5 times initial level in soil). The form of carbon may also affect its effectiveness within the soil environment. Application of sucrose was proved effective in suppression of Saharan mustard; therefore, sucrose solution should be used as one source of carbon at both the low and high rates. Because sucrose is expensive and may not be cost-effective on a larger scale, another source of carbon such as Molex® or lignin in liquid form should also be tested at both the low and high rates.

Carbon may be added on a broadcast level, covering all the ground within a test area, or only selectively around creosote shrubs where nitrogen levels area higher and Saharan mustard is more likely to germinate. Carbon should be applied in the winter season (November and December) prior to winter-fall rains and at least one month prior to construction activities.

Test Plot Design

Test plots should represent all three variables: 1) rate of carbon addition, 2) source of carbon and, 3) broadcast versus selective application, resulting in eight different treatments (Table 1). All test plots should be located within the southern third of the project area where the highest concentration of Saharan mustard was observed, as shown on Figure 3.1-1 of the IWMP. Test plots should be large enough to represent variability in local plant composition and microtopography. Each test plot will include six solar panels. Each test plot and control plot will be 100 feet (30.5 meters) by 150 feet (46 meters) for an area of 0.34 acre (0.14 hectare) (Figure 1). Three control plots will be located between test plots. Control plots will receive no carbon or herbicides. Three test plots receiving herbicide application will be located within areas receiving standard herbicide treatment. All test plots, control plots, and herbicide treatment plots will be the same size and located within the same soil type and aspect, as possible.

Table 1. Test Plot Variables.

		Source of Carbon	
		Sucrose	Molex® or lignin
Level of Carbon	High	broadcast	broadcast
	Low	broadcast	broadcast
	High	selective	selective
	Low	selective	selective

Figure 1. Test plot layout within solar panel arrays, showing four of the proposed eight test plots. Each plot includes six solar panels and is 100 feet by 150 feet. Sampling transects will be perpendicular to solar arrays.

Sampling of Test Plots

The target weed of concern is Saharan mustard; therefore, the density of Saharan mustard seedlings will be used to evaluate the effectiveness of carbon application as a method of control for this species. The density of Saharan mustard seedlings within 1-square-meter sampling quadrats will be recorded for the first growing season following carbon application and for three additional years following initial application of carbon.

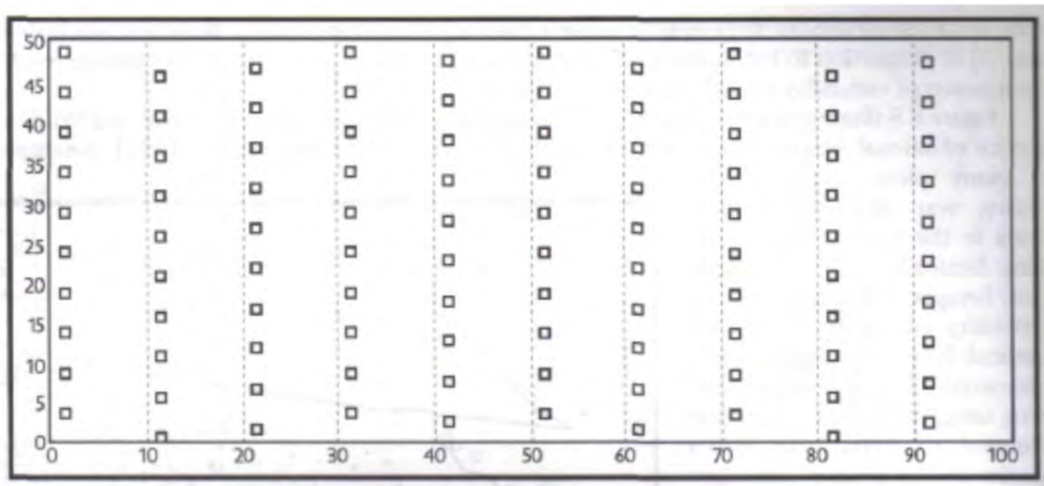
Within each plot a permanent baseline transect will be established along the long axis of the plot. The baseline transect will be randomly located using methods outlined by Elzinga et al. (2001). Sampling transects will be established perpendicular off the baseline, perpendicular to the solar panels such that areas under and between the panels will be sampled. Ten initial transects will be evenly spaced along the baseline transect. Ten one meter square sampling quadrats will be equally spaced along sampling transects (Figure 2). Sampling transects will be added until an 80% confidence level of the density of Saharan mustard seedlings is reached, meaning that 80% of the time the density of Saharan mustard seedlings should be within a range that includes the true density of Saharan mustard seedlings in the treatment or control area.

For plots in which carbon is only applied selectively to shrubs the baseline and sampling transects will be located and set up in the same manner as for other test plots but sampling quadrats will be placed only around shrubs. Because not all shrubs will intersect the sampling transects shrubs within 2 meters of the transects may be sampled. The distance along the sampling transect and the distance from the transect will be recorded for each shrub and the same shrubs will be sampled each year.

Because it is anticipated that the dripline of solar panels will have higher soil moisture and additional nitrogen from the atmospheric nitrogen settling on the panels quadrats located within the driplines of panels will be tallied separately such that the density of Saharan mustard within the drip line can be compared to the density of Saharan mustard in areas not influenced by the drip line.

The mean density of Saharan mustard seedlings will be recorded and compared among plots receiving carbon treatments, control plots, and plots receiving herbicide treatments. After one year soil samples will be collected within plots to which a source of carbon was applied. If there is no difference in the carbon-to-nitrogen ratio or the available soil nitrogen between the post-treatment soil samples and the pre-treatment soil samples carbon will be applied at the same rate and in the same form as was initially applied to the test plot. Precipitation within the project area will be recorded monthly. Applications of wash water to solar panels and herbicides to plots being treated with herbicides will be recorded.

Figure 2. Example of systematic, equally spaced sampling transects located along a randomly located baseline with systematic, equally spaced sampling quadrats located along sampling transects.



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APPENDIX F
Wilderness Characteristics Inventories

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6301 - Wilderness Characteristics Inventory

Summary of Findings and Conclusion

Unit Name and Number: Soda Mountain Valley CA-080-242-1

Results of Analysis:

1. Does the area meet any of the size requirements? __X__ Yes ____ No
2. Does the area appear to be natural? ____ Yes __X__ No ____ N/A
3. Does the area offer outstanding opportunities for solitude or a primitive and unconfined type of recreation? ____ Yes __X__ No ____ N/A
4. Does the area have supplemental values? __X__ Yes ____ No ____ N/A

Conclusion

____ The area, or a portion of the area, has wilderness characteristics and is identified as Land with Wilderness Characteristics (LWC).

__X__ The area does not have wilderness characteristics.

Prepared by:

Team Members:
Remijio Chavez Jr., Rangeland Management Specialist, BLM Barstow FO
Rusty Gates, Outdoor Recreation Planner, BLM Barstow FO
Brigit Hoover, Realty Specialist, BLM Barstow FO
Jamie Livingood, Geologist, BLM Barstow FO
Brad Mastin, Outdoor Recreation Planner, Barstow FO
Timothy Williamson, Wilderness Coordinator, BLM Barstow FO

Approved by:

Name: [signature] **Title:** Field Manager, Barstow Field Office

Date: 6/3/13

This form documents information that constitutes an inventory finding on wilderness characteristics. It does not represent a formal land use allocation or a final agency decision subject to administrative remedies under either 43 CFR parts 4 or 1610.5-2.

Wilderness Inventory
CDCA Wilderness Inventory Unit #242-1
Soda Mountain Valley CA-080-242-1
May 31st, 2013

Background

Under Section 201 of the Federal Land Policy Management Act (FLMPA) the Bureau of Land Management (BLM) is required to maintain an inventory of public land resources, including lands with wilderness characteristics. Wilderness characteristics are part of the resource values to be considered in inventories the BLM undertakes. The Wilderness Act of 1964 established the National Wilderness Preservation System which identified a system of federally managed areas designated by Congress as “wilderness areas”. The goal of the Wilderness Act was to “secure for the American people of present and future generations the benefit of an enduring resource of wilderness.” While the terms “wilderness character” and “wilderness characteristic” are not explicitly defined in the Wilderness Act, Section 2(c) identifies the wilderness characteristics used for evaluation of lands proposed for wilderness protections. The terms generally used to describe and evaluate lands with wilderness characteristics include size, naturalness, opportunities for solitude and/or primitive and unconfined recreation and special features of “ecological, geological or other features of scientific, scenic or historic value.”

All public lands within the California Desert District (CDD) were inventoried between 1978 and 1979 through a sequential process to determine if any of the CDD lands possessed wilderness characteristics. This process initially involved identifying Wilderness Inventory Units (WIUs) that were considered to potentially contain wilderness characteristics. Through a BLM cataloging of resources and with public involvement all the WIUs were reviewed at that time. The WIUs or portions of land within a WIU that were found to have wilderness characteristics were identified by the BLM in 1979 as Wilderness Study Areas (WSAs) and lands not found to have wilderness characteristics were managed without wilderness considerations. A WSA is managed to maintain their wilderness suitability until Congress either designates them as wilderness or denies this designation. A final intensive study phase between 1979 and 1991, which included the preparation of mineral surveys and an environmental impact statement and additional public involvement, led the BLM to recommend to the Secretary of the Interior that some of these WSAs should be designated as wilderness and others released for other management. The Secretary then forwarded his recommendations to Congress which has taken action to designate wilderness areas and WSAs in the CDD.

Since the original wilderness characteristic inventories are more than thirty years old, they are being updated at this time. The reason for this update is to accommodate the Desert Renewable Energy Conservation Plan (DRECP) in designating lands being considered for development by determining if conditions in the units have changed (i.e., do wilderness characteristics exist in locations where they were not present in the 1979). Several management factors could result if changes are found in these units. Specific examples would be, if natural or agency-initiated reclamation projects have restored the natural conditions or if land acquisitions have restored the ability for a solitary recreation experience, in either case wilderness characteristics would now be present and the agency may have to manage these lands for their wilderness potential.

As part of the preparation of this wilderness update, a records research was done. Due to the fact that WIU 242-1 is a new unit, no records exist for this particular area. However this unit was included in Area 242 and the descriptive narrative for that area can be found in the *California Desert Conservation Area, Wilderness Inventory, Final Descriptive Narratives, March 31, 1979* (http://www.blm.gov/style/medialib/blm/ca/pdf/pa/wilderness/wi.Par.92238.File.dat/CDCAWildernessInvNarr_Final_March1979.pdf) and the pages which describe this unit have been included in the appendix section. Other sources of information used in the research and writing of this inventory report include: *the California Desert Conservation Area Plan of 1980* (http://www.blm.gov/style/medialib//blm/ca/pdf/pdfs/cdd_pdfs.Par.aa6ec747.File.pdf/CA_Desert_.pdf), the *1990 California Statewide Wilderness Study Area Soda Mountains CDCA-242* http://www.blm.gov/ca/pa/wilderness/wilderness_pdfs/wsa/Volume-5/Soda%20Mountains.pdf, the 2000 Soda Mountains Desert Access Guide (DAG) and the Cronese Lake Sub Region Off Highway Vehicle West Mojave Supplement Map which showed open travel routes on BLM administered lands. Two field reconnaissance trips were made on July 26th, 2012 and May 24th, 2013 to record and photograph the unit's environmental situation. The trips involved driving designated routes within the unit and county roads and the Interstate around perimeter of the unit to help redefine the 1979 boundaries and to photograph the current conditions.

Year 2013 **Inventory Unit Number/Name** **CA-080-242-1 Soda Mountain Valley**

Documentation of BLM Wilderness Inventory Findings on Record

1. Is there existing BLM wilderness inventory information on all or part of this area?

Yes

Inventory Sources: 1979 Wilderness Inventory files, California Desert Conservation Area and the 1990 California Statewide Wilderness Study Area Report CDCA-242

Inventory Unit Name(s)/Number(s): Area 242

Map Name(s)/Number(s): USDI BLM California Desert Wilderness Final Inventory, Dec. 1979

BLM District(s)/Field Office(s): Barstow Field Office

2. BLM Inventory Findings on Record

Existing inventory information regarding wilderness characteristics:

Inventory Source: 1979 Wilderness Inventory files, BLM Barstow FO

Unit#/ Name	Size (historic acres)	Natural Condition? Y/N	Outstanding Solitude? Y/N	Outstanding Primitive & Unconfined Recreation? Y/N	Supplemental Values? Y/N
242	106,641	Y	Y	Y	N/A
242	118,537	Y	Y	Y	N/A

Summarize any known primary reasons for prior findings in this table:

The 1979 California Desert Conservation Area inventory unit number 242 covered a large area bounded on the north by a series of powerlines, to the east by California State Route 127 to the west by an improved road and to the south by Interstate 15. It was estimated that about ninety-five percent of the area was public lands with twenty scattered parcels of private property. Large scale mining existed in multiple locations however, despite the old mining scars, various powerline and telephone lines in the region, the overall natural conditions of the landscape were mostly free of human imprint. Opportunities for solitude and unconfined recreation were outstanding and combined with the public comments about the area kept this area in for wilderness consideration. The 1990 California Statewide Wilderness Study Area report for this area excluded most the area that is now being called Area 242-1.

Documentation of Current Wilderness Inventory Conditions

Unit Number/Name: CA-080-242-1 Soda Mountain Valley

(1) Sufficient size

Acreage: A rough estimate of Area 242-1 is 9,608 acres pending a GIS calculation with a perimeter 25.6 miles long.

Boundaries: This area does not have well defined boundaries in places for the western and northern borders. The northern boundary is combination of three elements: a BLM designated Route CL 8839, a set of powerlines owned by either the Los Angeles Department of Water and Power or Southern California Edison and the official boundary of the Soda Mountain Wilderness Study Area. The eastern boundary is California State Route 127. The southern boundary is Interstate 15. The western boundary is a series of two tracks just north of the Rasor Road exit off Interstate 15.

Description of Current Conditions

Land ownership: The majority of land within the area is managed by the BLM with some private lands located in two places on the eastern side: the Silver Lake section and lands surrounding the Town of Baker, CA.

Location: Area 242-1 is located in San Bernardino County. The location is northwest of the Mojave National Preserve, north of the Rasor Open Road OHV Area and west of the Town of Baker. The area is sandwiched between Interstate 15 to the south while the Soda Mountain Wilderness Study Area is just north.

Topography:
The entire area lies rough and rugged, with water often difficult to find. The majority of this strip of land area is a slight downhill from the northern/western end to the Interstate boundary. Elevation levels are estimated at 900 feet near Silver Lake and the Town of Baker to hill tops located near Zzyzx Road topping out around 1600 feet. The soil is a rocky dirt/sand mix with large rocks scattered throughout the area. Temperatures in the area range from below freezing in January to 100 degrees Fahrenheit or more in July.

Vegetation features: Vegetation consists primarily of creosote and salt bush scrub. The most common plants in the area are: creosote bush, desert peach, needle-grass, paper bag bush, brittlebush and cacti. Quail and other small birds, ground squirrels and coyotes dwell in the area. This area is also a recognized Bighorn Sheep corridor.

Major human uses/activities: The major recreation use is motorized recreation which includes all types of off-highway vehicular (OHV) use on designated routes. Other recreational uses include camping (dispersed camping is also evidenced in a few locations within the area), recreational shooting and hunting. There are various old mines in the area but none are currently active.

(2) Natural condition

No

The most visible item throughout the whole area is the set of powerlines that run throughout the entirety of this area. The powerlines are visible and dominate the landscape. The use of off-highway vehicle (OHV) has also lessened the natural area's appearance as well as the recreational shooting that has occurred over time. Lastly the area near the Zzyzx Road turn-around is littered with an array of garbage and waste and has been used by individuals over time as a dumping spot.

(3) Outstanding opportunities for solitude

No

By design this area does not have opportunities for solitude since the handfuls of small hills do not provide enough coverage to eliminate the sense of the Interstate. Also most of this area is an open valley that either can look into Baker or the powerlines. Lastly, there is a steady traffic in the area related to the pipeline and powerlines.

(4) Outstanding opportunities for primitive and unconfined recreation

No

The area has a handful of major OHV routes and a couple of locations known for recreational target shooting that combined make primitive recreation pursuits difficult. The designated routes in the area are used both as means for recreational travel and as 'rights of ways' for the pipeline and powerlines in the area.

(5) Supplemental values

Yes

There are a series of old mines in the area that provide a sense of California's rich mining history.

Appendix A

Route Analysis of Area 242-1

WIU # 242-1 **Date:** 07/26/12
Appendix C - Route Analysis **Evaluator(s):** Rusty Gates & Tim Williamson

Route #	Purpose	ROW Y/N/UK	ROW In Use?	Constructed Mechanically	Type of Evidence	Improved Mechanically	Hand Tools Or Machinery	Type of Evidence
Unnamed route	FAA Tower	Y	Y	Y	Bladed & Pavement	Y	M	Berms
CL 8839	Pipeline & Powerlines	Y	Y	Y	Bladed & Berms	Y	M	Berms
Unnamed route	Powerlines	Y	Y	Y	Bladed & Berms	Y	M	Berms
CL 8845	Old Mining Road	N	N	Y	Bladed	N	-	Plant growth between berms
CL 8837	Pipeline	Y	Y	N	Two Track	N	-	Two Track
CL 8847	Old Mining Road - Today Recreation	Y	Y	Y	Bladed in Spots	N	-	Parts are Two Track
CL 8854	Pipeline	UK	UK	Y	Bladed	N	-	One side has berm but mainly Two Track
CL 8853	Recreation	N	N	N	Two Track	N	-	No defined trail
Unnamed route	Powerlines	Y	Y	Y	Bladed	Y	M	Berms on Two Sides
Mining Road off Hwy 127	Powerlines	Y	Y	Y	Bladed and Hard Packed	Y	M	Developed Road in spots

Appendix B

Photo Log of Area 242-1

Photo #1 - Along the Powerline Corridor - Northeast View

Photo #2 - Designated Route CL 8839 - Southeast View

Photo #3 - Designated Route CL 8839 - Northern View

Photo Log for Area 242-1				
Photo #	**GPS**	**Town & Range**	**Dir**	**Description**
1	3900215 N 579877 E	T 13 N R 8 E Sec 3	NE	Powerline corridor, creosote scrub community, slight downhill slope to east, sandy rocky loam
2	3897843 N 577209 E	T 13 N R 8 E Sec 8	SE	Designated Route CL 8839, creosote scrub community, valley area with a slight downhill slope, sandy rocky loam
3	3889796 N 571807 E	T 12 N R 7 E Sec 11	N	Designated Route CL 8839, creosote scrub community, valley area with a slight downhill slope, sandy rocky loam

Appendix C

BLM California Desert Conservation Area Wilderness Final Inventory, Dec. 1979

Written Description & Map of Area 242

V. OUTSTANDING OPPORTUNITIES FOR SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

Although the area has been affected primarily by the forces of nature, the topography and vegetation have limited ability to screen one person from another. The level terrain, combined with low vegetation and small size, allows visitors to see one another within the area. Thus, outstanding opportunities for solitude are greatly limited. The uniform flat terrain limits the diversity of recreational potential and opportunities for primitive and unconfined types or recreation are not outstanding.

VI. SUMMARY OF PUBLIC COMMENTS

Comments received supported inclusion for further study or addressed study phase factors.

AREA 241A

I. PHYSICAL BOUNDARIES

The area is located southeast of the town of Baker. The northern border is a transmission lines corridor right-of-way and associated access road that parallels Interstate 15. The southern border is a gas line and associated access road one mile south of, and parallel to, Interstate 15. The western boundary is the Kelbaker Road. The eastern boundary is a maintained dirt road used by ranchers for access to water tanks.

II. LAND OWNERSHIP

This roadless area does not contain 5000 acres of contiguous public lands and is not of sufficient size to make practical its preservation and use in an unconfined condition.

III. SUMMARY OF PUBLIC COMMENTS

No comments received.

AREA 242

I. PHYSICAL BOUNDARIES

The area is located west of the town of Baker. The northern boundary of the Wilderness Study Area is the southern edge of the utility right-of-way which contains power transmission lines. This boundary is located along a line 400 feet south of the three existing transmission lines (except where a service road may extend outside the right-of-way). The eastern boundary is Highway 127, between the town of Baker and the powerlines. The southern boundary is split into two sections: (1) From the town of Baker to the East Cronese Lake, the southern boundary is a powerline road right-of-way; (2) from the Lake to the western boundary, the southern boundary is Interstate 15. The western boundary is an improved Pacific Telephone and Telegraph line road between Interstate 15 and the powerline road to the north.

II. LAND OWNERSHIP

The site includes approximately 20 sections of non-public land scattered throughout, accounting for approximately 5 percent of the total.

III. DESCRIPTION OF ENVIRONMENT

The topography of this area varies from gentle sloping bajadas to the rugged Soda Mountains. This highly eroded mountain range has jagged ridges and sharp peaks. The associated washes have steep rocky walls that vary in color from brown at the base to red in the middle and gold toward the top. Within the range are large interior valleys caused by erosion. The bajadas are interlaced with washes and slope away from the mountains toward the boundaries. The vegetation of this area is found mostly at the base of the mountains, in the interior valleys, and in the bajadas. The dominant vegetation is sparse stands of creosote. Intermixed with the creosote are small annual plants and occasional barrel cactus, cholla and yucca.

IV. NATURAL CONDITION

Portions of this area have been affected by man. Some activity, both past and present, has resulted in a degradation of the natural environment and in the exclusion of these sites from those containing wilderness values. A telephone relay station and access road in the southern Soda Mountains near Interstate 15 at the Beacon overpass has been included. In addition, the active Blue Bell Mine, at VABM 2849, in the Soda Mountains was excluded because of current operations (bulldozing, slag piles, shafts, equipment). Along the western border two active quarries, one mine, borrow pit, and their associated roads and ways have been excluded, in portions of Sections 21, 22, 26, 28, 34 and all of 27, (T. 12N., R. 5E.). Another borrow pit and road, off Highway 91, have been excluded in Section 33 (T. 12N., R. 6E.). In the northern portion of the area having 2(c) values, signs of man's works including an active mine with open pit scars, a house, and its associated road have been excluded. From the northern border in Section 25, (T. 15N., R. 7E.), this road runs south through Sections 25, 36, (T. 15N., R. 7E.), and Sections 1, 2, 11, 14, 15, (T. 14N., R. 7E.). Nearby another mining road comes off the northern border in Section 3 (T. 14N., R. 7E.). It has been excluded also due to its maintenance and associated mining scraps. The southeast corner, near Baker, has been excluded due to several ways, old mining scars and ORV tracks.

The remainder of the area has been affected primarily by the forces of nature with the imprint of man's works substantially unnoticeable. A way crosses the valley between the Cronese and Soda Mountains. Sections of this way are under water at East Cronese Lake. Several other old ways are in the area but have an insignificant affect upon the naturalness of the area.

V. OUTSTANDING OPPORTUNITIES FOR SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

Opportunities for both solitude and for a primitive and unconfined type of recreation are outstanding in the area. The large size and variation in landform provide numerous opportunities.

VI. SUMMARY OF PUBLIC COMMENTS

The majority of the comments agreed with the findings. Several comments suggested the southeast border should be extended south. A few comments dealt with additional roads. After field checks, the appropriate changes were made.

AREA 243

I. PHYSICAL BOUNDARIES

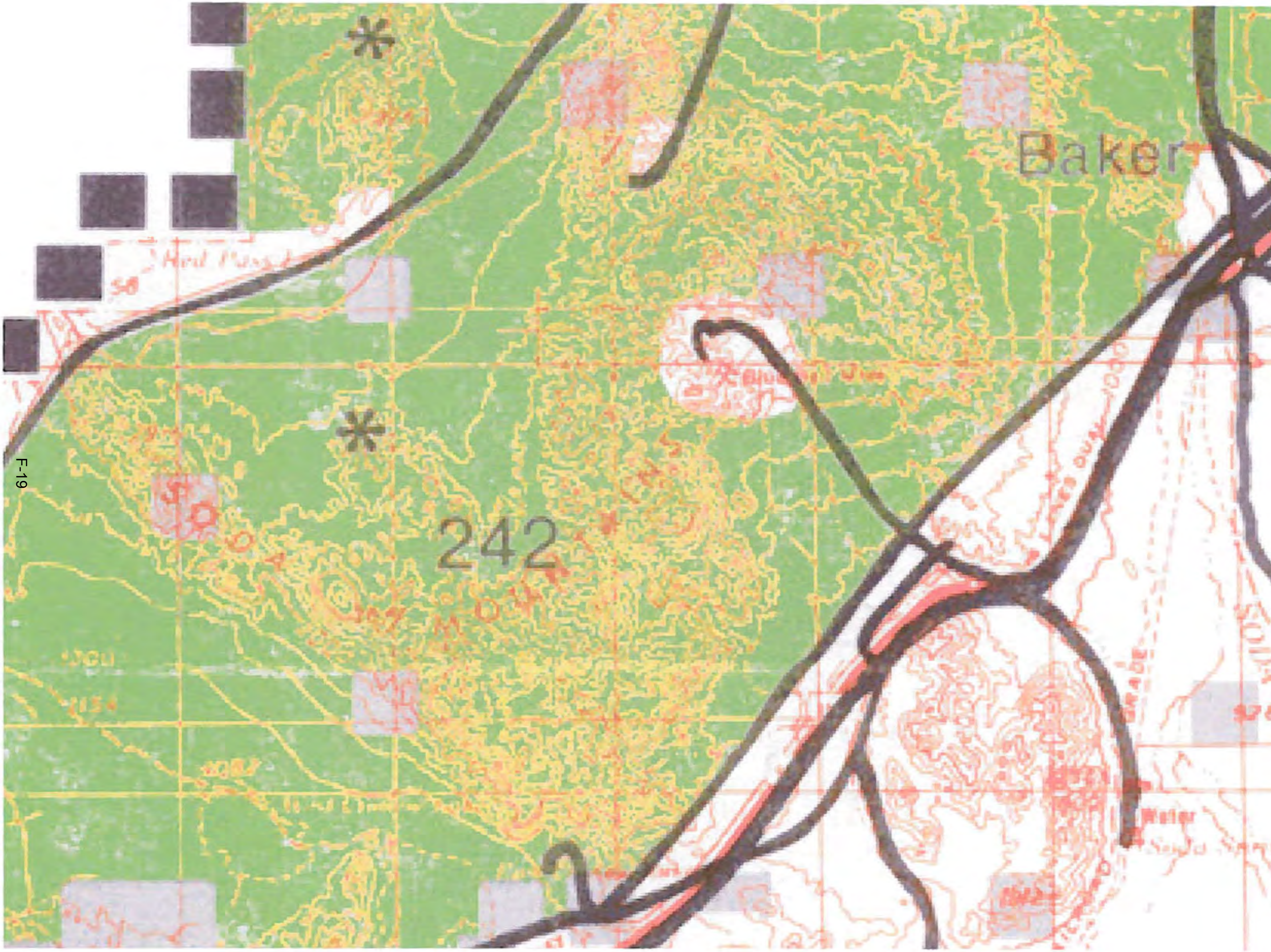
The northern boundary includes an underground telephone line right-of-way, a cattle fence maintenance road south of Rattlesnake and Big Cowhole Mountains; and, a cattle fence maintenance road that eventually ties into the telephone road near 17-Mile Point on the Kelbaker Road. The eastern boundary includes the Kelbaker Road. The southern boundary of the Wilderness Study Area is the northern edge of the utility right-of-way which contains power transmission lines. This boundary is located along a line 400 feet north of the three existing transmission lines (except where a service road may extend outside the right-of-way); the railroad line and maintenance road; and, the western boundary, Basin Road.

II. LAND OWNERSHIP

Approximately 10-15 percent of this area is non-public land scattered throughout the area.

III. DESCRIPTION OF ENVIRONMENT

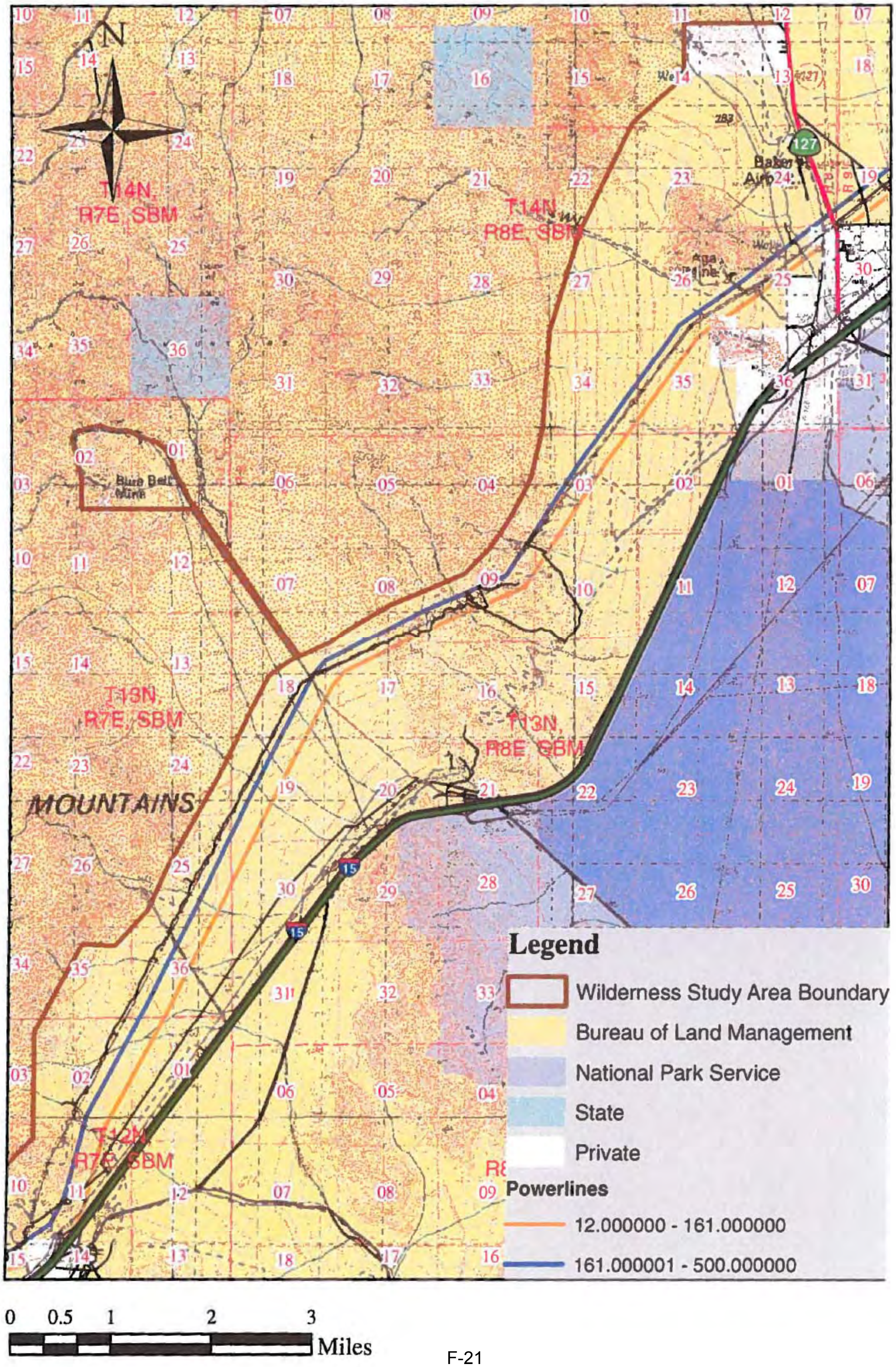
This area contains a variety of vegetative types, geographical features, and landforms. Of particular significance is the Mojave River Sink, occupying the southern portion of the area, which grades from flat, rocky terrain on the west to mesquite-covered sand hummocks and small dunes in the central portion. Other significant landforms include the flat, alkali-covered Soda Lake Bed, the low, sand-blanketed hills of Devil's Playground, the large, steep-sided Old Dad Mountain, and the smaller, but rugged, Soda Mountains and Cowhole Mountains. Except for the sand hummock area, which supports a rich community of mesquite and other sand-tolerant plants, vegetation throughout the area is sparse, consisting mostly of creosote and mixed shrubs. A major portion of Soda Lake Bed is entirely devoid of vegetation due to the mineral content in the soil.


Baker
242

Appendix D

Current Land Status Map of Area 242-1

Area 242-1 Surface Ownership



6301 - Wilderness Characteristics Inventory

Summary of Findings and Conclusion

Unit Name and Number: CA-080-243 Rasor Open Area

Results of Analysis:

1. Does the area meet any of the size requirements? _X_ Yes ____ No
2. Does the area appear to be natural? ____ Yes _X_ No ____ N/A
3. Does the area offer outstanding opportunities for solitude or a primitive and unconfined type of recreation? ____ Yes _X_ No ____ N/A
4. Does the area have supplemental values? _X_ Yes ____ No ____ N/A

Conclusion

____ The area, or a portion of the area, has wilderness characteristics and is identified as Land with Wilderness Characteristics (LWC).

_X_ The area does not have wilderness characteristics.

Prepared by:

Team Members:

Remijio Chavez Jr., Rangeland Management Specialist, BLM Barstow FO
Rusty Gates, Outdoor Recreation Planner, BLM Barstow FO
Mickey Quillman, Supervisory Resource Management Specialist, BLM Barstow FO
Timothy Williamson, Wilderness Coordinator, BLM Barstow FO

Approved by:

Name: __________ **Title:** Field Manager, Barstow Field Office

Date: 6/3/13

This form documents information that constitutes an inventory finding on wilderness characteristics. It does not represent a formal land use allocation or a final agency decision subject to administrative remedies under either 43 CFR parts 4 or 1610.5-2.

Wilderness Inventory
CDCA Wilderness Inventory Unit #243
CA-080-243 Rasor Open Area
May 29th, 2013

Background

Under Section 201 of the Federal Land Policy Management Act (FLMPA) the Bureau of Land Management (BLM) is required to maintain an inventory of public land resources, including lands with wilderness characteristics. Wilderness characteristics are part of the resource values to be considered in inventories the BLM undertakes. The Wilderness Act of 1964 established the National Wilderness Preservation System which identified a system of federally managed areas designated by Congress as "wilderness areas". The goal of the Wilderness Act was to "secure for the American people of present and future generations the benefit of an enduring resource of wilderness." While the terms "wilderness character" and "wilderness characteristic" are not explicitly defined in the Wilderness Act, Section 2(c) identifies the wilderness characteristics used for evaluation of lands proposed for wilderness protections. The terms generally used to describe and evaluate lands with wilderness characteristics include size, naturalness, opportunities for solitude and/or primitive and unconfined recreation and special features of "ecological, geological or other features of scientific, scenic or historic value."

All public lands within the California Desert District (CDD) were inventoried between 1978 and 1979 through a sequential process to determine if any of the CDD lands possessed wilderness characteristics. This process initially involved identifying Wilderness Inventory Units (WIUs) that were considered to potentially contain wilderness characteristics. Through a BLM cataloging of resources and with public involvement all the WIUs were reviewed at that time. The WIUs or portions of land within a WIU that were found to have wilderness characteristics were identified by the BLM in 1979 as Wilderness Study Areas (WSAs) and lands not found to have wilderness characteristics were managed without wilderness considerations. A WSA is managed to maintain their wilderness suitability until Congress either designates them as wilderness or denies this designation. A final intensive study phase between 1979 and 1991, which included the preparation of mineral surveys and an environmental impact statement and additional public involvement, led the BLM to recommend to the Secretary of the Interior that some of these WSAs should be designated as wilderness and others released for other management. The Secretary then forwarded his recommendations to Congress which has taken action to designate wilderness areas and WSAs in the CDD.

Since the original wilderness characteristic inventories are more than thirty years old, they are being updated at this time. The reason for this update is to accommodate the Desert Renewable Energy Conservation Plan (DRECP) in designating lands being considered for development by determining if conditions in the units have changed (i.e., do wilderness characteristics exist in locations where they were not present in the 1979). Several management factors could result if changes are found in these units. Specific examples would be, if natural or agency-initiated reclamation projects have restored the natural conditions or if land acquisitions have restored the ability for a solitary recreation, in either case wilderness characteristics are now present and the agency might have to manage these lands for their existence.

As part of the preparation of this wilderness update, a records research was done. The permanent inventory file for WIU #243 could not be located for this review however the descriptive narrative for the unit was found in the *California Desert Conservation Area, Wilderness Inventory, Final Descriptive Narratives, March 31, 1979* (http://www.blm.gov/style/medialib/blm/ca/pdf/pa/wilderness/wi.Par.92238.File.dat/CDCAWildernessInvNarr_Final_March1979.pdf) and the pages which describe this unit have been included in the appendix section. Other sources of information used in the research and writing of this inventory report were: *the California Desert Conservation Area Plan of 1980* (http://www.blm.gov/style/medialib//blm/ca/pdf/pdfs/cdd_pdfs.Par.aa6ec747.File.pdf/CA_Desert_.pdf), the 2000 Soda Mountains Desert Access Guide (DAG), the 2008 Newberry Springs Desert Access Guide (DAG) and the Afton Canyon Sub Region Off Highway Vehicle West Mojave Supplement Map which showed open travel routes on BLM administered lands. Also, a draft of the *2000 Rasor Off-Highway Vehicle Area Management Plan (uncompleted)* and the *1990 Old Dad Mountain CDCA-243 California Statewide Wilderness Study Report* were used for referencing only. Two field reconnaissance trips were made on July 31, 2012 and April 17, 2013 to record and photograph the unit's environmental situation. The trips involved driving designated routes within and county roads around the unit to help redefine the 1979 boundaries and photograph the existing conditions.

Year 2013 Inventory Unit Number/Name CA-080-243, Rasor Open Area

Documentation of BLM Wilderness Inventory Findings on Record

1. Is there existing BLM wilderness inventory information on all or part of this area?

Yes

Inventory Source: 1979 Wilderness Inventory files, California Desert Conservation Area

Inventory Unit Name(s)/Number(s): Area 243

Map Name(s)/Number(s): USDI BLM California Desert Wilderness Final Inventory, Dec. 1979

BLM District(s)/Field Office(s): Barstow Field Office

2. BLM Inventory Findings on Record

Existing inventory information regarding wilderness characteristics:

Inventory Source: 1979 Wilderness Inventory files, BLM Barstow FO
The California Desert Protection Act of 1994

Unit#/ Name	Size (historic acres)	Natural Condition? Y/N	Outstanding Solitude? Y/N	Outstanding Primitive & Unconfined Recreation? Y/N	Supplemental Values? Y/N
243	49,301	Y	Y	Y	N/A

Summarize any known primary reasons for prior findings in this table:

The 1979 California Desert Conservation Area inventory unit number 243 originally had a much different border than it does today. The northern boundary was the utility right-of-way south of the Soda Mountains Wilderness Study Area. The Western boundary was Basin Road while the eastern boundary was Kelbaker Road and the southern boundary consisted of the railroad line and associated maintenance routes. An environmental assessment ranged widely from the Mojave River basin and Soda Lake bed to various rocky hills and mountains and sand dune formations. Vegetation throughout most of the area is sparse consisting of creosote and mixed shrubs. At that time, a majority of the area was deemed "affected by the forces of nature" without the impacts of modern civilization. Also, this area had areas which provided opportunities of solitude and unconfined recreation. Public comments supported these findings and asked for the area's inclusion as wilderness. The 1994 California Desert Protection Act reclassified a large section of this area with former Bureau of Land Management lands becoming National Park Service lands that are now known as the Mojave National Preserve.

Documentation of Current Wilderness Inventory Conditions

Unit Number/Name: CA-080-243, Rasor Open Area

(1) Sufficient size

Acreage: The rough estimate of Area 243 is roughly 34,051 acres pending a GIS calculation with a perimeter of 37 miles long.

Boundaries: This area does not have a well-defined eastern border since it is the western boundary of the Mojave Natural Preserve. The eastern boundary is Basin Road as well as sections of BLM designated routes AC8711 and AC8712. The southern boundary is the Southern Transcon main rail line owned by the Burlington Northern and Santa Fe Railway (BNSF). The northern boundary is Interstate 15.

Description of Current Conditions

Land ownership: The majority of land within the area is public and managed by the BLM. However there are a handful of private lands located within the area accounting for just over three percent of the total.

Location: Area 243 is located within San Bernardino County roughly 50 miles northeast from Barstow and 25 miles southwest of Baker. This area consists of a large tract of public lands with the private lands in the located throughout. Located in the midst of the Mojave Desert

Topography:
The topography varies from flat, sandy areas on the west and south, to the popular sand dunes on the east, and steep, rugged hills on the north. The soil composition goes from sand predominant to a dirt/sand mix with rocks scattered at higher elevations. Temperatures in the area range from below freezing in January to 100 degrees Fahrenheit or more in July.

Vegetation features: The Mojave Creosote Scrub, Stabilized Desert Dunes and Partially-Stabilized Dunes are the dominant plant communities within the area. Dominant plant species found within the Creosote Bush Scrub plant community include creosote bush, burro-bush, cheese-bush, Anderson boxthorn and the Mojave yucca. This community occurs primarily on the higher elevation bajada and alluvial fans. Stabilized and Partially-Stabilized Desert Dunes plant communities within the area are characterized by plant species such as sandpaper plant, felt-thorn, Spanish needle and honey mesquite. These communities are found at lower elevations on sandy hummocks throughout the planning area. Notable annual species occurring in these communities include desert lily, desert sand verbena and dune primrose. Mesquite often forms thickets within these communities, and is crucial in stabilizing dune systems.

Major human uses/activities: The major human use in this area is semi-primitive motorized recreation which includes all types of off-highway vehicular (OHV) use on designated routes and everywhere within the Rasor Road Open OHV riding area. Other recreational uses include:

camping (dispersed camping is evidenced throughout the area), hiking, sightseeing, rock climbing and hounding plus wildlife and plant study.

(2) Natural condition

No

The Rasor Open OHV area is designed to be an open riding area where any OHV participant could, in theory, ride wherever they wanted to. There are also areas where permanent roads cross the lands and when these are added to the OHV routes; the naturalness of the area has lessened since earlier inventories.

(3) Outstanding opportunities for solitude

No

The area has seen increased levels of public off-highway vehicle (ohv) use in this area and when you combine that noise from the open riding area to the increased traffic along Interstate 15, opportunities for solitude are minimal.

(4) Outstanding opportunities for primitive and unconfined recreation

No

Unlike the 1979 inventory, this smaller area is crisscrossed with OHV routes within the open riding area and outside it making it the significant recreational pursuit within this area. Since OHV riding is prominent, this makes both primitive and unconfined recreation activities difficult to achieve.

(5) Supplemental values

Yes

The Mojave Road, an important historic period travel route, transects the area in a southwest-to-northeast direction. Remnants of the 1906 Tonopah & Tidewater Railroad berm are adjacent to the eastern boundary and a portion of the historic and still active Union Pacific (now BNSF) Railroad follows the southern boundary. Also there are some historic mines and associated mining debris located within this area.

Appendix A

Route Analysis of Area 243

WIU # Area CA-080-243 **Date:** April 17, 2013

Appendix C - Route Analysis **Evaluator(s):** Rusty Gates and Tim Williamson

Route #	Purpose	ROW Y/N/UK	ROW In Use?	Constructed Mechanically	Type of Evidence	Improved Mechanically	Hand Tools Or Machinery	Type of Evidence
AC 8711	Industrial & Recreation	Y	Y	Y	Hardpack & Blading	Y	Machinery	Berms on two sides
AC 8828	Recreation	UK	UK	Y	Hardpack & Blading	N	Machinery	Berms on two sides
Historic Mojave Road	Recreation	N	N	N	Two Track	N	N/A	Many different two tracks visible in wash
*Unnamed & Unmapped	Recreation	N	N	N	Two Track	N	N/A	Two track that turns into a wash
**Unnamed & unmapped	Recreation	N	N	Y	Hardpack & Blading	N	Machinery	Berms on two sides

* Route is more of an illegal route that starts on the edge of the Rasor Open Off-Highway Vehicle area and ends approximately 500 yards north of where it starts. GPS coordinates - 3889300 N 575842 E is the rough starting point off AC 8828.

** This appears to be an old road which is no longer in use. It starts off AC 8828 and runs parallel to interstate for roughly three miles until it terminates. GPS coordinates - 3889090 N 573950 E off AC 8828.

Appendix B

Photo Log of Area 243

#1 - Route 8711 & Historic Mojave Road - Eastern View

#2 - Route 8711 OHV Staging Area - Northeastern View

#3 - Small Hill West of Rasor Road/Route 8828 - Northwestern View

#4 - Rasor Road/Route 8828 - Northwestern View

#5 - Unnamed Route South of I-15 - Eastern View

#6 - Unnamed Route South of I-15 - Southern View

#7 - Unnamed Route South of I-15 - Northern View

#8 - Rasor Road/Route 8828 - Northern View

Photo Log for Area 243				
Photo #	**GPS**	**Town & Range**	**Dir**	**Description**
1	3879026 N 565034 E	T 11 N R 7 E Sec 7	E	Route 8711 and Historic Mojave Road, dry river wash, pebbly sandy loam, willow, mesquite and scrubs.
2	3883072 N 567002 E	T 12 N R 7 E Sec 32	NE	Route 8711, staging area for the Rasor Open OHV area, pebbly sandy loan, mesquite and scrubs.
3	3884280 N 578498 E	T 12 N R 8 E Sec 28	NW	Small Hill due west of Rasor Road/Route 8828 and within the Rasor Road Open OHV Area, Rocky with sandy pebbly loam, sparse scrub in foreground.
4	3888281 N 576485 E	T 12 N R 8 E Sec 8	NW	Rasor Road/Route 8828, within the Rasor Road Open OHV Area, pebbly sandy loam, creosote scrub and grasses.
5	3891256 N 575316 E	T 12 N R 8 E Sec 6	E	Unmaintained and unnamed route, south of I-15, creosote scrub, pebbly sandy loam.
6	3891256 N 575316 E	T 12 N R 8 E Sec 6	S	Unmaintained and unnamed route, south of I-15, creosote scrub, pebbly sandy loam.
7	3891256 N 575316 E	T 12 N R 8 E Sec 6	N	Unmaintained and unnamed route, south of I-15, creosote scrub, pebbly sandy loam.
8	3888681 N 572717 E	T 12 N R 7 E Sec 11	N	Rasor Road/Route 8828, pebbly sandy loam but hard packed in spots with visible evidence of an old road, creosote scrub.

Appendix C

BLM California Desert Conservation Area Wilderness Final Inventory, Dec. 1979

Written Description & Map of Area 243

IV. NATURAL CONDITION

Portions of this area have been affected by man. Some activity, both past and present, has resulted in a degradation of the natural environment and in the exclusion of these sites from those containing wilderness values. A telephone relay station and access road in the southern Soda Mountains near Interstate 15 at the Beacon overpass has been included. In addition, the active Blue Bell Mine, at VABM 2849, in the Soda Mountains was excluded because of current operations (bulldozing, slag piles, shafts, equipment). Along the western border two active quarries, one mine, borrow pit, and their associated roads and ways have been excluded, in portions of Sections 21, 22, 26, 28, 34 and all of 27, (T. 12N., R. 5E.). Another borrow pit and road, off Highway 91, have been excluded in Section 33 (T. 12N., R. 6E.). In the northern portion of the area having 2(c) values, signs of man's works including an active mine with open pit scars, a house, and its associated road have been excluded. From the northern border in Section 25, (T. 15N., R. 7E.), this road runs south through Sections 25, 36, (T. 15N., R. 7E.), and Sections 1, 2, 11, 14, 15, (T. 14N., R. 7E.). Nearby another mining road comes off the northern border in Section 3 (T. 14N., R. 7E.). It has been excluded also due to its maintenance and associated mining scraps. The southeast corner, near Baker, has been excluded due to several ways, old mining scars and ORV tracks.

The remainder of the area has been affected primarily by the forces of nature with the imprint of man's works substantially unnoticeable. A way crosses the valley between the Cronese and Soda Mountains. Sections of this way are under water at East Cronese Lake. Several other old ways are in the area but have an insignificant affect upon the naturalness of the area.

V. OUTSTANDING OPPORTUNITIES FOR SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

Opportunities for both solitude and for a primitive and unconfined type of recreation are outstanding in the area. The large size and variation in landform provide numerous opportunities.

VI. SUMMARY OF PUBLIC COMMENTS

The majority of the comments agreed with the findings. Several comments suggested the southeast border should be extended south. A few comments dealt with additional roads. After field checks, the appropriate changes were made.

AREA 243

I. PHYSICAL BOUNDARIES

The northern boundary includes an underground telephone line right-of-way, a cattle fence maintenance road south of Rattlesnake and Big Cowhole Mountains; and, a cattle fence maintenance road that eventually ties into the telephone road near 17-Mile Point on the Kelbaker Road. The eastern boundary includes the Kelbaker Road. The southern boundary of the Wilderness Study Area is the northern edge of the utility right-of-way which contains power transmission lines. This boundary is located along a line 400 feet north of the three existing transmission lines (except where a service road may extend outside the right-of-way); the railroad line and maintenance road; and, the western boundary, Basin Road.

II. LAND OWNERSHIP

Approximately 10-15 percent of this area is non-public land scattered throughout the area.

III. DESCRIPTION OF ENVIRONMENT

This area contains a variety of vegetative types, geographical features, and landforms. Of particular significance is the Mojave River Sink, occupying the southern portion of the area, which grades from flat, rocky terrain on the west to mesquite-covered sand hummocks and small dunes in the central portion. Other significant landforms include the flat, alkali-covered Soda Lake Bed, the low, sand-blanketed hills of Devil's Playground, the large, steep-sided Old Dad Mountain, and the smaller, but rugged, Soda Mountains and Cowhole Mountains. Except for the sand hummock area, which supports a rich community of mesquite and other sand-tolerant plants, vegetation throughout the area is sparse, consisting mostly of creosote and mixed shrubs. A major portion of Soda Lake Bed is entirely devoid of vegetation due to the mineral content in the soil.

IV. NATURAL CONDITION

A major portion of the area generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. Boundary adjustments have been made in order to exclude heavily impacted areas, such as the area just east of Afton Canyon which contains numerous ways and surface scrapings and which appears to have been used as a dumpsite for scrap metal; the Rasor Ranch/Crucero area which contains numerous ways, off-road vehicle impacts, and the abondoned Rasor Ranch structures; the road to private dwellings from the Rasor Ranch exit on Interstate 15; the improved roads, buildings, and other developments in and around Soda Springs; the roads to active mines (surface scraping, structures, and slag piles) in the Cowhole and Little Cowhole Mountains; and the roads, slag piles, tunnels, and shafts near 17-mile point. A previously graded road leads along the western edge of Old Dad Mountain to a mine (grading or slopes) on the northern edge. An unimproved way continues north from this road along the western edge of the mountains and ties into the road going east from the Little Cowhole Mountains. The way has little impact on the naturalness of the area due to its deteriorated condition.

The adjusted boundary proceeds northeast following a wash from the Union Pacific Railroad at Section 12 (T. 11 N., R. 9 E.) to the edge of the dry lake. It then follows the edge of the dry lake and skirts around the southern edge of the Cowhole Mountains, then northward to the roadless area boundary at Section 30 (T. 13 N., R. 10 E.). Except for the exclusion of the mines near 17-mile point, the boundary generally follows the roadless area boundary from this point on.

Within the adjusted boundaries, the land has generally retained its primeval character and influence. Other works of man, which include a few primitive ways, are substantially unnoticeable due to terrain variety and the sandy nature of some areas.

V. OUTSTANDING OPPORTUNITIES FOR SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

The area contains a variety of topography which provides outstanding opportunities for solitude within the secluded canyons of the mountains and in the vast, open plains. Unobstructed views in many directions enhance feelings of remoteness in the area. The diversity of geological features also provides outstanding opportunities for a wide range of primitive and unconfined types of recreation.

VI. SUMMARY OF PUBLIC COMMENTS

Public comment is overwhelmingly in favor of this area's inclusion as a study area. Many comments urged the addition of the Mojave River Sink on the basis of its ecological significance and apparent naturalness. A few comments opposed the addition of the Sink area due to its popularity for off-road vehicle and camping use in the Rasor Ranch/Crucero area. Field examination revealed the impacts mentioned in Part IV which impaired the natural condition.

AREA 244

I. PHYSICAL BOUNDARIES

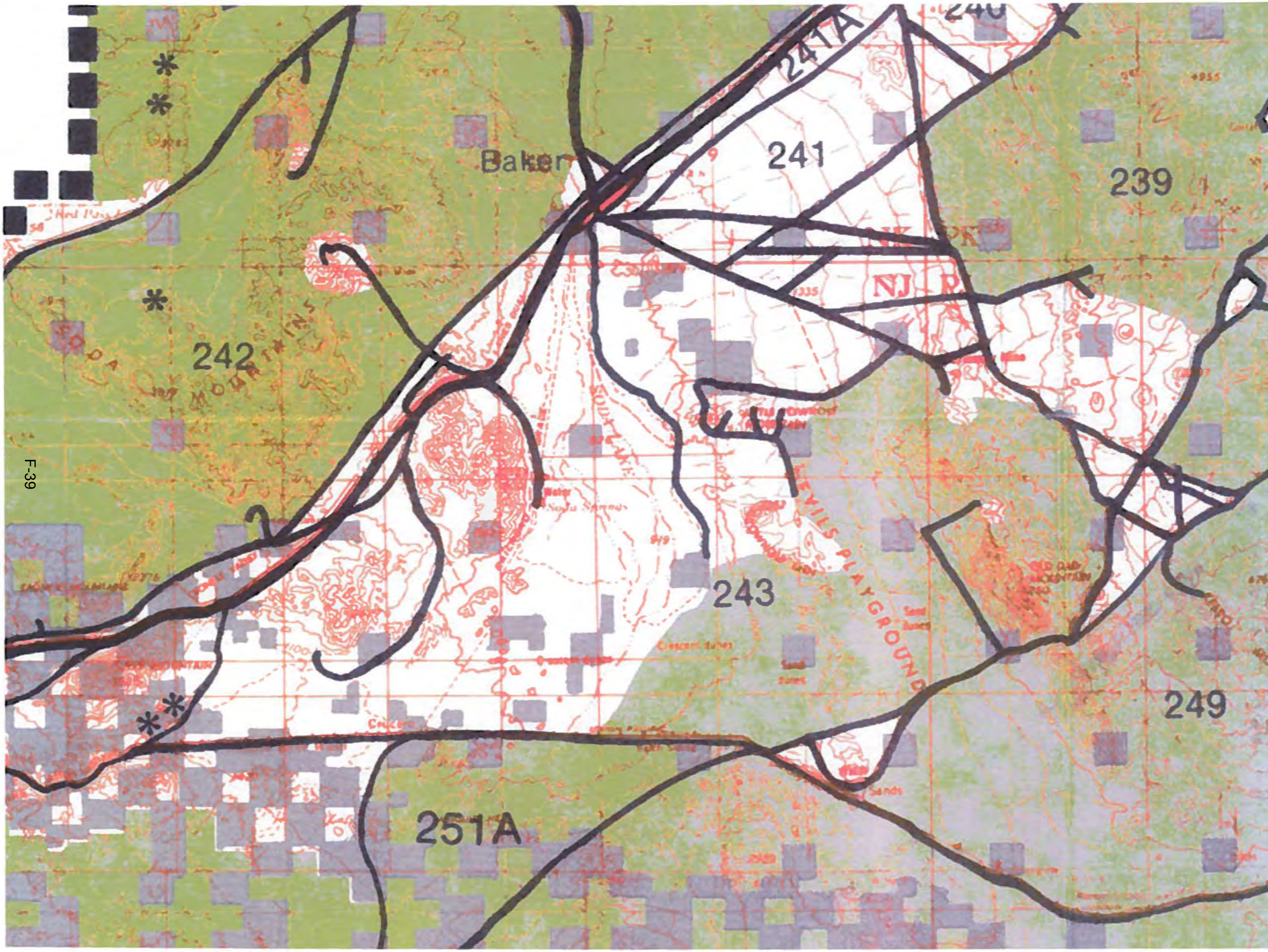
The southern boundary of the Wilderness Study Area is the northern edge of the utility right-of-way which contains power transmission lines. This boundary is located along a line 400 feet north of the three existing transmission lines (except where a service road may extend outside the right-of-way); on the east, by a maintained road used for access to Rainbow Wells and for service to a utility line; and, on the northwest, by a road used for access to the Aiken Cinder Mine, as well as a maintenance road for adjoining cattle tanks and water line.

II. LAND OWNERSHIP

The area contains two sections of non-public land, accounting for roughly 10 percent of the total area.

III. DESCRIPTION OF ENVIRONMENT

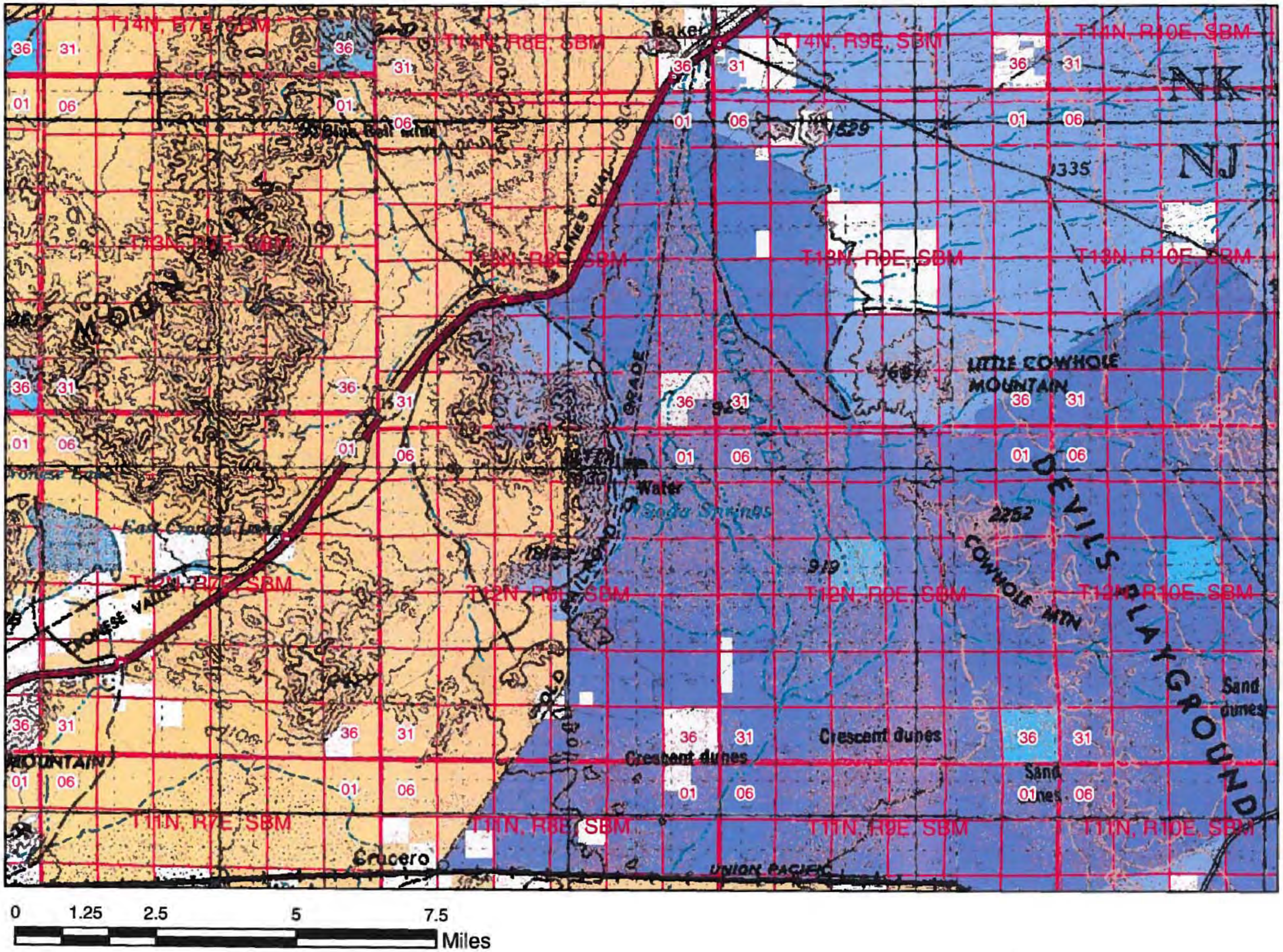
This area contains about half of the area known as the "Cinder Cones." Topography varies throughout the area. The Cones rise above the surrounding terrain about 300 feet, are dark red and black, and symmetrically shaped. Between the Cones are large


241A
240
Baker
241
239
NJ
242
SODA MOUNTAINS
DEVILS PLAYGROUND
243
249
251A

Appendix D

Current Land Status Map of Area 243

Current Status of Area 243



APPENDIX G
Visual Resources

G-1. BLM Form 8400-4, Visual Contrast Rating Worksheet

G-2. Glare Analysis

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APPENDIX G-1
BLM Form 8400-4, Visual Contrast Rating Worksheet

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Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

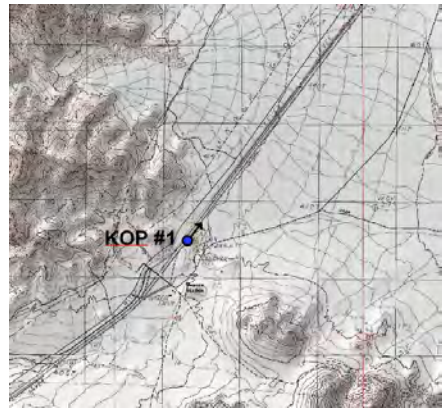
1. Project Name: SODA MOUNTAIN SOLAR

2. Key Observation Point #1

3. VRM Class: Not yet assigned

4. Location
Longitude: 35° 8'20.18"N
Latitude: 116°12'23.16"W

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Slightly sloping, virtually horizontal desert floor. Rounded to angular backdrop mountains with diversity through bulk forms created by drainage patterns.	Uniform low cover of creosote scrub that with distance provides even horizontal appearance. Lacking significant variation.	I-15 corridor improvements and heavy traffic dominate view. Vertical transmission line towers and highway fencing.
LINE	Horizontal to very sloping for alluvial fan. Common, relatively smooth ridgelines of surrounding mountains silhouetted against sky. Horizontal edge where mountains meet alluvium.	Monoculture of creosote dominates creating a horizontal line against mountain backdrop.	Linear band effect of highway improvements strengthened by transmission lines and fencing parallel to the highway.
COLOR	Light-beige soils dominate immediate foreground. Backdrop mountains present variations in brown with reddish tints.	Light gray-green of desert sage to dark olive green of creosote shrubs.	Charcoal gray with contrasting white and yellow stripes. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Fine textured sandy soils with no or little presence of rocks or variation in texture.	Sparse density vegetation in immediate foreground transitioning to dense even tone with distance.	Smooth.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Minor terracing of array areas but generally conforming with overall topography. Virtually level form will not be significantly altered	Vegetation to be removed within solar array areas and fence lines.	Solar arrays, inverter enclosures, access roads, fencing, substation, 34.5-kV collector line.
LINE	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	North-south rows of PV panels at 45 degree angle to I-15. 34.5-kV collector line,
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures and substation buildings not defined. Substation facilities silver and black. 34.5-kV collector line brown (wood).
TEX-TURE	Smooth texture on access roads, along fence lines, and within array areas that where vegetation is removed.	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a fine to medium uniform texture of even rows at a regular angle to highway.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		LAND/WATER BODY (1) STRONG	LAND/WATER BODY (1) MODERATE	LAND/WATER BODY (1) WEAK	LAND/WATER BODY (1) NONE	VEGETATION (2) STRONG	VEGETATION (2) MODERATE	VEGETATION (2) WEAK	VEGETATION (2) NONE	STRUCTURES (3) STRONG	STRUCTURES (3) MODERATE	STRUCTURES (3) WEAK	STRUCTURES (3) NONE
ELEMENTS	FORM				X				X		X		
	LINE			X				X		X			
	COLOR				X			X		X			
	TEXTURE				X				X		X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

Minimal grading with the solar array areas will create straight edges, but not substantially alter the overall form of the land. The cumulative form of the solar arrays is substantially low and horizontal. The lines created by the arrays themselves and the rectilinear edges of the array areas will contrast with the random but even pattern of the desert floor and exiting vegetation. Views to distant mountains are not blocked.

The lines and patterns of the PV solar arrays will be rank and file and contrast with the randomness of the surrounding vegetation. The dark gray color of the solar arrays, potential colors of the inverter enclosures, and glare from silver galvanized fencing contrast with the flat light browns of the desert soils and olive greens of vegetation. The texture of the arrays is coarser and organized in rectilinear patterns that contrasts with the random spacing of desert vegetation and the transitioning of vegetation that becomes dense and even with distance.

Because of distance, the overhead 34.5-kV collector poles, conductors, and route clearing will not be readily evident nor significantly contrast because of foreground vegetation and backdrop mountains. Depending on sun angle, 34.5-kV conductors will reflect and contrast with the backdrop during some portions of the day.

The substation will be seen north of I-15 approximately 2.8 miles from the viewpoint. Because of distance, the scale of facilities will be minimal in relation to the surrounding mountain backdrop. Lighting on the substation site is to be dark sky-compliant.

Additional Mitigating Measures

To be determined.

Form 8400-4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
VISUAL CONTRAST RATING WORKSHEET

Date: 12/7/12

District/ Field Office: Barstow

Resource Area: Western Mojave

Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

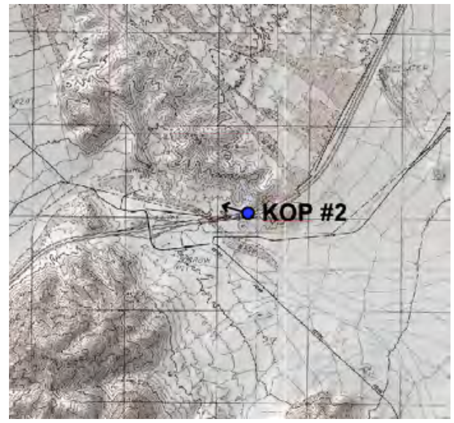
1. Project Name SODA MOUNTAIN SOLAR

2. Key Observation Point #2

3. VRM Class: Not yet assigned

4. Location
Longitude: 35°11'49.78"N
Latitude: 116° 7'46.26"W

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Broadly sloping desert alluvial fan with minor topographic drainage variations. Rounded to angular backdrop mountains with diversity through bulk forms created by drainage patterns. Disturbed lands north of interchange.	Uniform low cover. Lacking significant variety.	The angular, engineered forms of I-15 and the ZZYZX interchange contrast with natural forms of the landscape. Less dominant are vertical fencing and two sets of transmission line towers. Dynamic vehicular traffic.
LINE	Varied ridgelines of mountains silhouetted against sky. Mountain drainages create vertical, curvilinear lines. Horizontal edge where mountains meet alluvium.	Monoculture of creosote dominates without noticeable variation in line.	Linear corridor effect of highway strengthened and fencing parallel to the highway.
COLOR	Light-beige soils dominate immediate foreground. Backdrop mountains present variations in brown with reddish tints.	Light gray-green of desert sage to dark olive green of creosote shrubs.	Charcoal gray with contrasting white and yellow stripes on highway. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Sandy to rocky soils with variation in texture. Backdrop mountains present some variations of ridgelines and drainage patterns.	Evenly but sparse texture vegetation in immediate foreground transitioning to dense even tone with distance.	Pavement is smooth. Ancillary facilities (signs, fencing, etc.) random.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography.	Vegetation to be removed within solar array areas and fence lines.	Solar arrays, inverter enclosures, access roads, fencing.
LINE	Sloped form of alluvial fan will not be significantly altered.	Angular lines created by outside edge of solar array areas and direction of fence line where vegetation is removed.	North-south rows of PV panels at an almost perpendicular angle to I-15.
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined.
TEX-TURE	Smooth texture on access roads, along fence lines, and within array areas that where vegetation is removed.	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a fine to medium uniform texture of even rows at a regular angle to highway.

SECTION D. CONTRAST RATING __SHORT TERM _X_ LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM			X				X				X	
	LINE		X					X		X			
	COLOR			X			X			X			
	TEXTURE			X				X			X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2:

The immediate foreground around the interchange is a disturbed landscape from previous mining and apparent construction staging activities. Grading within the project will follow the contours of the area with straight edges, but not substantially alter the overall color or texture of the land. The overall form of the solar arrays will create a canted plane as the topography rises. The lines created by the rectilinear edges of the array areas contrast with the even pattern of the desert floor and vegetation. Views to distant mountains are not blocked.

The lines and patterns of the PV solar arrays will appear stacked behind one another and conform to the general topography of the ground. The dark gray color of the solar arrays, colors of the inverter enclosures, and glare from silver galvanized fencing will contrast with the flat light browns of the desert soils and olive greens of vegetation. The texture of the arrays is coarser and organized in rectilinear patterns that contrasts with the even cover of the desert vegetation that is created by the distance from I-15.

Additional Mitigating Measures:

To be determined.

Form 8400-4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
VISUAL CONTRAST RATING WORKSHEET

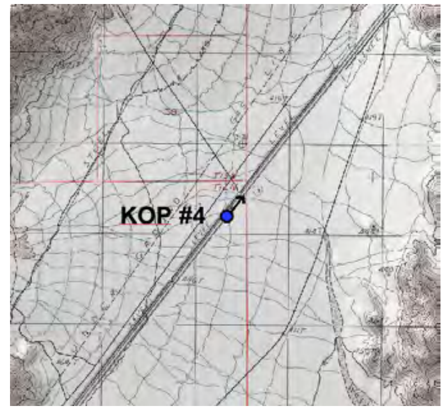
Date: 12/7/12

District/ Field Office: Barstow

Resource Area: Western Mojave

Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #4 3. VRM Class: Not yet assigned	4. Location Longitude: 35° 9'51.94"N Latitude: 116°10'58.63"W	5. Location Sketch 

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Slightly sloping, virtually horizontal desert floor. Rounded to angular backdrop mountains with diversity through bulk forms created by drainage patterns.	Uniform low cover of creosote scrub that with distance provides even horizontal appearance. Lacking significant variation.	I-15 corridor and heavy traffic dominate view. Vertical transmission line towers and highway fencing.
LINE	Horizontal to very sloping for alluvial fan with barely perceptible wash crossing perpendicular under road.. Common, relatively smooth ridgelines of surrounding mountains silhouetted against sky. Horizontal edge where mountains meet alluvium.	Monoculture of creosote dominates creating a horizontal line against mountain backdrop.	Linear band effect of highway strengthened by transmission lines and fencing parallel to the highway.
COLOR	Light-beige soils dominate immediate foreground. Backdrop mountains present variations in brown with reddish tints.	Light gray-green of desert sage to dark olive green of creosote shrubs.	Charcoal gray with contrasting white and yellow stripes. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Fine textured sandy soils with no or little presence of rocks or variation in texture.	Sparse density vegetation in immediate foreground transitioning to dense even tone with distance.	Smooth.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading of solar array areas will generally conform with overall topography. Drainage control and channel berms of up to 3-feet high will be noticeable	Vegetation to be removed within solar array areas and fence lines.	Solar arrays, inverter enclosures, fencing.
LINE	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	Access road improvements. North-south rows of PV panels at an approximate 45-degree angle to I-15.
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined.

TEX-TURE	Smooth texture on access roads, along fence lines, and within array areas that where vegetation is removed.	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a fine to medium uniform texture of even rows at a regular angle to highway.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? ___Yes ___No (Explain on reverses side) VRM designations not yet determined.
		LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)				
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	3. Additional mitigating measures recommended _X_ Yes ___No (Explain on reverses side)
ELEMENTS	FORM		X					X				X		
	LINE		X					X		X				Evaluator's Names: Patrick T. Miller, 2M Associates
	COLOR			X			X			X				Date: 12/7/12
	TEXTURE			X				X			X			

SECTION D. (Continued)

Comments from item 2.

Grading within the solar array areas will create some low-formed terraces with straight edges, but not substantially alter the overall form of the land. The cumulative form of the solar arrays is substantially low and horizontal. The engineered, trapezoidal forms of the diversion berms contrast with the gentle slopes of the landscape. The lines created by the rectilinear edges of the array areas created by removal of vegetation contrast with the even pattern of the desert floor and exiting vegetation. Views to distant mountains are not blocked.

The lines and patterns of the PV solar arrays will be rank and file and contrast with the randomness of the surrounding vegetation. The dark gray color of the solar arrays, potential colors of the inverter enclosures, and glare from silver galvanized fencing contrast with the flat light browns of the desert soils and olive greens of vegetation. The straight lines of the engineered diversion berms contrast with the meandering, braided drainage patterns. The texture of the arrays is coarser and organized in rectilinear patterns that contrasts with the random spacing of desert vegetation and the transitioning of vegetation that becomes dense and even with distance.

The substation will appear as an island of contrasting form and color adjacent to existing transmission lines.

Additional Mitigating Measures

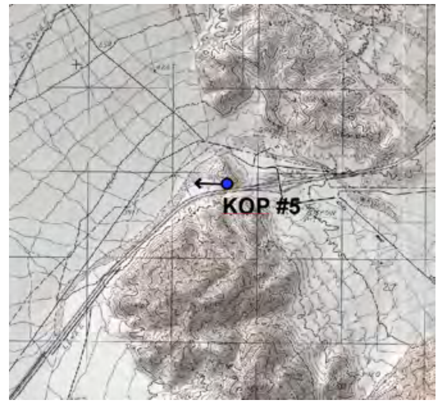
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date:
	District/ Field Office: Barstow
	Resource Area: Western Mojave
	Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR	4. Location Longitude: 35°11'41.79"N Latitude: 116° 9'1.48"W	5. Location Sketch
2. Key Observation Point #5		
3. VRM Class: Not yet assigned		



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Rolling hills in immediate foreground. Broadly sloping desert alluvial fan with minor topographic drainage variations. Prominent rounded to angular backdrop mountains with diversity through creasing forms of drainages.	Sparse to low uniform low cover. Lacking significant variety.	I-15 corridor and heavy traffic contrast with natural forms and lack of motion. Less dominant because of distance and backdrop are fencing and two sets of transmission line towers.
LINE	Varied ridgelines of silhouetted mountains and drainage patterns. Mountain drainages create vertical, curvilinear lines.	Monoculture of creosote dominates without noticeable variation in line.	Linear corridor effect of highway strengthened and fencing parallel to the highway.
COLOR	Light-beige soils dominate immediate foreground. Backdrop mountains present variations in brown with reddish tints.	Light gray-green of desert sage to dark olive green of creosote shrubs.	Charcoal gray with contrasting white stripes. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Sandy to rocky soils with variation in texture. Backdrop mountains present some variations of ridgelines and drainage patterns.	Evenly but sparse texture vegetation in immediate foreground transitioning to dense even tone with distance.	Pavement is smooth. Ancillary facilities (signs, fencing, etc.) random.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography. The canted angle of the desert floor will not be significantly altered.	Vegetation to be removed within solar array areas, fence lines, and substation.	Solar arrays, inverter enclosures, access roads, substation facilities, fencing.
LINE	Internal to the solar array areas there are no visibly obvious drainage patterns to be changed.	Collector line route and edge of array areas where vegetation is create a contrasting angular line pattern.	North-south rows of PV panels at a approximate 15-degree angle.
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined. Silver to dark gray materials in substation.
TEX-TURE	Smooth texture on access roads, along fence lines, and within array areas that where vegetation is removed.	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a fine to medium uniform texture of even rows at a regular angle to highway.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM		X					X				X	
	LINE		X			X				X			
	COLOR			X			X			X			
	TEXTURE			X				X			X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

Grading within the project will follow the contours of the area creating straight edges, but not substantially alter the overall color or texture of the land. The overall form of the solar arrays will create a canted plane as the topography rises. The lines created along the rectilinear edges of the array areas will contrast with the even pattern of the desert floor and vegetation. Views to distant mountains are not blocked.

The lines and patterns of the PV solar arrays will appear stacked behind one another and conform to the general topography of the ground. The dark gray color of the solar arrays, colors of the inverter enclosures, and glare from silver galvanized fencing will contrast with the flat light browns of the desert soils and olive greens of vegetation. The texture of the arrays is coarser and organized in rectilinear patterns that contrasts with even cover of the desert vegetation that is created by the distance from I-15.

Additional Mitigating Measures:

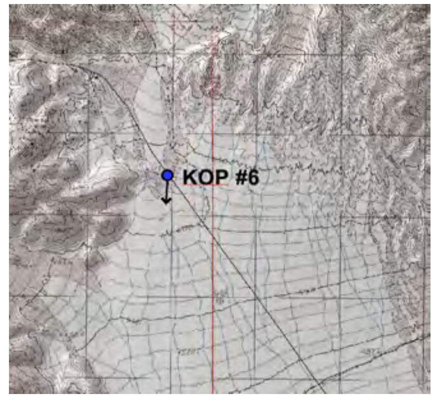
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #6 3. VRM Class: Not yet assigned	4. Location Longitude: 35°14'15.41"N Latitude: 116°11'16.83"W	5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Broad sloping alluvial fan with surrounding mountains providing contrast and diversity in bulk form.	Creosote and sage provide a uniform cover that at a distance provides even tone appearance	Tops of vertical lattice transmission line towers noticeable. I-15 visible but appears horizontal because of distance. Moving forms of vehicular traffic draw attention.
LINE	Bold irregular mountain ridgelines from rounded to pointed. Bottom of slopes form meandering lines with relatively flat alluvial fans.	Vegetation presents an even pattern without line.	Straight lines of I-15, transmission line conductors, and Blue Bell Mine Road contrast with generally horizontal plain of alluvial fan. Linear movement of traffic on I-15 evident and attracts attention.
COLOR	Light to dark gray.	Light tan, gold, and olive green.	Gray transmission line towers. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Fine to moderate coarseness of rocky souls.	Moderate texture created by density of vegetation.	Lattice transmission line towers contrast with surround natural textures.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography and at distance seen changes in form will be imperceptible.	Vegetation to be removed within solar array areas and along fence lines.	Solar arrays, inverter enclosures, access roads, and fencing at distance seen will be flat. 334.5-kV collector poles.
LINE	There are no visibly obvious drainage patterns to be changed.	Angular edges created by outside edge of solar array areas, fence line, and access roads where vegetation is removed..	North-south rows of PV panels parallel to view. Collector route not readily perceptible.
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined. Brown wood collector poles.
TEX-TURE	At distance seen changes will be imperceptible	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a uniform texture of even lines parallel to view.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM		X				X					X	
	LINE		X				X				X		
	COLOR			X			X				X		
	TEXTURE			X			X				X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

The view is oriented to the East and South Solar Array areas from between an approximate 2.5-mile to 5.0-mile distance. Distance will mute the contrast effects of form, color, and texture. Mid-day sun/shadow patterns will create a linear texture within north-south rows of PV panels within array areas. Lines created by removal of vegetation along the edges of the solar array areas and the connector route will contrast with the existing even color, texture, and form of the vegetated desert floor.

The North Solar Array area, because of the angle of the ground plane, will not be seen. The contrast of 34.5-kV collector poles will be muted by backdrop landforms. Depending on sun angle, 34.5-kV conductors will reflect and contrast with the backdrop during some portion of the day.

Additional Mitigating Measures:

To be determined.

Form 8400-4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
VISUAL CONTRAST RATING WORKSHEET

Date: 12/7/12

District/ Field Office: Barstow

Resource Area: Western Mojave

Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

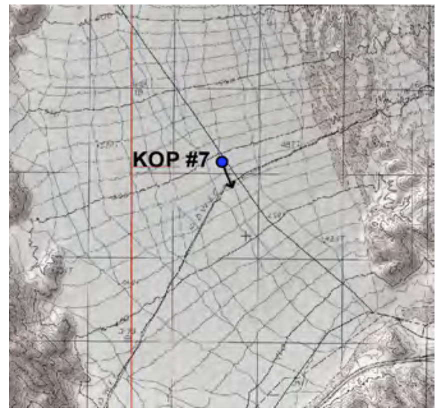
1. Project Name: SODA MOUNTAIN SOLAR

2. Key Observation Point #7

3. VRM Class: Not yet assigned

4. Location
Longitude: 35°12'58.08"N
Latitude: 116°10'12.00"W

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Broad sloping alluvial fan with mountains providing contrast in bulk form.	Creosote and sage provide a uniform cover that at a distance provides even tone appearance	Two sets of transmission lines with vertical and angled forms of lattice towers dominate view. Horizontal I-15 visible. Moving forms of vehicular traffic draw attention.
LINE	Bold irregular mountain ridgelines from rounded to pointed. Bottom of slopes form meandering lines with relatively flat alluvial fans.	Vegetation presents an even pattern without line.	Scalloped transmission line conductors and horizontal access roads readily evident. Linear movement of traffic on I-15 evident and attracts attention.
COLOR	Light to dark gray.	Light tan, gold, and olive green.	Gray transmission towers. One set of transmission line conductors reflective and silver in appearance. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEXTURE	Fine to moderate coarseness of rocky souls.	Moderate texture created by density of vegetation.	Lattice transmission line towers contrast with surround natural textures.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography.	Vegetation to be removed within solar array areas and fence lines.	Solar arrays, inverter enclosures, access roads, fencing, collector poles.
LINE	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	North-south rows of PV panels parallel to view. Edges of
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined. Brown wood collector poles.
TEXTURE	Smooth texture on access roads, along fence lines, and within array areas that where vegetation is removed.	Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a uniform linear texture of even parallel to view in foreground.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES											
		LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM			X				X		X			
	LINE		X				X			X			
	COLOR			X			X			X			
	TEXTURE			X				X			X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

The view is directly north of the North Solar Array and in the immediate foreground with the East and South Solar Array areas behind. The PV collectors will be parallel to the view and contrast with the graded bare earth within the solar array areas. Views to distant mountains are not blocked.

The lines and patterns of the PV solar arrays will be rank and file and contrast with the randomness of the surrounding vegetation. The dark gray color of the solar arrays, potential colors of the inverter enclosures, and glare from silver galvanized fencing contrast with the flat light browns of the desert soils and olive greens of vegetation. The texture of the arrays is coarser and organized in rectilinear patterns that contrasts with the random spacing of desert vegetation and the transitioning of vegetation that becomes dense and even with distance.

Distance will mute the contrast effects of color and texture of the East and South Solar Array areas. Mid-day sun/shadow patterns will create a linear texture within north-south rows of PV panels within array areas. Lines created by removal of vegetation along the edges of the solar array areas and the connector route will contrast with the existing even color, texture, and form of the vegetated desert floor.

The contrast of 34.5-kV collector poles will be muted by backdrop landforms. Depending on sun angle, 34.5-kV conductors will reflect and contrast with the backdrop during some portions of the day.

Additional Mitigating Measures:

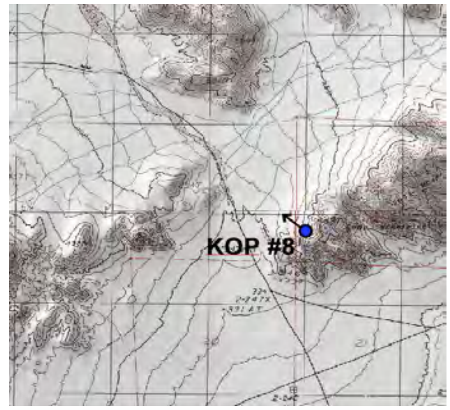
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #8 3. VRM Class: Not yet assigned	4. Location Longitude: 35° 7'21.36"N Latitude: 116° 8'38.46"W	5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Gently sloping alluvial fan. Prominent, rounded to angular backdrop mountains with diversity through bulk forms created by drainage patterns.	Uniform cover that at a distance provides even appearance	Engineered forms of I-15 dominate immediate foreground. 2 sets of vertical transmission line towers somewhat less evident.
LINE	Horizontal edge where mountains meet alluvium. Mountain drainages create vertical, curvilinear lines.	Indistinct.	Linear corridor presented from I-16 and transmission line routes.
COLOR	Light sand-colored soils dominate. Backdrop mountains present variations in brown with reddish tints.	Monotone dark olive green of creosote shrubs.	Charcoal gray with contrasting white and yellow stripes. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Coarse rocks in immediate foreground,	Medium to smooth due to distance.	Smooth.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading of solar array areas will generally conform with overall topography. Detention basin form noticeable,	Vegetation to be removed within solar array areas and along fence lines.	North-south rows of PV panels at 45-degree angle to view. Solar arrays, inverter enclosures, access roads, and fencing at distance seen will appear low to ground plain. Collector poles perpendicular to land form.
LINE	Realigned Rasor Road and angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	Realigned Rasor Road and angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	North-south rows of PV panels parallel to view. Collector route not readily perceptible.
COLOR	Light beige exposed soils created after vegetation removal and grading.	Not applicable. No revegetation proposed.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined. Brown wood collector poles.
TEX-TURE	At distance seen changes will be imperceptible	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a uniform linear texture of even parallel to view.

SECTION D. CONTRAST RATING __SHORT TERM _X_ LONG TERM

1. DEGREE OF CONTRAST		FEATURES											
		LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM		X				X					X	
	LINE		X				X				X		
	COLOR			X			X				X		
	TEXTURE			X			X				X		

2. Does project design meet visual resource management objectives? ___Yes ___No (Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended _X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

The view is oriented to the South Solar Array area from between an approximate 1.7-mile to 3.5-mile distance. The observer position is superior looking directly at the broad alluvial fan canted toward the KOP. Distance will somewhat mute the contrast effects of color and texture. Lines created by removal of vegetation along the edges of the solar array areas and the connector route will contrast with the existing even color, texture, and form of the vegetated desert floor. The rectilinear forms of the solar array area will also contrast with the meandering, braided lines of the wash and smooth low ridgelines bordering the project area.

Additional Mitigating Measures:

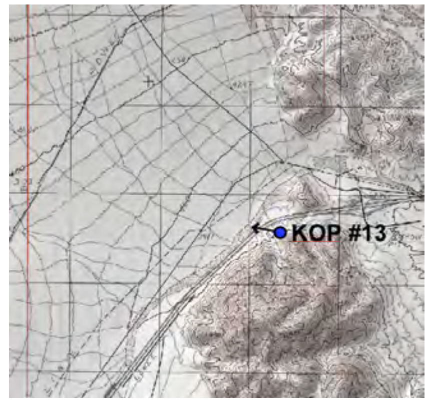
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #13 3. VRM Class: Not yet assigned	4. Location Longitude: 35°11'37.62"N Latitude: 116° 9'6.49"W	5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Gently sloping alluvial fan. Prominent, rounded to angular backdrop mountains with diversity through bulk forms created by drainage patterns.	Uniform cover that at a distance provides even appearance	Engineered forms of I-15 dominate immediate foreground. 2 sets of vertical transmission line towers somewhat less evident.
LINE	Horizontal edge where mountains meet alluvium. Mountain drainages create vertical, curvilinear lines.	Indistinct.	Linear corridor presented from I-16 and transmission line routes.
COLOR	Light sand-colored soils dominate. Backdrop mountains present variations in brown with reddish tints.	Monotone dark olive green of creosote shrubs.	Charcoal gray with contrasting white and yellow stripes. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Coarse rocks in immediate foreground,	Medium to smooth due to distance.	Smooth.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography. The canted angle of the desert floor will not be significantly altered.	Vegetation to be removed within solar array areas, fence lines, and substation.	Solar arrays, inverter enclosures, access roads, substation facilities, fencing, 34.5-kV collector line.
LINE	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	Angular edges created by outside edge of solar array areas and direction of fence line where vegetation is removed.	North-south rows of PV panels at a approximate 45-degree angle.
COLOR	Light beige exposed soils created after vegetation removal and grading.	Light beige exposed soils created after vegetation removal and grading.	Dark gray PV panels with flat off-white backs. Silver posts and fencing. Color of inverter enclosures not defined. Silver to dark gray materials in substation.
TEX-TURE	Smooth texture on access roads, along fence lines, and within array areas that where vegetation is removed.	Not applicable. No revegetation proposed. Fine ground texture where vegetation is removed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a fine to medium uniform texture of even rows at a regular angle to viewpoint.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES											
		LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM		X					X				X	
	LINE		X			X				X			
	COLOR			X			X			X			
	TEXTURE			X				X			X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
P Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

I-15 and its traffic movement and sound dominate the view.

Grading within the solar array areas will create the appearance of low-formed leveled areas with straight edges, but not substantially alter the overall form of the land. The cumulative form of the solar arrays is substantially low and horizontal. The solar arrays will create a textured canted plane as the topography rises. The lines created along the rectilinear edges of the array areas through removal of vegetation will contrast with the even pattern of the desert floor and exiting vegetation. Views to distant mountains are not blocked.

The lines and patterns of the PV solar arrays will be rank and file and contrast with the randomness of the surrounding vegetation. The dark gray color of the solar arrays, potential colors of the inverter enclosures, and glare from silver galvanized fencing contrast with the flat light browns of the desert soils and olive greens of vegetation. The texture of the arrays is coarser and organized in rectilinear patterns that contrasts with the random spacing of desert vegetation and the transitioning of vegetation that becomes dense and even with distance.

The overhead 34.5-kV collector poles, conductors, and route clearing will be readily evident creating a contrasting line through the otherwise even desert vegetation. Depending on sun angle, 34.5-kV conductors will reflect and contrast with the backdrop during some portions of the day.

Additional Mitigating Measures:

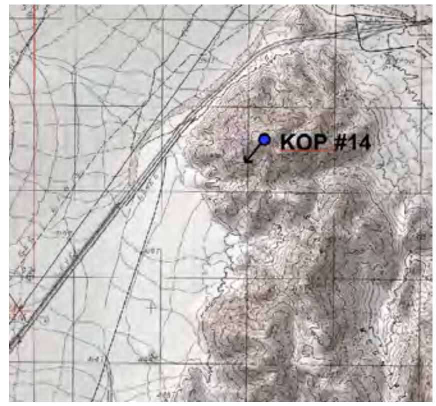
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #14A 3. VRM Class: Not yet assigned	4. Location Longitude: 35°11'2.70"N Latitude: 116° 9'13.17"W	5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Rugged irregular rocks within immediate foreground area of the summit. Prominent bulk forms of surrounding mountains, peaks, and sand dunes contrasts with evenly sloped alluvial fans.	No to insignificant vegetation within immediate foreground area of the peak. Individual plants of alluvial vegetation not discernable.	I-15 and other access roads flat on the landscape. Vertical transmission line towers noticeable but small in scale because of distance.
LINE	Bold irregular mountain ridgelines, meandering washes, and rounded edges of contrasted by smooth undulating sand dunes.	No to insignificant vegetation within immediate foreground area of the peak. Indistinct on desert floor below.	Straight I-15 and parallel utility line access routes highly evident. Transmission line towers in a straight alignment less noticeable but evident.
COLOR	Varied from light sand dunes to taupe desert floor (influenced by vegetation), and dark gray rocks and mountains.	Monotone. Olive green of creosote scrub muted by distance. No to insignificant vegetation within immediate foreground area of the peak.	Dark gray roadway with light beige soil color in median. OHV routes and utility line access roads beige. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Coarse, angular rocks of varying size within immediate foreground area of the summit. Distance mutes other visual textures.	Smooth due to distance.	Not noticeable.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography and because of distance any changes in land form will be imperceptible.	Vegetation to be removed within solar array areas and along fence lines.	Solar arrays will be seen as planar horizontal blocks.
LINE	Main drainages will remain in tact with edge of solar array areas creating a contrasting linear rectilinear edge.	Angular edges created by outside edge of solar array areas, fence line, and access roads where vegetation is removed.	Edges of solar arrays will create stratight lines on the relatively featureless desert floor. The access route associated with the 345-kV collector line will be noticeable but small in scale to the arrays
COLOR	Light brown after grading.	Not applicable. No revegetation proposed.	Dark gray to light tan depending on angle of PV panels.
TEX-TURE	Smooth texture in solar array areas and on access roads.	Not applicable. No revegetation proposed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a uniform linear texture of even perpendicular to view.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM			X			X			X			
	LINE	X				X				X			
	COLOR	X				X				X			
	TEXTURE			X			X			X			

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

The observer position is superior, approximately 885 feet above the East Solar Array area. Because of height, the overall scale of the project and rectilinear form of the solar arrays is emphasized. Within the overall planar form of the array areas, the ground color and PV panel color will contrast to create an obvious 30-degree angle linear pattern that will vary in intensity during the day from a combination of dark gray to light tan depending on the rotation of the PV panels.

Vegetation removal associated with the 34.5-kV collector lines and access roads will appear as light tan lines that contrast with surrounding vegetated landscape.

Additional Mitigating Measures (See item 3)

None. See KOP #1.

Form 8400-4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
VISUAL CONTRAST RATING WORKSHEET

Date: 12/7/12

District/ Field Office: Barstow

Resource Area: Western Mojave

Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

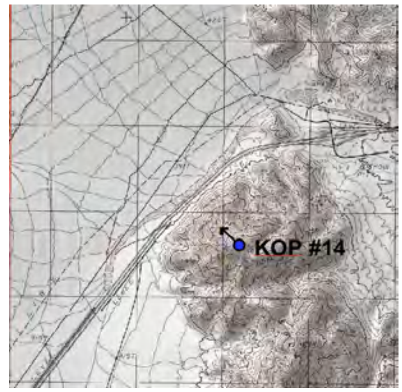
1. Project Name: SODA MOUNTAIN SOLAR

2. Key Observation Point #14B

3. VRM Class: Not yet assigned

4. Location
Longitude: 35°11'2.70"N
Latitude: 116° 9'13.17"W

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Rugged irregular rocks within immediate foreground area of the summit. Bulk forms of surrounding mountains contrasts with evenly sloped alluvial fan.	No to insignificant vegetation within immediate foreground area of the peak. Individual plants of alluvial vegetation not discernable.	I-15 screened by mountain ridgeline. Vertical transmission line towers noticeable but small in scale because of distance.
LINE	Bold irregular mountain ridgelines. Faint braided linear drainage patterns across alluvial fan.	Generally indistinct. Slight reflection of linear drainage patterns through density of vegetation.	Straight Blue Bell Mine Road (BLM Open Route: CL 8847) evident. Transmission line towers in a straight alignment less noticeable but evident.
COLOR	Dark brown with orange tints on foreground rocks. Taupe (influenced by vegetation) alluvial fan. Brown with reddish tint background mountains.	Monotone. Olive green of creosote scrub muted by distance. No to insignificant vegetation within immediate foreground area of the peak.	Light brown soil color contrasted by vegetation.
TEX-TURE	Coarse, angular rocks of varying size within immediate foreground area of the peak. Distance mutes other visual textures.	Smooth due to distance.	Not noticeable.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography and because of distance any changes in land form will be imperceptible.	Vegetation to be removed within solar array areas and along fence lines.	Solar arrays will be seen as planar horizontal blocks.
LINE	Main drainages will remain in tact with edge of solar array areas creating a contrasting linear rectilinear edge.	Angular edges created by outside edge of solar array areas, fence line, and access roads where vegetation is removed.	Edges of solar arrays will create stratight lines on the relatively featureless desert floor. The access route associated with the 345-kV collector line will be noticeable but small in scale to the arrays
COLOR	Light brown after grading.	Not applicable. No revegetation proposed.	Dark gray to light tan depending on angle of PV panels.
TEX-TURE	Smooth texture in solar array areas and on access roads.	Not applicable. No revegetation proposed.	Evenly spaced regular pattern of solar arrays. At a distance arrays will appear as a uniform linear texture of even perpendicular to view.

SECTION D. CONTRAST RATING __SHORT TERM _X_ LONG TERM

1. DEGREE OF CONTRAST		FEATURES											
		LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM			X			X			X			
	LINE	X				X				X			
	COLOR	X				X				X			
	TEXTURE			X			X			X			

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

The observer position is superior, approximately 950 feet above the North Solar Array area. Because of height, the overall scale of the project and rectilinear form of the solar arrays is emphasized. Within the overall planar form of the array area, the ground color and PV panel color will contrast to create an obvious 60-degree angle linear pattern that will vary in intensity during the day from a combination of dark gray to light tan depending on the rotation of the PV panels.

Vegetation removal associated with the 34.5-kV collector lines and access roads will appear as light tan lines that contrast with the surrounding vegetated landscape.

Additional Mitigating Measures (See item 3)

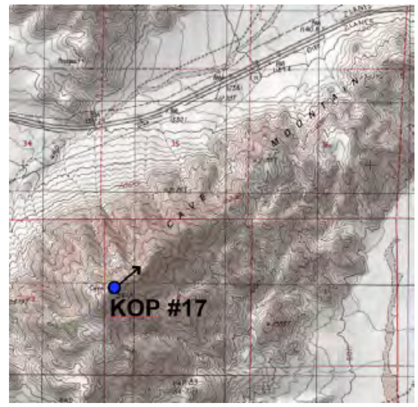
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12
	District/ Field Office: Barstow
	Resource Area: Western Mojave
	Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR	4. Location Longitude: 35° 4'15.25"N Latitude: 116°19'24.24"W	5. Location Sketch
2. Key Observation Point #17		
3. VRM Class: Not yet assigned		



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography and at distance seen changes in form will be imperceptible.	No to insignificant vegetation within immediate foreground area of the peak	I-15 and UPRR tracks visually flat on landscape. Vertical transmission line towers noticeable but small in scale because of distance.
LINE	Bold irregular mountain ridgelines, meandering washes, and rounded edges of contrasted by smooth undulating sand dunes.	No to insignificant vegetation within immediate foreground area of the peak or because of distance.	Vivid straight alignment of I-15 and UPRR contrasts with varied edges of ridgelines, curving alluvial fans and rounded dry lakes and attracts attention. Transmission line towers in a straight alignment less noticeable but evident.
COLOR	Vivid, highly varied values from gray-green in foreground, light sand desert floor, off-white dry lake beds, to dark brown-gray mountains.	Not distinct.	Dark gray color of I-15 pavement. Multiple colors of vehicles on I-15 with white being the most contrasting.
TEX-TURE	Coarse, angular rocks of varying size within immediate foreground area of the peak. Distance mutes other visual textures.	Random and scattered in immediate foreground contrasting with smooth in distance.	Not noticeable because of distance.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	At distance changes in landform will be imperceptible.	Ground vegetation to be removed for access.	Solar arrays.
LINE	At distance changes line patterns will be imperceptible.	Edges will be created surrounding array areas where vegetation is removed.	At distance changes in line will be imperceptible.
COLOR	Light brown with vegetation removal	Not applicable. No revegetation proposed.	Dark gray.
TEX-TURE	At distance changes in textures will be imperceptible.	Not applicable. No revegetation proposed.	At distance changes textures will be imperceptible.

SECTION D. CONTRAST RATING __SHORT TERM _X_ LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM				X				X				X
	LINE				X				X				X
	COLOR			X					X			X	
	TEXTURE				X				X				X

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

Portions of the East and South Solar Array areas may be seen. At approximately 8.1 miles from the project site any form, line and texture changes created by the arrays will not be noticeable. Weak contrast will be created with a change of color. Distance and atmosphere will mute the general color contrast. The line created by I-15 will continue to be the cultural modification that dominates the view.

Additional Mitigating Measures (See item 3)

To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #19 3. VRM Class: Not yet assigned	4. Location Longitude: 35° 6'3.55"N Latitude: 115°51'41.09"W	5. Location Sketch

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Highly varied from flat desert floor, individual mountains, mountain ranges, and sand dunes.	Uniform low shrubs within immediate foreground area of the peak; not noticeable at a distance.	Not noticeable because of distance.
LINE	Bold irregular mountain ridgelines contrasted with plainer desert floor and smooth undulating sand dunes.	Regular patterns in within immediate foreground area of the peak with no dendritic lines evident,	A few desert roads visible in middleground and background.
COLOR	Vivid, highly varied values from gray with orange-tinted rocks in foreground, light sand desert floor, off-white dry lake beds, to dark brown mountains.	Sparse olive green.	Not discernable.
TEX-TURE	Coarse, angular rocks of varying size within immediate foreground area of the peak. Distance mutes other visual textures.	Random and scattered in immediate foreground contrasting with smooth in distance.	Not noticeable because of distance.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	At distance changes in landform will be imperceptible.	Ground vegetation to be removed for access.	Solar arrays.
LINE	At distance changes line patterns will be imperceptible.	Edges will be created surrounding array areas where vegetation is removed.	At distance changes in line will be imperceptible.
COLOR	Light brown with vegetation removal	Not applicable. No revegetation proposed.	Dark gray.
TEX-TURE	At distance changes in textures will be imperceptible.	Not applicable. No revegetation proposed.	At distance changes textures will be imperceptible.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
		STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE	STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM				X				X				X
	LINE				X				X				X
	COLOR			X					X			X	
	TEXTURE				X				X				X

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

Portions of the North Solar Array area may be seen. At approximately 17.6 miles from the project site any form, line and texture changes created by the arrays will not be noticeable. Weak contrast will be created with a change of color. Distance and atmosphere will mute the general color contrast such that it would be barely noticeable.

Additional Mitigating Measures

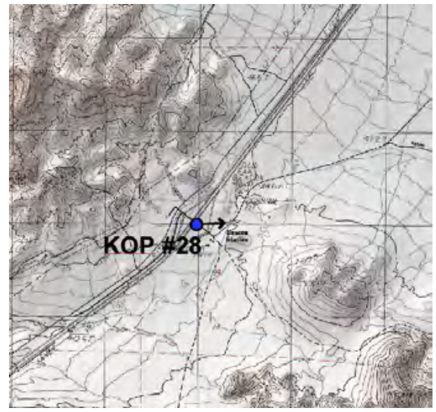
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #28 3. VRM Class: Not yet assigned	4. Location Longitude: 35° 8'4.01"N Latitude: 116°12'39.53"W	5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Low rounded foothills in immediate foreground. Cults and fill associated with previous mining and access routes.	I-15 interchange and service station void of vegetation. Low cover of sparse creosote / sage scrub. Lacking significant variation in form.	I-15 / Rasor Road interchange, service station, a communication tower are discordant forms against the surrounding mountain backdrop. Vertical communications tower and utility service lines silhouetted against the sky and prominent.
LINE	Straight edge line created by desert floor with mountain backdrop. Irregular, braided dry wash.	Vegetation along the wash forms braided linear pattern.	Access roads. Edges of paved areas associated with I-15 interchange and service station.
COLOR	Native soil colors vary from yellow-tinted sand to light brown soils to off-white.	Sparse gray green to olive green.	Dark gray pavement with varied colors (orange, red, white, brown, gray) on service station and ancillary facilities. Beige communication tower.
TEX-TURE	Fine textured sands.	Sparse, patchy, and scattered.	Fine texture of barren interchange and parking areas.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Cut and fill to related to water tank, water tank access road, Rasor Road realignment, and operations and maintenance area	Ground vegetation to be removed development reflects shape of grading limit lines.	Water tank, operations and maintenance buildings, and fences
LINE	Water tank access road, Rasor Road realignment, edges of operations and maintenance area	Edges of cut and fill slopes where vegetation is removed and contrasts surrounding landscape.	Relocated Rasor Road contrasting with lines of natural topography and edges of soil color changes.
COLOR	yellow-tinted sand to light brown soils to off-white,	Not applicable. No revegetation proposed.	Building colors not defined. Security lighting.
TEX-TURE	Fine textured.	Not applicable. No revegetation proposed.	Bold blocks of water tank, control room/office building, maintenance building, and storage warehouse; varied textures within storage areas; fine textures of parking and detention basin.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1) STRONG	MODERATE	WEAK	NONE	VEGETATION (2) STRONG	MODERATE	WEAK	NONE	STRUCTURES (3) STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM		X					X		X			
	LINE		X					X		X			
	COLOR			X				X			X		
	TEXTURE			X				X			X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
Note: VRM designations not yet determined.

3. Additional mitigating measures recommended
_X_ Yes ___No (Explain on reverses side)

Evaluator's Name: Patrick T. Miller, 2M Associates
Date: 12/7/12

SECTION D. (Continued)

Comments from item 2.

The operations and maintenance area will be in open view. The water tank, access route, and the level area needed for the tank will contrast with the profile of the hill. The form of the water tank will be backdropped by mountains with its color drawing attention to it. The realignment of Rasor Road as a straight route contrasts with the existing soft lines created by the changes of soil colors and low rolling hills through which the route passes. The contrast presented in the forms and textures of the operations and maintenance area facilities, other than the water tank, are an extension of existing development at the interchange (service station, storage buildings, communications tower, etc.).

Additional Mitigating Measures

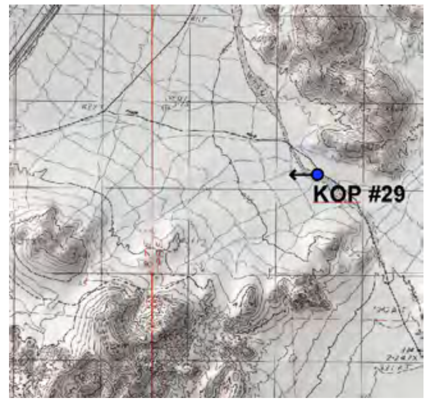
To be determined.

Form 8400-4

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT **VISUAL CONTRAST RATING WORKSHEET**	Date: 12/7/12 District/ Field Office: Barstow Resource Area: Western Mojave Activity (program): Soda Mountain Solar

SECTION A. PROJECT INFORMATION

1. Project Name: SODA MOUNTAIN SOLAR 2. Key Observation Point #29 3. VRM Class: Not yet assigned.	4. Location Longitude: 35° 8'6.00"N Latitude: 116° 9'43.20"W	5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Slightly sloping alluvial wash and meandering dry drainages. Irregular bulk forms of rounded mountains in backdrop.	Round forms of low cover creosote / sage scrub. Lacking significant variation in form.	Razor Road conforms to natural terrain following drainage patterns.
LINE	Straight edge line created by desert floor with mountain backdrop. Irregular, braided dry wash.	Vegetation along the wash forms a braided linear pattern.	Razor Road is a curving linear clearing within the surrounding creosote scrub community. OHV trails in surrounding hills accentuate drainage patterns.
COLOR	Light beige sand.	Brown to olive green.	Razor Road and OHV trails composed of light beige sand generally indistinct from surrounding undisturbed soils.
TEX-TURE	Fine textured sands.	Sparse and patchy patterns in immediate foreground become less dense near wash. Cover gradational with smooth dense texture at a distance .	Fine granular sand materials.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Grading will generally conform with overall topography. Some grading associated with berms and detention basin	Vegetation to be removed within solar array areas and fence lines.	Rasor Road realignment, solar arrays, inverter enclosures, access roads, detention area, fencing.
LINE	Sloped form of alluvial fan will not be significantly altered.	Angular lines created by outside edge of solar array areas and direction of Rasor Road and fence line where vegetation is removed.	North-south rows of PV panels at an almost perpendicular angle to view location. Road, fence line, and edge of array.
COLOR	Light beige sand.	Not applicable. No revegetation proposed.	Silver to dark gray.
TEX-TURE	Fine texture on natural surface access roads.	Not applicable. No revegetation proposed.	At a distance solar arrays will appear as a fine to medium uniform texture, striped, with a matt finish.

SECTION D. CONTRAST RATING __SHORT TERM X LONG TERM

1. DEGREE OF CONTRAST		FEATURES: LAND/WATER BODY (1) STRONG	MODERATE	WEAK	NONE	VEGETATION (2) STRONG	MODERATE	WEAK	NONE	STRUCTURES (3) STRONG	MODERATE	WEAK	NONE
ELEMENTS	FORM			X				X				X	
	LINE		X					X		X			
	COLOR			X				X		X			
	TEXTURE			X				X			X		

2. Does project design meet visual resource management objectives? ___Yes ___No
(Explain on reverses side)
VRM designations not yet determined.

3. Additional mitigating measures recommended
X_ Yes ___No (Explain on reverses side)

Evaluator's Names Date
Patrick T. Miller, 2M Associates 12/7/12

SECTION D. (Continued)

Comments from item 2.

The observer position is inferior to the project features. The realigned Rasor Road, perimeter fence line around the array area, and the berms associated with the detention basin will be seen approximately 1,000 feet away with the solar array area behind. The inverter enclosures may be silhouetted against the sky. The existing information at the boundary of the Rasor OHV Recreation Area will not to be seen.

Additional Mitigating Measures (See item 3)

To be determined.

APPENDIX G-2
Glare Analysis

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ESA Energy

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memorandum

date September 26, 2014

to Project File

from Karen Lancelle

subject Soda Mountain Solar - Glare Analysis

Introduction

This analysis uses a tool designed by Sandia National Laboratories to determine if and when glare would be experienced by observers at the 17 key observation points (KOPs) around the Soda Mountain Solar project PV arrays in eastern San Bernardino County, California that were examined in the Proposed Plan Amendment/Final Environmental Impact Statement/Environmental Impact Report.

Background

Glint is a momentary flash of light perceived by the viewer. Glare is a continuous source of excessive brightness. Glint and glare can cause unwanted visual effects, including distraction, temporary after-image (also called flash-blindness), and retinal burn if the light is concentrated.

While solar panels are designed to absorb light from the sun, because glass is used to protect the cells from damage, some light reflects off the panels depending on the incident angle of sunlight. The type of material in the solar panel also affects the magnitude of reflectance.

When a surface is polished, light reflects at an angle equal to the incident angle of sunlight to the panel. This reflection is more focused, and is called specular reflection. When a surface is textured, diffuse reflection occurs instead, in which the reflected light bounces off the panel in all directions.

The impact of reflected light (or any light) on the eye is a function of irradiance[1] at the cornea (front of eye). The irradiance at the cornea is affected by the size of the reflected light source (which changes with viewing angle and distance) and the energy of the light.

[1] Irradiance is the light flux per unit area.

Methodology

This analysis was performed using Version 2.E of the Solar Glare Hazard Analysis Tool (SGHAT) developed by Sandia National Laboratories. The SGHAT is a "web-based interactive tool that provides a quantified assessment of (1) when and where glare will occur throughout the year for a prescribed solar installation, (2) potential effects on the human eye at locations where glare occurs, and (3) the annual energy production from the PV array so that alternative designs can be compared to maximize energy production while mitigating the impacts of glare." (DOE, 2014)

If glare is found with the SGHAT, the tool rates the glare as having one of the following:

1) low potential for temporary after-image,

2) potential for temporary after-image, or

3) potential for permanent eye damage.

Unfiltered viewing of the sun falls into the high range of the "potential for temporary after-image" category.

Inputs

Data inputs for this analysis included the PV array areas, the KOPs (see **Figure 1**), panel characteristics and placement, and height of observers above the ground surface. The tool uses the latitude and longitude of the geographic inputs to determine elevation and sun position and to calculate light vectors.

The Soda Mountain PV arrays were conservatively modeled by determining the latitude and longitude of points at or slightly outside of the arrays as provided in data from the Applicant. Due to server limitations, calculations were run for three scenarios consisting of portions of the solar plant site, rather than for the full site in one analysis (see **Figure 2**). The PV array defined for the first scenario ("South Arrays" scenario) included South Arrays 2 and 3, and a portion of South Array 1. The PV array defined for the second scenario ("East Arrays") encompassed the remainder of South Array 1 as well as East Arrays 1 and 2. The North Array was the third scenario analyzed. Glare from all 17 KOPs was evaluated for each scenario.

Data regarding panel tilt, orientation, reflectance, and height above the ground surface were input as shown in the table below. This information reflects the most recent updates to the plan of development for the Soda Mountain Solar Project. Observer eye height was estimated as 5 feet above the ground surface.

TABLE 1
INPUT DATA

PV Axis Tracking	Single
Tilt of axis tracking (0 degrees is parallel to the ground surface)	0
Orientation of tracking axis (degrees from true north)	0

Vertical offset angle between panel and tracking axis	0
Maximum tracking angle (maximum angle panel will rotate in clockwise or counterclockwise from the upward position)	90
Module Surface Material	Smooth glass without antireflective coating
Height of panels above ground (average)	10 feet

For sites where glare was calculated to occur at some point during the year, the retinal irradiance and size/distance of the glare source were determined. Data outputs are shown in plots which specify when glare would occur throughout the year and the expected magnitude of the glare, measured in potential ocular hazard.

Tool Limitations and Assumptions

The SGHAT only applies to flat reflective surfaces. In addition, for simplicity, the PV arrays selected for analysis are more conservative than the actual arrays. The arrays were modeled as if no spaces were present between individual panels or between arrays. Spaces between the actual arrays may reduce actual glare results. The SGHAT also does not consider obstacles between observation points and the prescribed solar installation, including mountains. This also results in a more conservative analysis. The tool assumes sunny skies every day of the year. All times reported are standard time.

Results

The results of this analysis are summarized in Tables 2 and 3. Table 2 presents a summary of the output from all three PV array scenarios. Table 3 presents the detailed output from each PV array scenario for each KOP. Columns in this table also indicate the presence of any obstacles tall enough to block the view of the PV arrays from the given KOP. This was included because the SGHAT does not determine whether such obstacles are present when performing glare calculations.

Glare was found to occur at least once during the year at most of the KOPs. The KOPs at which an observer would not experience glare are KOPs 6, 7, and 29. At most of the KOPs where glare would occur, the magnitude of the glare would be low and the resulting potential for temporary after-image would be low. Glare with a greater potential for temporary after-image would occur at KOPs 4 and 14.

TABLE 2
SUMMARY RESULTS

KOP	Output	Magnitude
KOP 1	Glare from East Arrays for 5 to 30 minutes duration between 6:30 and 7:00 pm, May – July Glare from South Arrays for 15 minutes duration between 4:30 and 7:00 pm, year round	Low potential for temporary after-image
KOP 2	Glare from East Arrays blocked by intervening topography Glare from North Array for 30 minutes duration between 4:30 am and 6:30 am, March – October	Low potential for temporary after-image
KOP 4	**Glare from East Arrays for 1.5 to 2.5 hours duration between 2:00 and 7:00 pm, year round** **Glare from East Arrays for 1 to 2 minutes duration at 4:30 pm, Mid-April and early September**	**Low potential for temporary after-image** **Potential for temporary after-image**
KOP 5	Glare from North Array for 15 to 30 minutes duration between 4:30 and 6:15 am, March - September	Low potential for temporary after-image
KOP 6	*No Glare*	
KOP 7	*No Glare*	
KOP 8	Glare from South Arrays for 30 minutes duration between 4:30 and 5:30 am, April - August	Low potential for temporary after-image
KOP 13	Glare from North Array for 15 to 30 minutes duration between 4:30 and 6:30 am, March - October	Low potential for temporary after-image
KOP 14	Glare from East Arrays for 15 minutes to 1.75 hours duration between 6:30 am and 9:00 am, September - April Glare from North Array for 45 minutes duration between 4:45 and 5:45 am, May – July **Glare from East Arrays for 1 minute duration at 7:00 am, early September**	Low potential for temporary after-image **Potential for temporary after-image**
KOP 17	Glare from South Arrays for 5 to 30 minutes duration between 6:30 and 7:00 pm, May - August	Low potential for temporary after-image
KOP 19	Glare from all arrays blocked by intervening topography	Low potential for temporary after-image
KOP 28	Glare from South Arrays for 5 to 15 minutes duration between 4:30 and 7:00 pm, January - November	Low potential for temporary after-image
KOP 29	*No Glare*	
KOP 30	Glare from North and South Arrays blocked by intervening topography	Low potential for temporary after-image
KOP 31	Glare from North Array for up to 30 minutes duration between 6:00 and 7:00 am, February - March and October - November, maybe blocked by intervening topography Glare from South Arrays for up to 30 minutes duration between 6:30 and 7:30 am, November - January, maybe blocked by intervening topography	Low potential for temporary after-image
KOP 32	Glare from North Array for 5 to 30 minutes duration between5:30 and 6:30 am, March and September, maybe blocked by intervening topography Glare from East and South Arrays blocked by intervening topography	Low potential for temporary after-image
KOP 33	Glare from North Array for 5 to 30 minutes duration between5:30 and 6:15 am, March and September, maybe blocked by intervening topography Glare from East and South Arrays blocked by intervening topography	Low potential for temporary after-image

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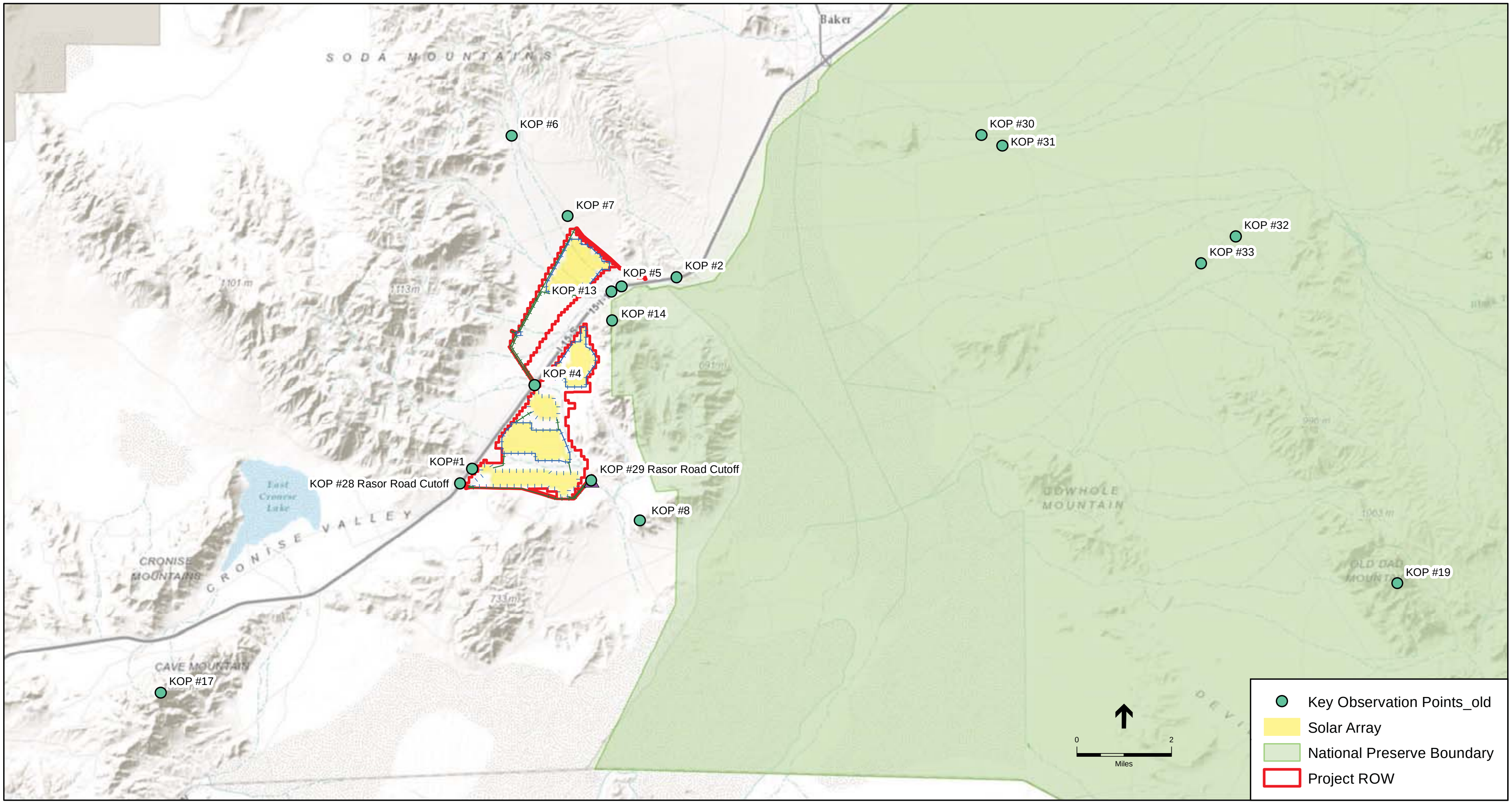
TABLE 3
DETAILED RESULTS

KOP	Elevation (feet)	East Arrays Scenario			North Array Scenario			South Arrays Scenario		
		Output	Magnitude	Intermediate obstacles	Output	Magnitude	Intermediate obstacles	Output	Magnitude	Intermediate obstacles
KOP 1	1499	Glare	Low potential for temporary after-image	No	No Glare			Glare	Low potential for temporary after-image	No
KOP 2	1158.29	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	No	No Glare		
KOP 4	1397.56	Glare	Potential for temporary after-image; low potential for temporary after image	No	No Glare			No Glare		
KOP 5	1270.18	No Glare			Glare	Low potential for temporary after-image	No	No Glare		
KOP 6		*No Glare*			*No Glare*			*No Glare*		
KOP 7		*No Glare*			*No Glare*			*No Glare*		
KOP 8	1375.26	No Glare			No Glare			Glare	Low potential for temporary after-image	No

KOP	Elevation (feet)	East Arrays Scenario			North Array Scenario			South Arrays Scenario		
		Output	**Magnitude**	**Intermediate obstacles**	**Output**	**Magnitude**	**Intermediate obstacles**	**Output**	**Magnitude**	**Intermediate obstacles**
KOP 13	1262.06	No Glare			Glare	Low potential for temporary after-image	No	No Glare		
KOP 14	2274.08	Glare	Potential for temporary after-image; low potential for temporary after image	No	Glare	Low potential for temporary after-image	No	No Glare		
KOP 17	3605.85	No Glare			No Glare			Glare	Low potential for temporary after-image	No
KOP 19	1023.75	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	Yes
KOP 24	2094.98	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	Yes
KOP 28	1499.65	No Glare			No Glare			Glare	Low potential for temporary after-image	No
KOP 29		*No Glare*			*No Glare*			*No Glare*		
KOP 30	1132.65	No Glare			Glare	Low potential for temporary	Yes	Glare	Low potential for temporary	Yes

KOP	Elevation (feet)	East Arrays Scenario			North Array Scenario			South Arrays Scenario		
		Output	Magnitude	Intermediate obstacles	Output	Magnitude	Intermediate obstacles	Output	Magnitude	Intermediate obstacles
						after-image			after-image	
KOP 31	2274.08	No Glare			Glare	Low potential for temporary after-image	Maybe	Glare	Low potential for temporary after-image	Maybe
KOP 32	1654.32	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	Maybe	Glare	Low potential for temporary after-image	Yes
KOP 33	1525.76	Glare	Low potential for temporary after-image	Yes	Glare	Low potential for temporary after-image	Maybe	Glare	Low potential for temporary after-image	Yes



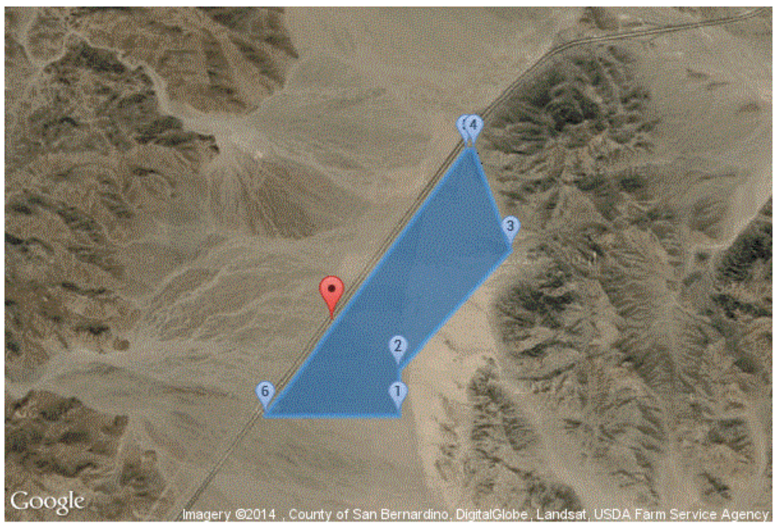
SOURCE: Panorama Environmental Inc., 2013; ESRI, 2014

Soda Mountain Solar Project . 120592

Figure 1

Key Observation Points

North Array



East Array

South Array

Figure 2
Model Arrays

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:57 p.m.

Glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

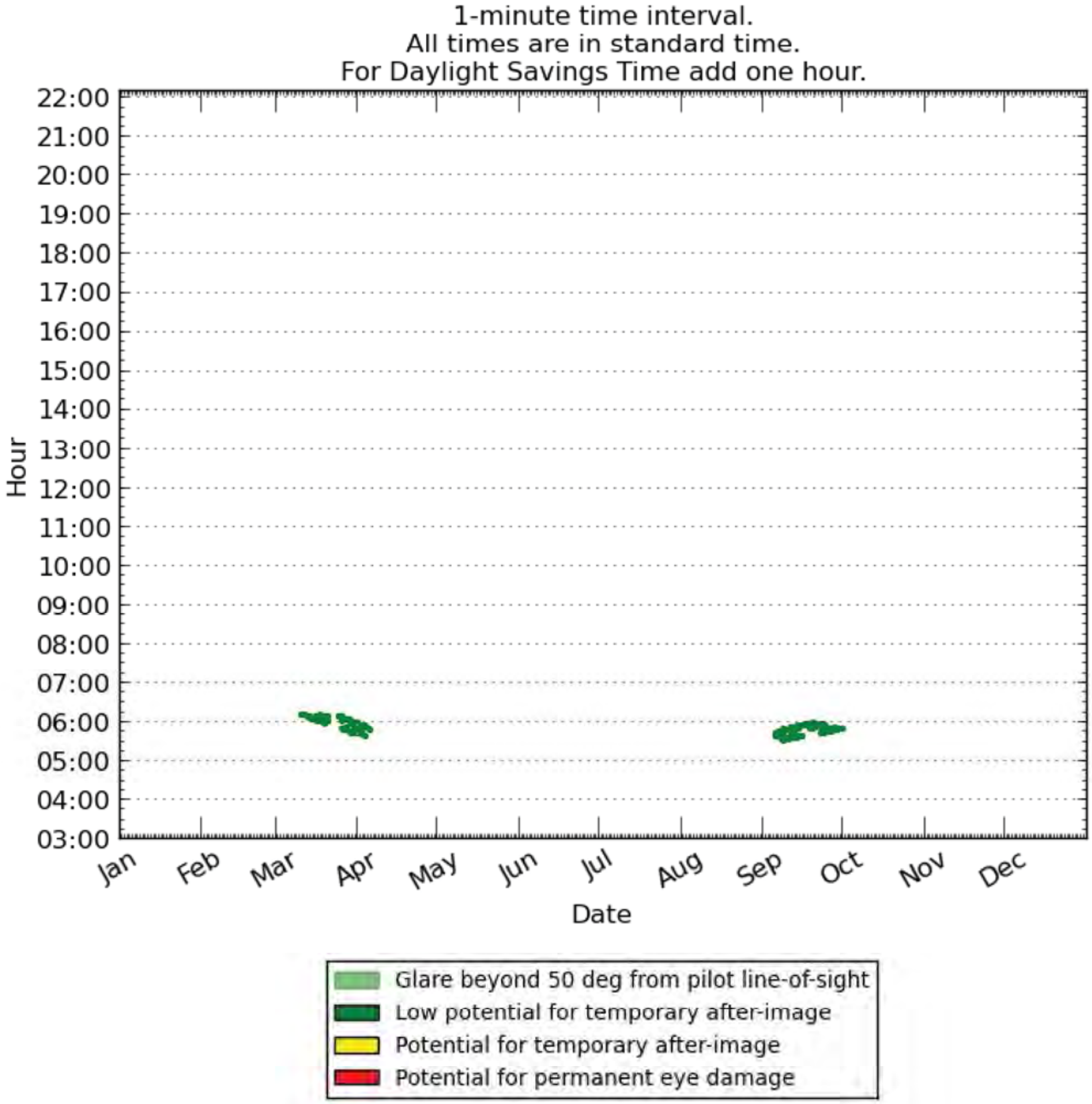
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 33	35.199816	-115.933395	1525.76	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:56 p.m.

Glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

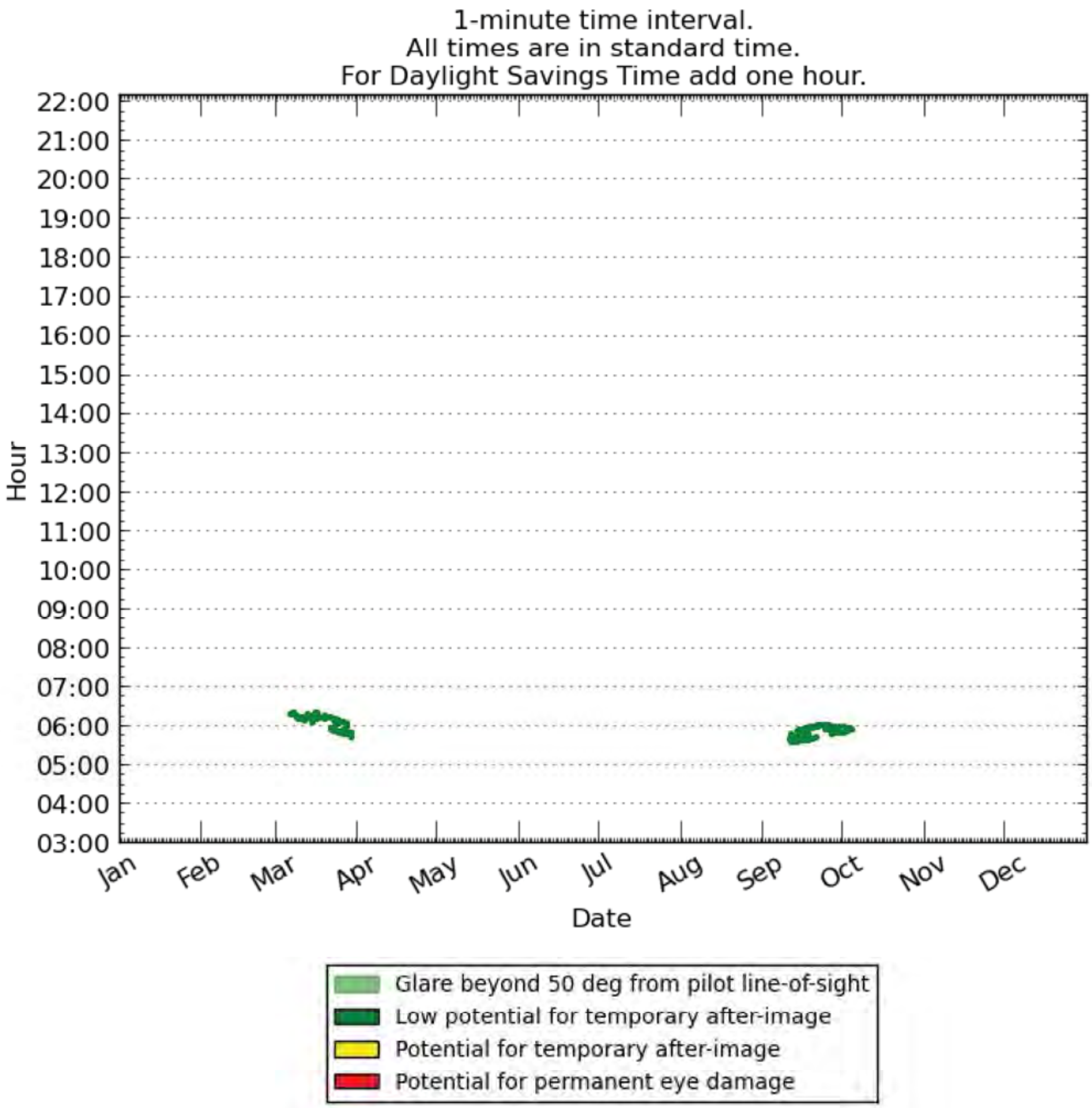
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 32	35.207974	-115.920394	1654.32	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



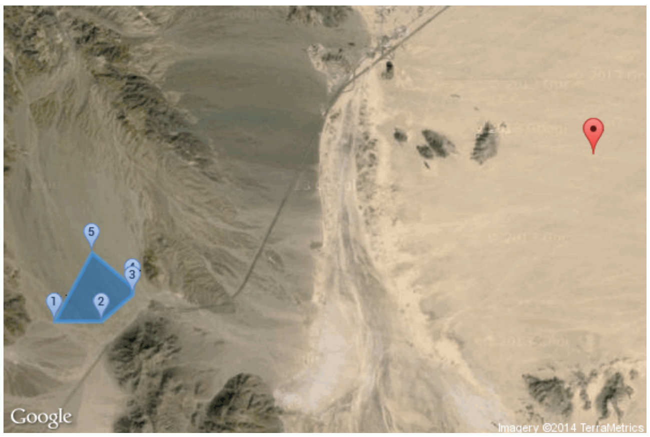
G.2-18

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:55 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

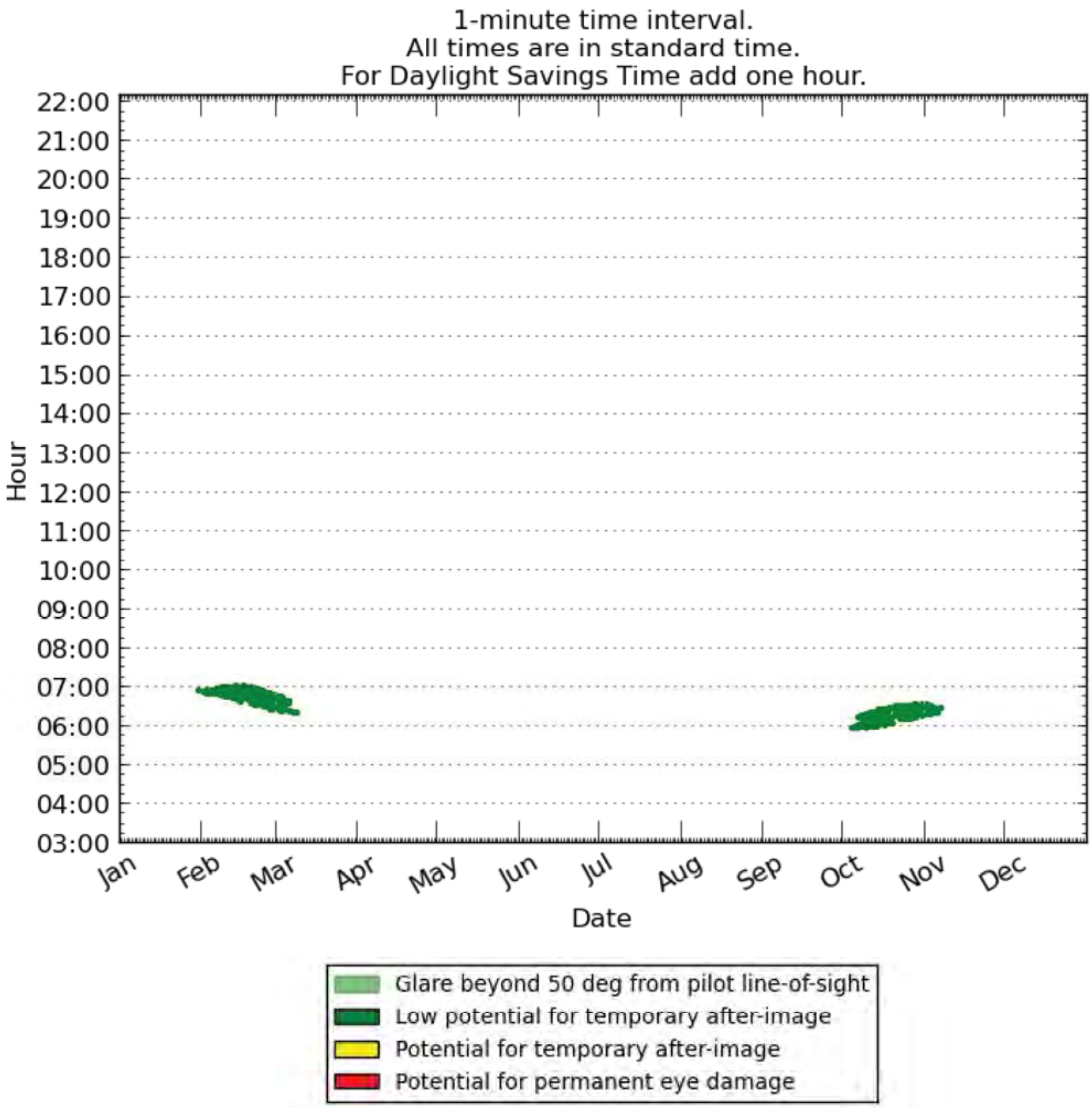
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 31	35.236588	-116.007326	2274.08	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

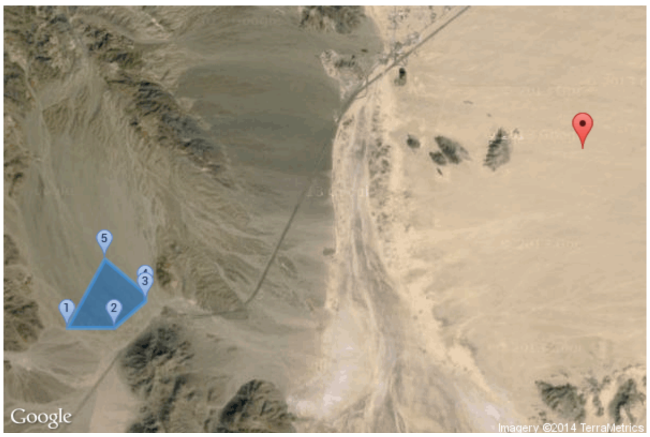


Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:56 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

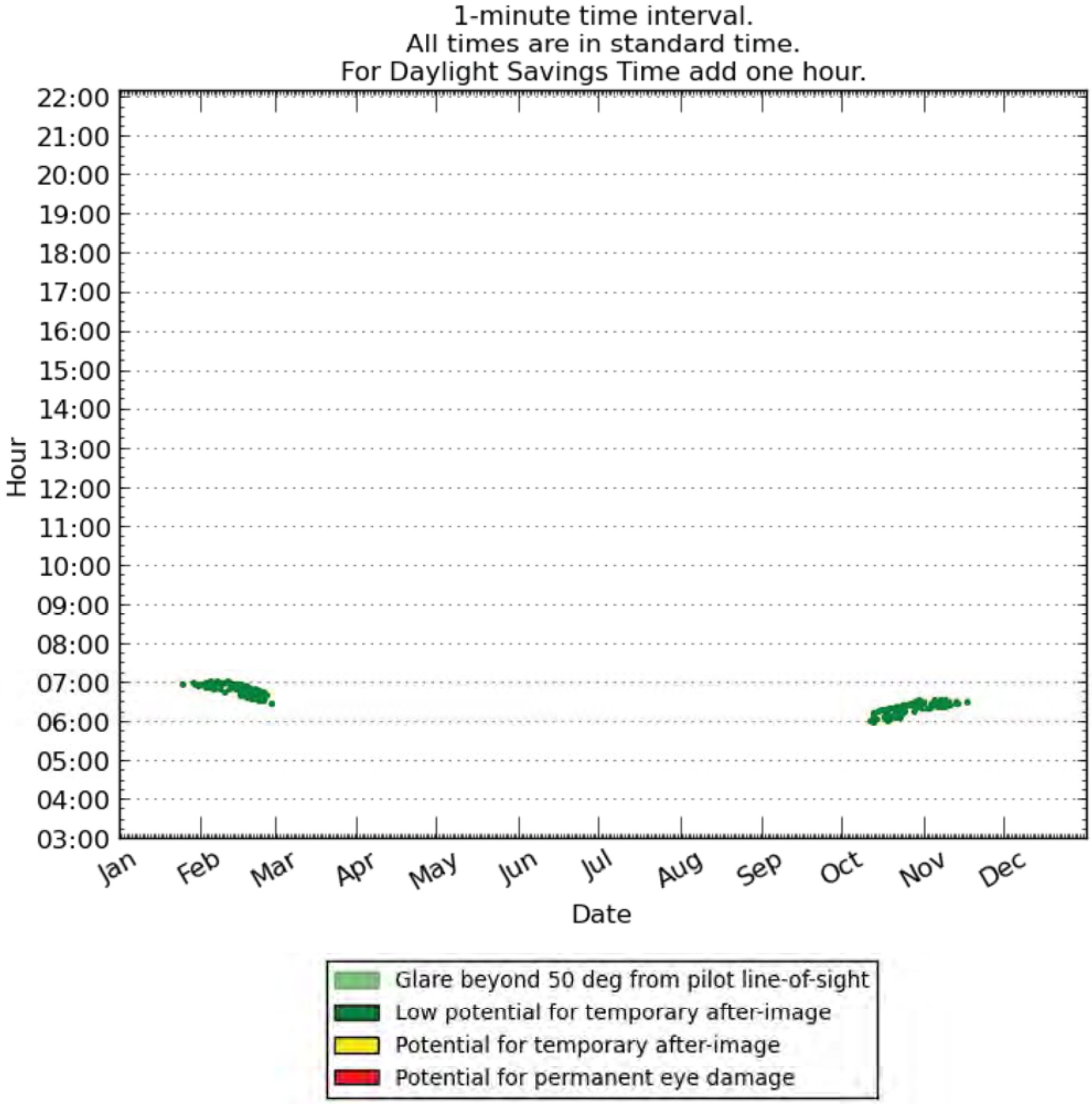
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 30	35.23987	-116.015094	1132.65	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:52 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 29	35.135	-116.162	1234.19	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:51 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 28	35.134447	-116.21098	1499.65	5.0

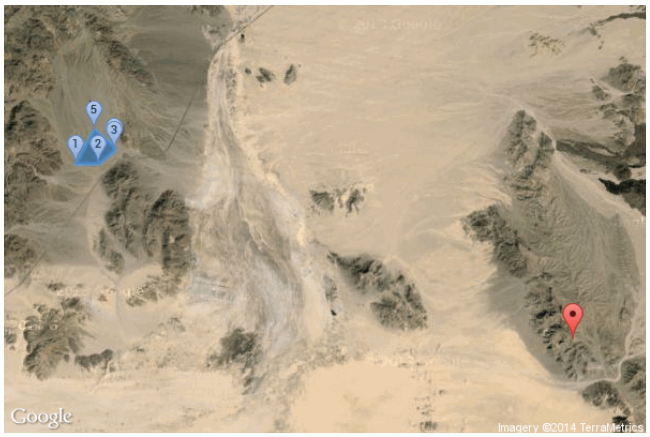
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:50 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

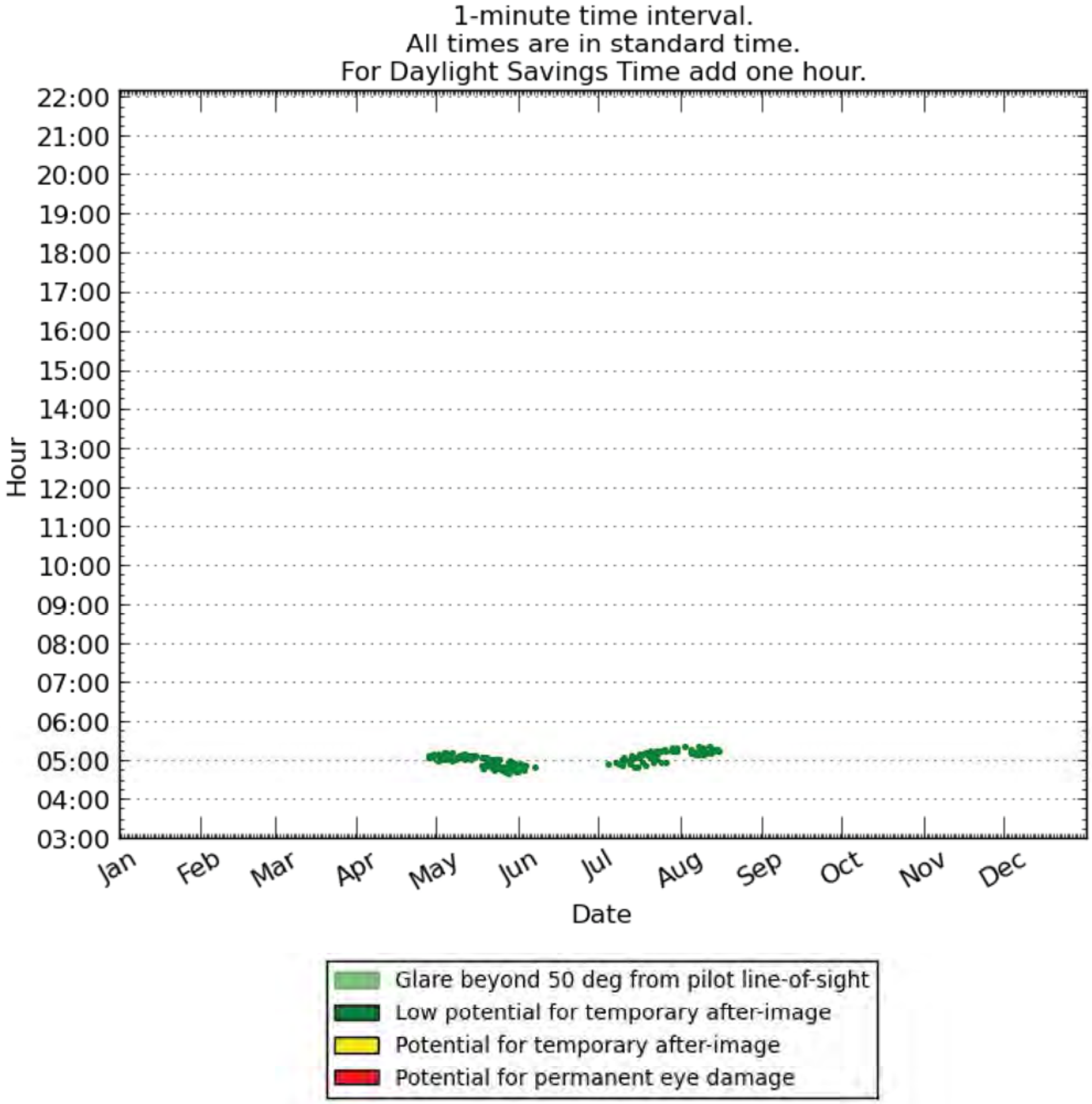
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 19	35.100986	-115.861413	1023.75	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

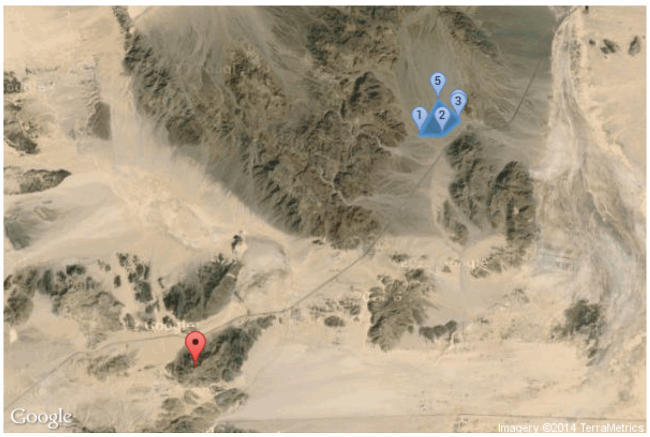


Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:49 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 17	35.070904	-116.323399	3605.85	5.0

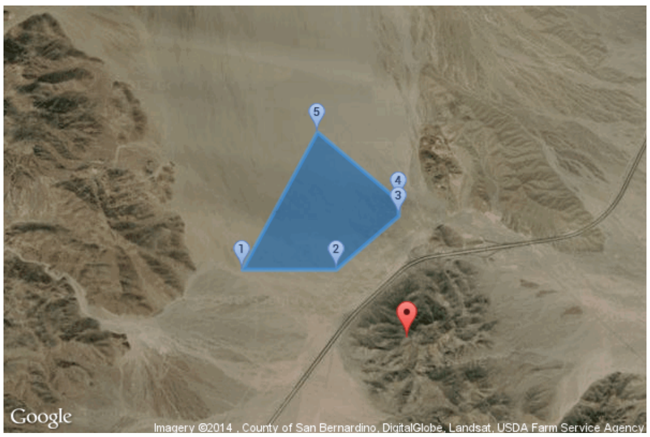
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:49 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

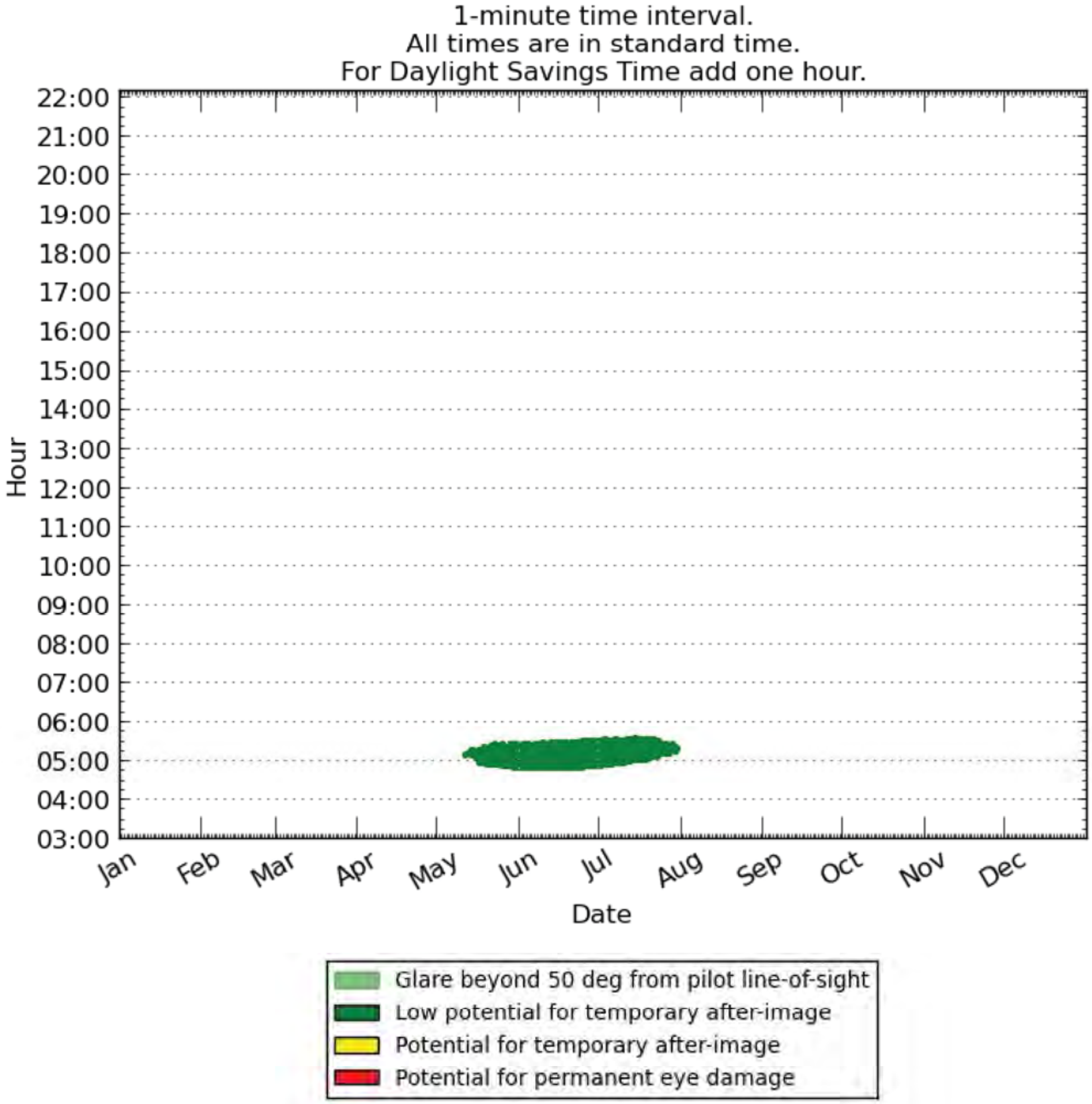
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 14	35.184083	-116.15366	2274.08	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:42 p.m.

Glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

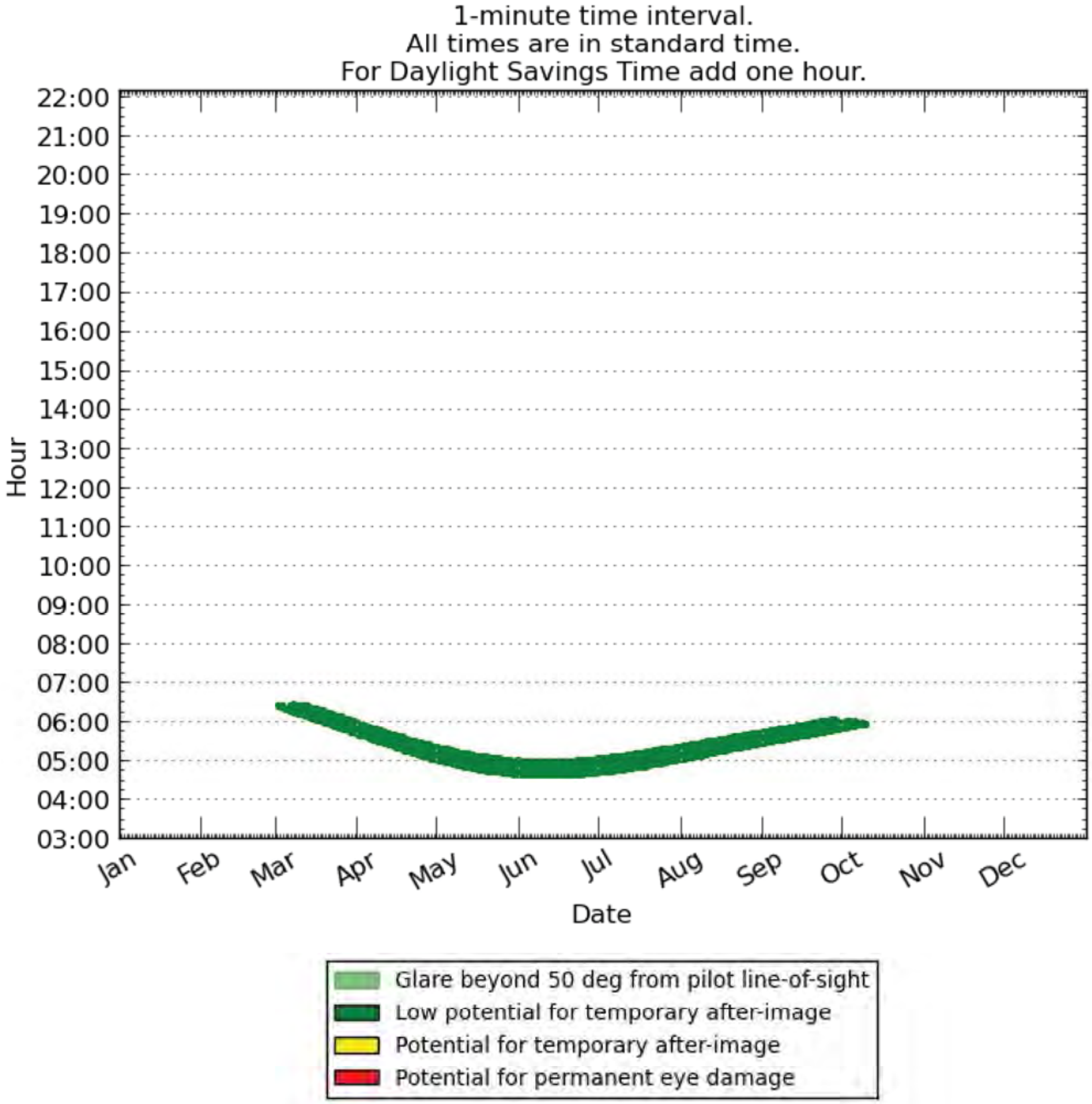
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 13	35.194403	-116.150074	1262.06	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:41 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 8	35.1226	-116.144016	1375.26	5.0

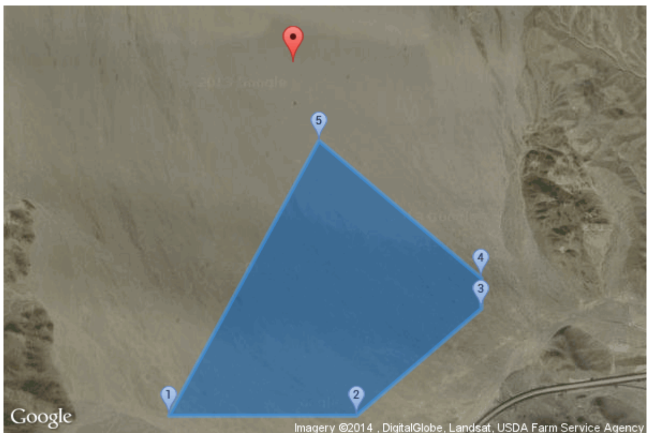
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:41 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 7	35.216133	-116.17	1623.29	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:41 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 6	35.241008	-116.190772	1384.93	5.0

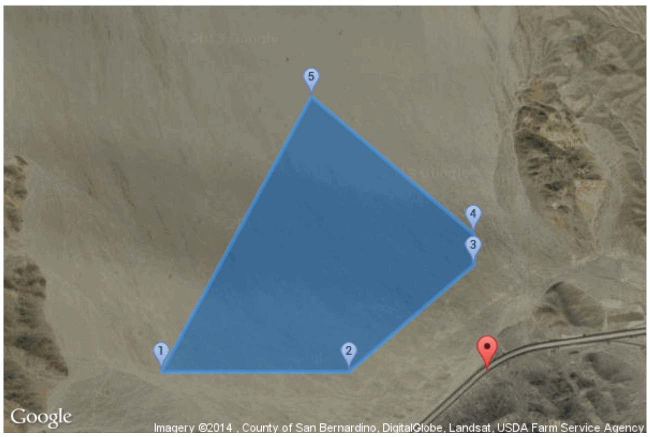
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:40 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

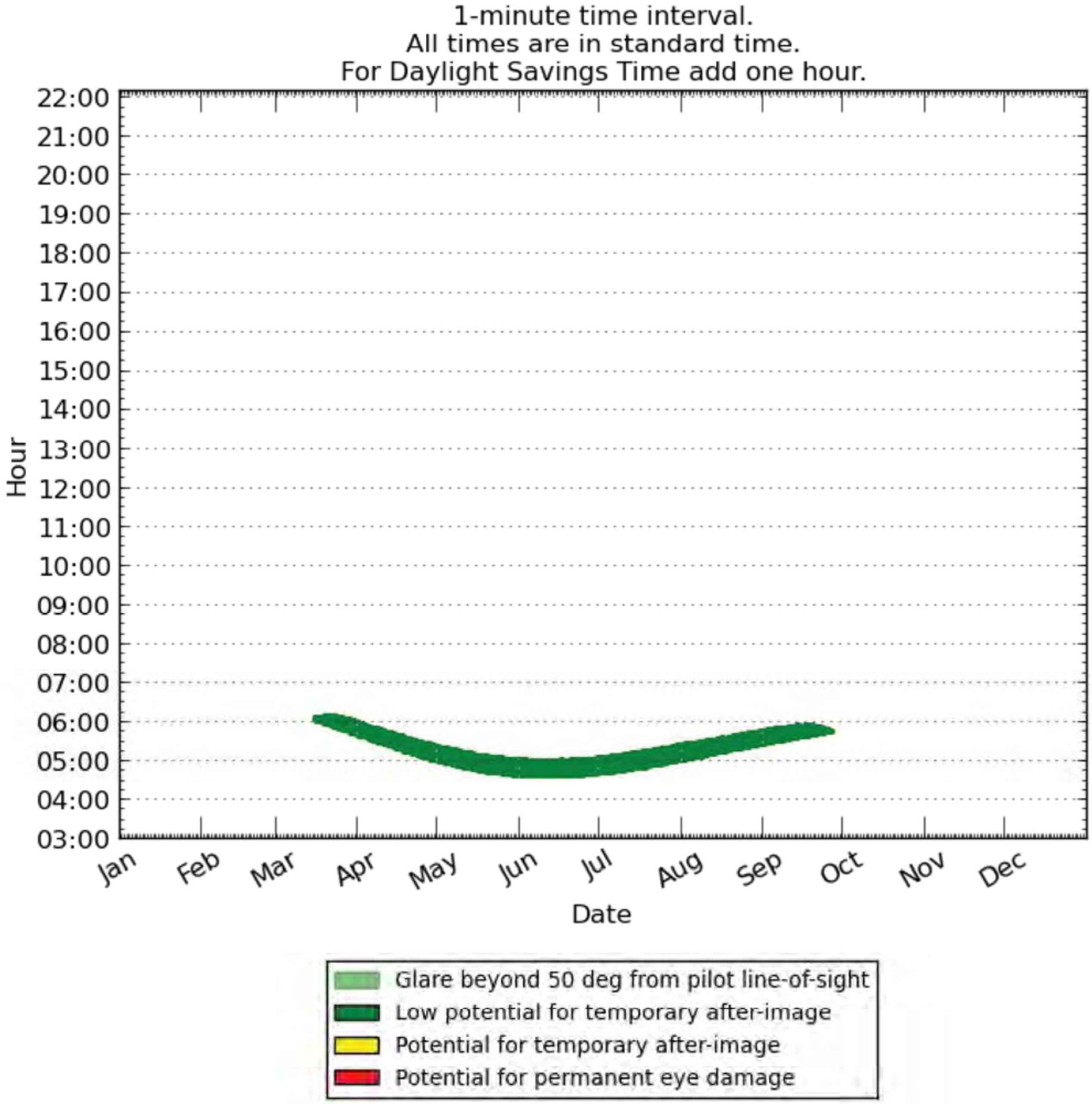
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 5	35.192936	-116.153899	1270.18	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:40 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 4	35.164427	-116.182954	1397.16	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:40 p.m.

Glare found

Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

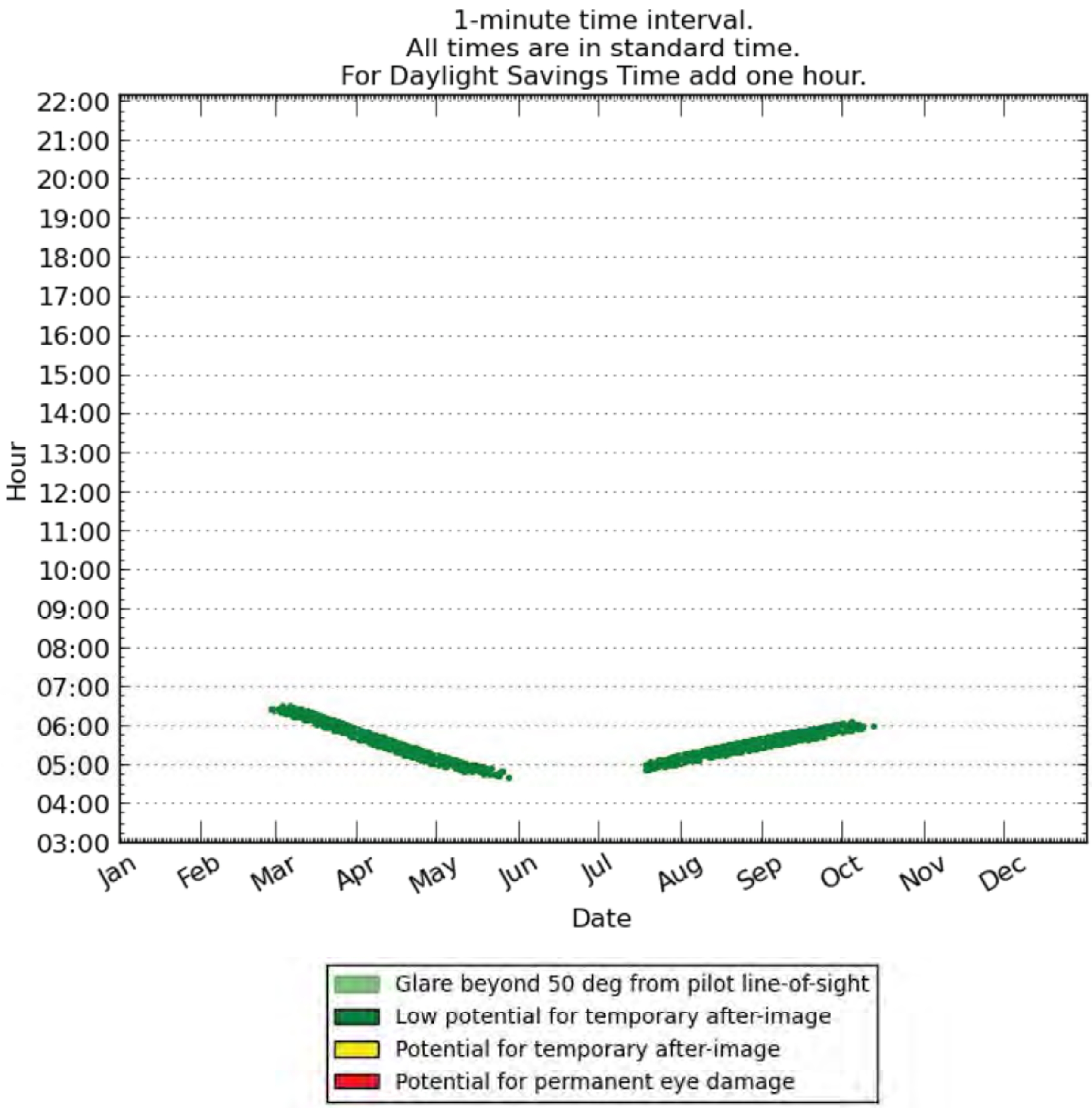
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 2	35.197162	-116.129516	1158.29	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:39 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - North Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.193	-116.18	1400.47	6.0	1406.47
2	35.193	-116.165	1293.19	6.0	1299.19
3	35.2	-116.155	1256.73	6.0	1262.73
4	35.202	-116.155	1279.37	6.0	1285.37
5	35.211	-116.168	1551.54	6.0	1557.54

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 1	35.138938	-116.211018562	1499.73	5.0

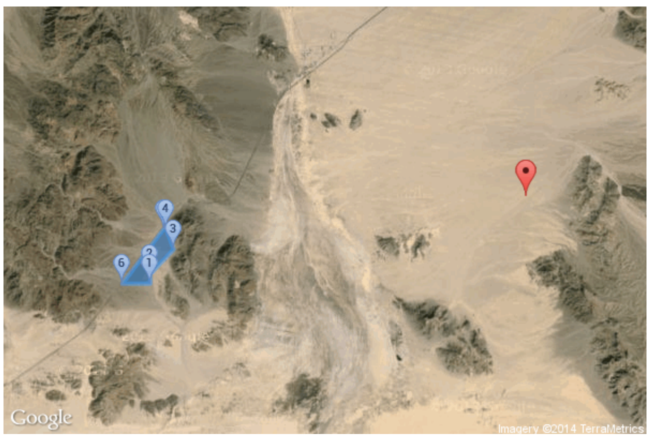
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:11 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

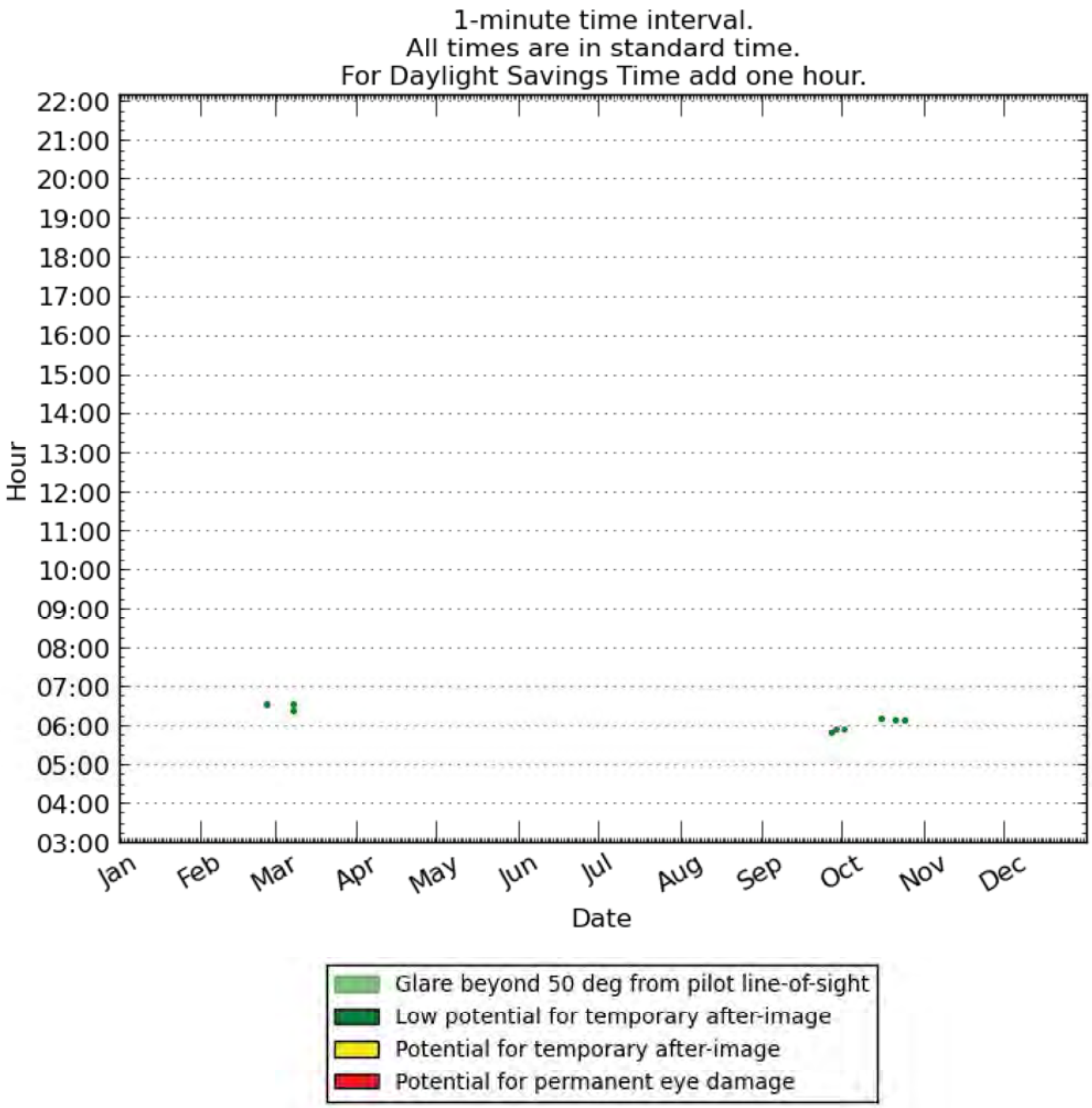
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 33	35.199816	-115.933395	1525.76	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

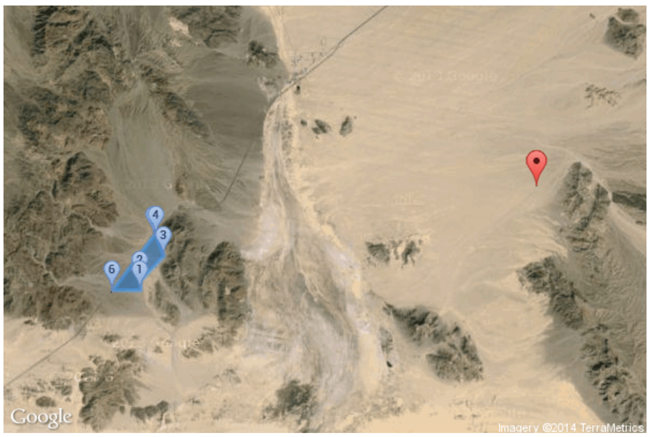


Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:12 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

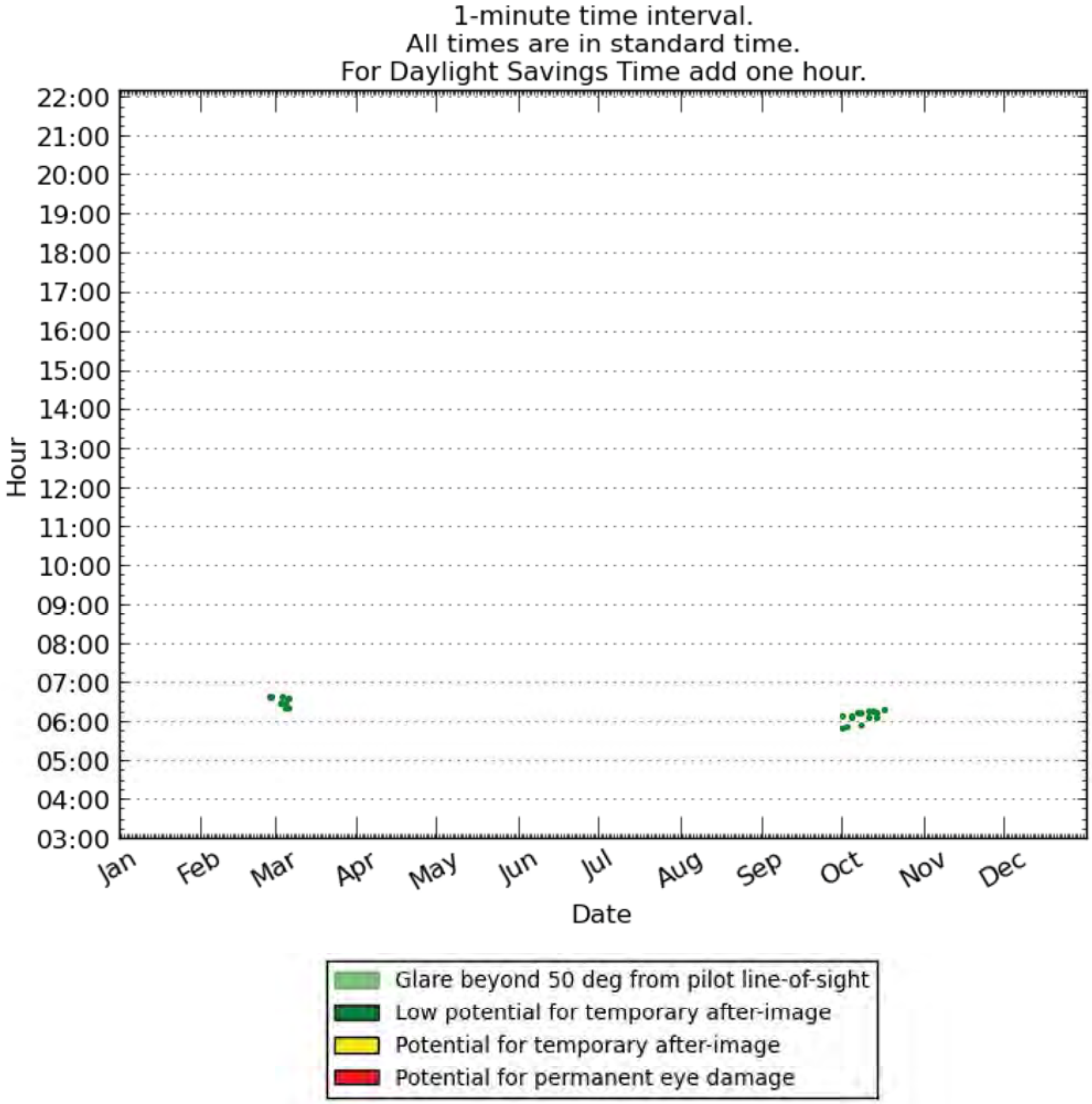
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 32	35.207974	-115.920394	1654.32	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

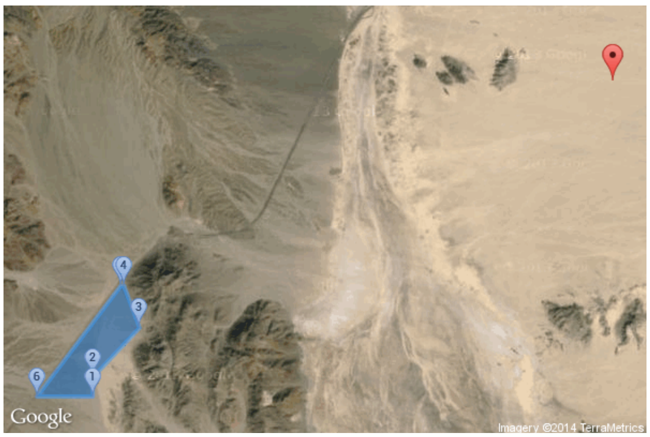


Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:14 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 31	35.236588	-116.007326	1164.78	5.0

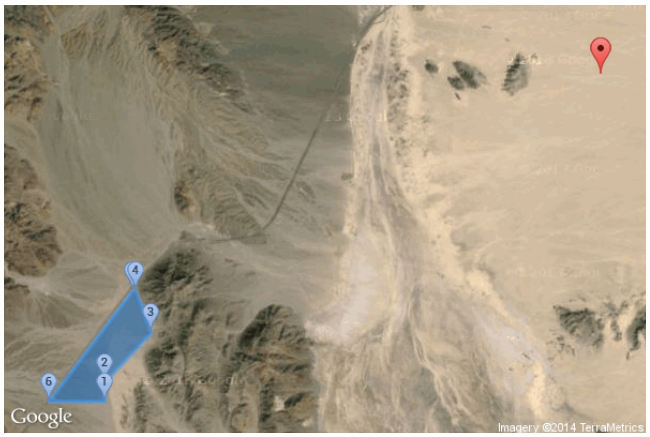
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:13 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 30	35.23987	-116.015094	1132.65	5.0

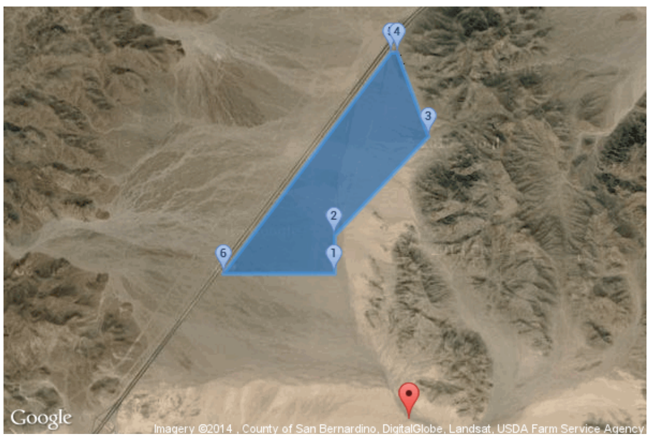
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:27 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 29	35.135	-116.162	1234.19	5.0

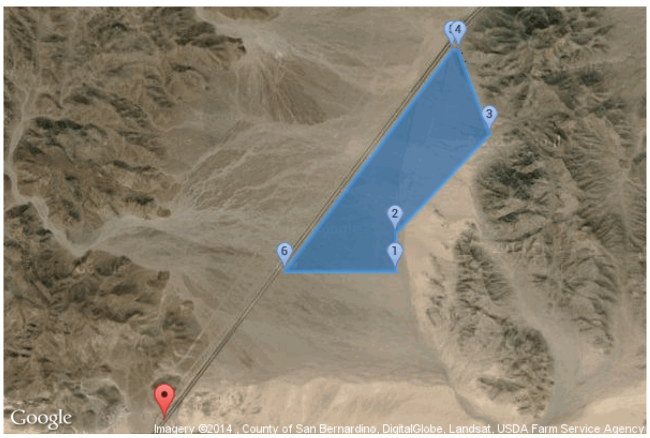
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:26 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 28	35.134447	-116.21098	1499.65	5.0

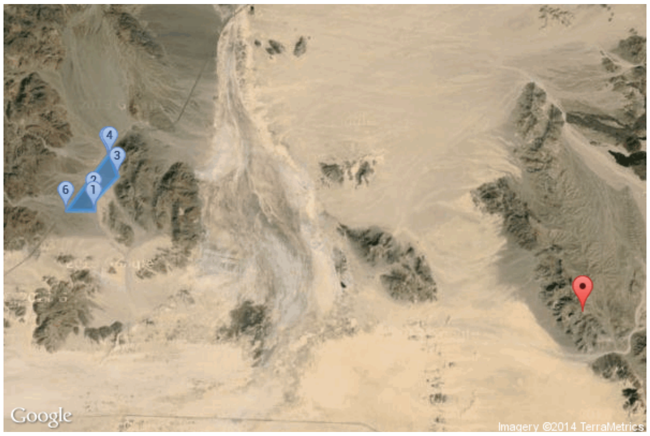
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:22 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

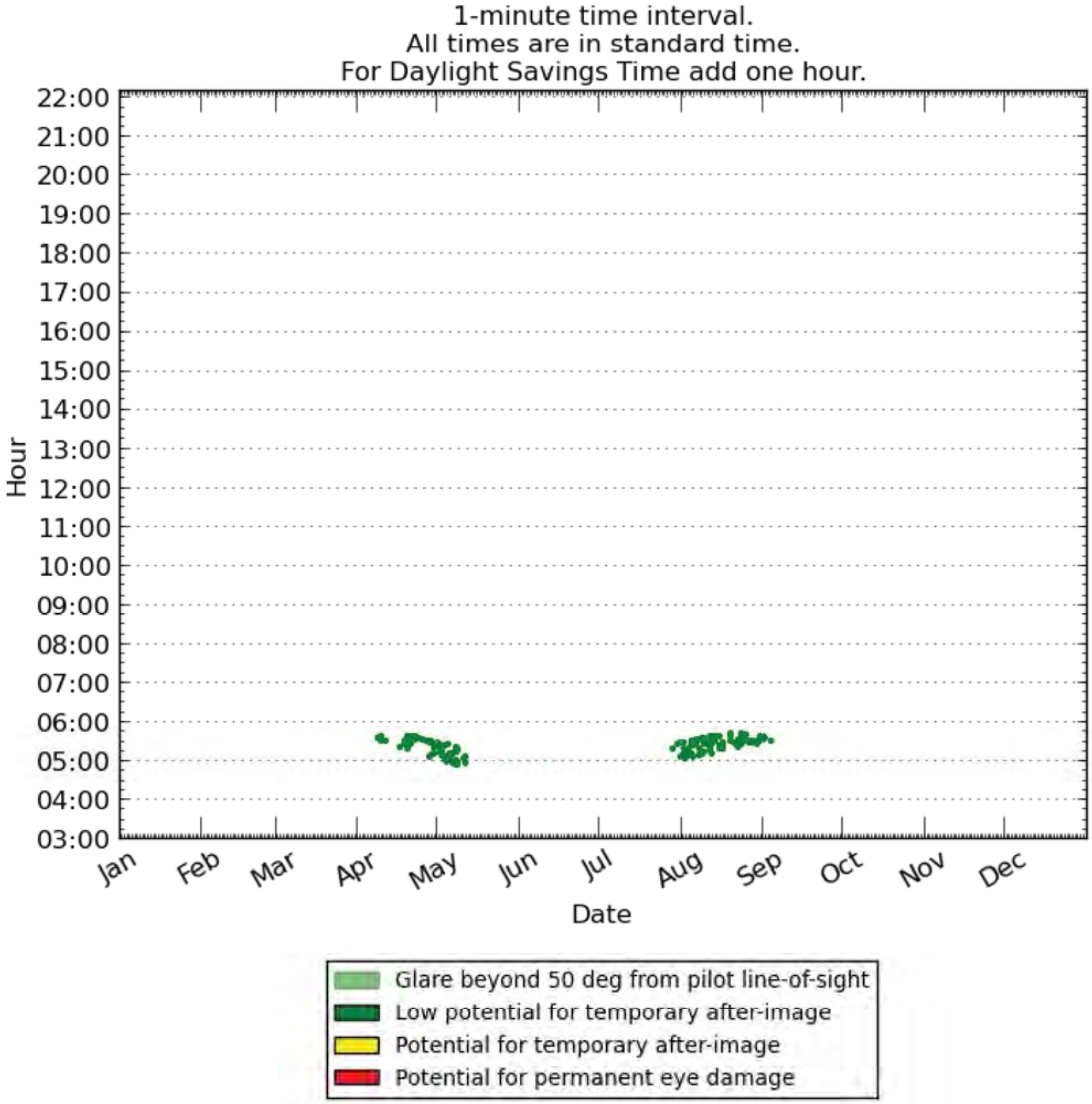
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 19	35.100986	-115.861413	4234.28	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:24 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

G.2-96

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 17	35.070904	-116.323399	3605.85	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:24 p.m.

Glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

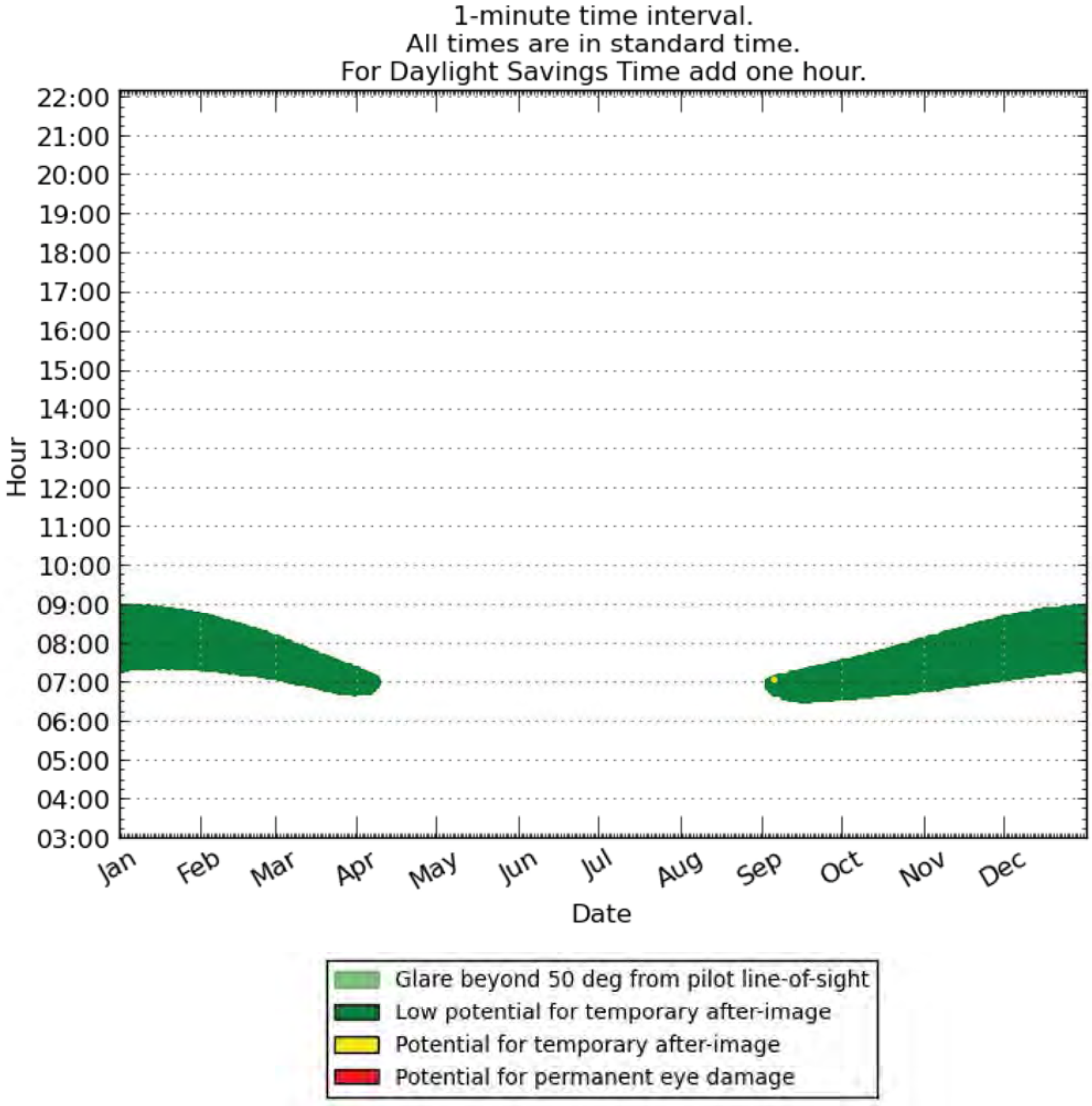
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 14	35.184083	-116.15366	2274.08	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.



Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:40 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 8	35.1226	-116.144016	1375.26	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:40 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 8	35.1226	-116.144016	1375.26	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:40 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 7	35.216133	-116.17	1623.29	5.0

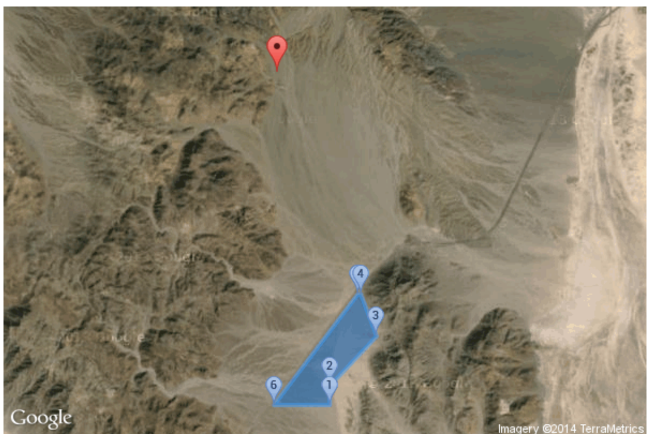
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:39 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 6	35.241008	-116.190772	2134.98	5.0

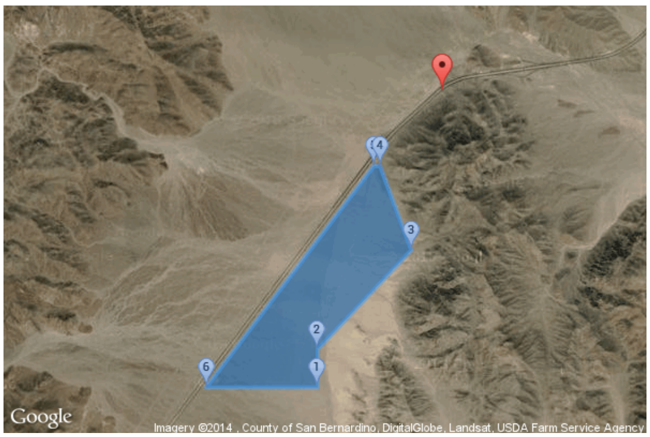
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:37 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

G.2-115

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 5	35.192936	-116.153899	1270.18	5.0

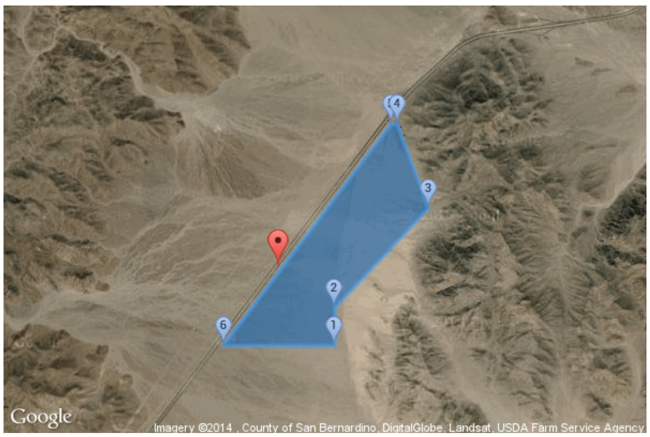
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:37 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

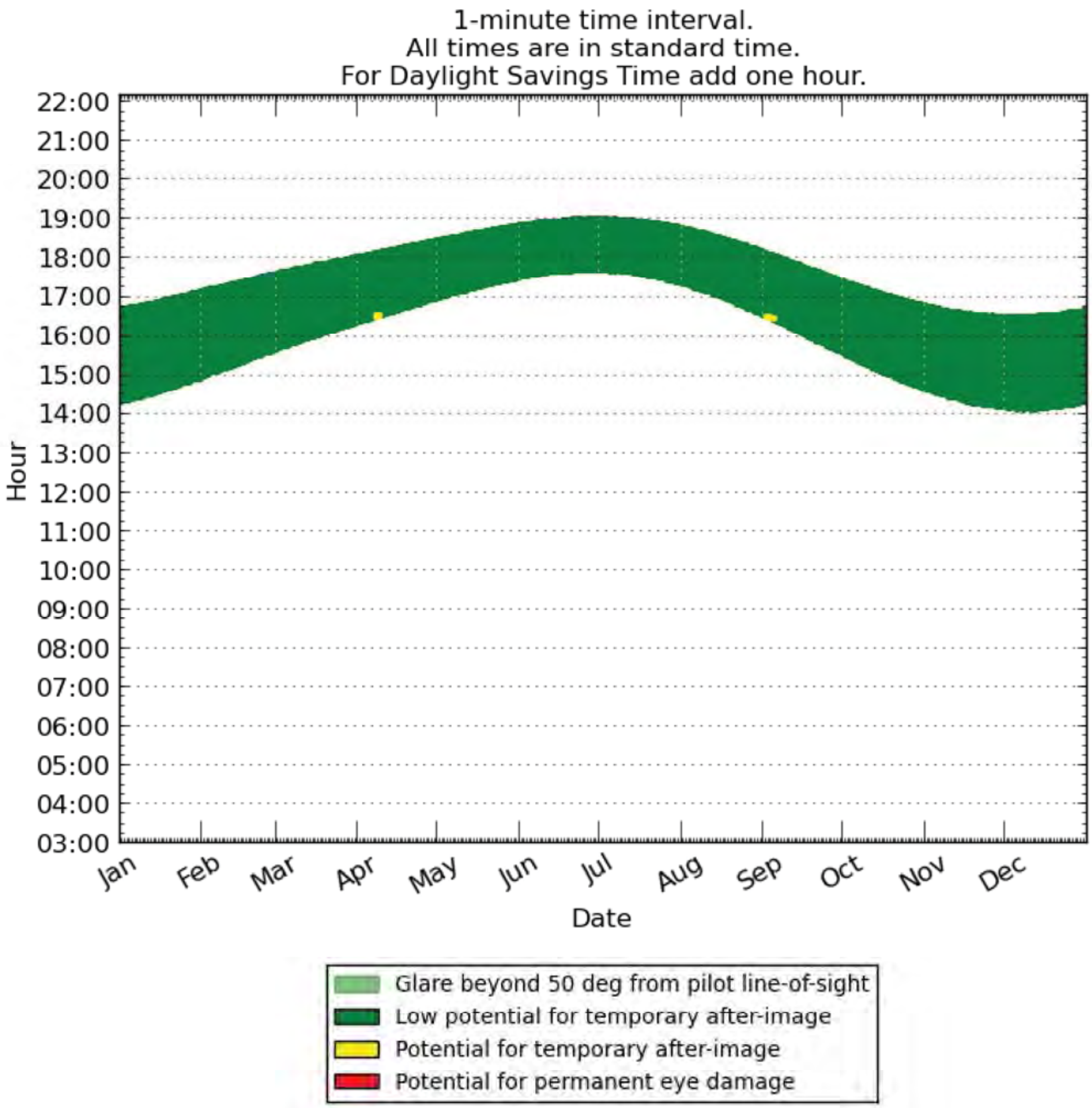
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 4	35.164427	-116.182954	1397.16	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

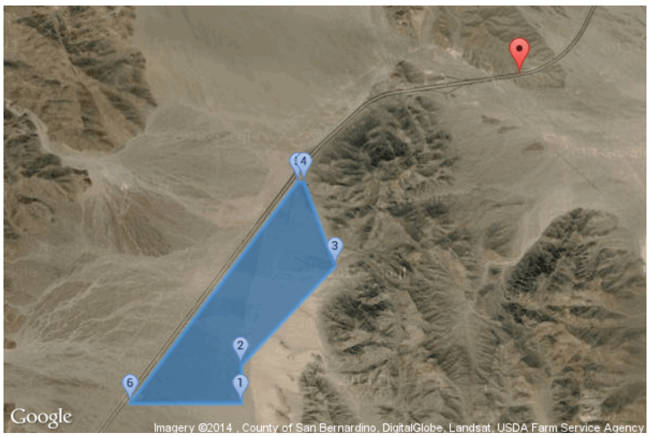


Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:38 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

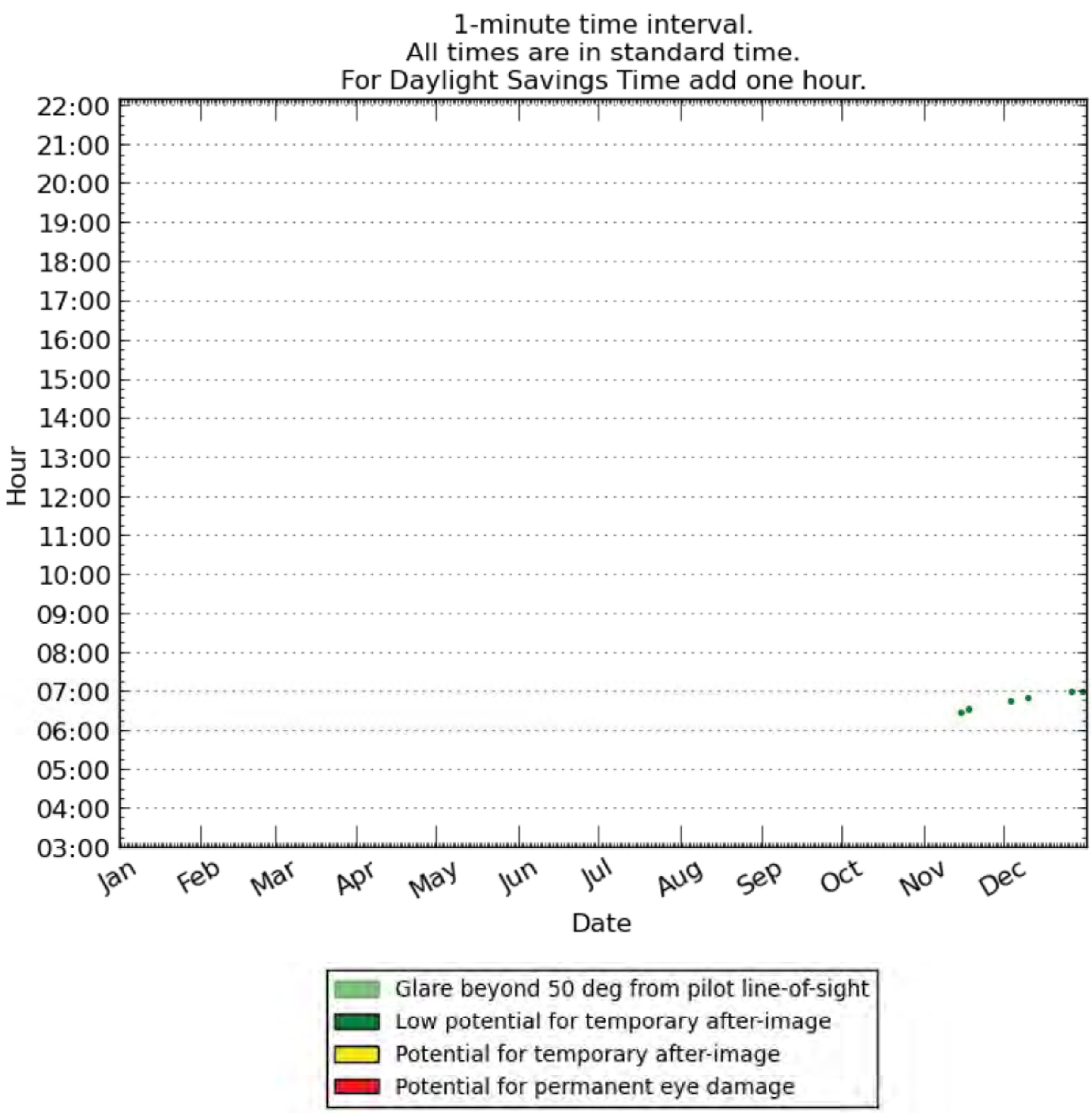
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 2	35.197162	-116.129516	1158.29	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

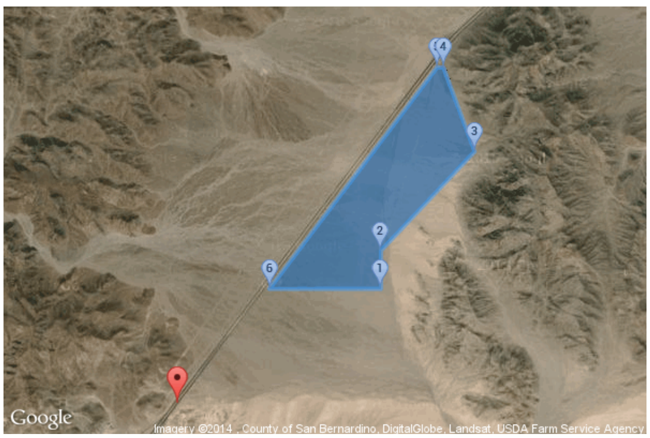


Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:39 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - East Array
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.154	-116.174	1332.72	10.0	1342.72
2	35.159	-116.174	1348.07	10.0	1358.07
3	35.172	-116.159	1464.99	10.0	1474.99
4	35.183	-116.164	1344.53	10.0	1354.53
5	35.183	-116.165	1340.53	10.0	1350.53
6	35.154	-116.191835403	1448.05	10.0	1458.05

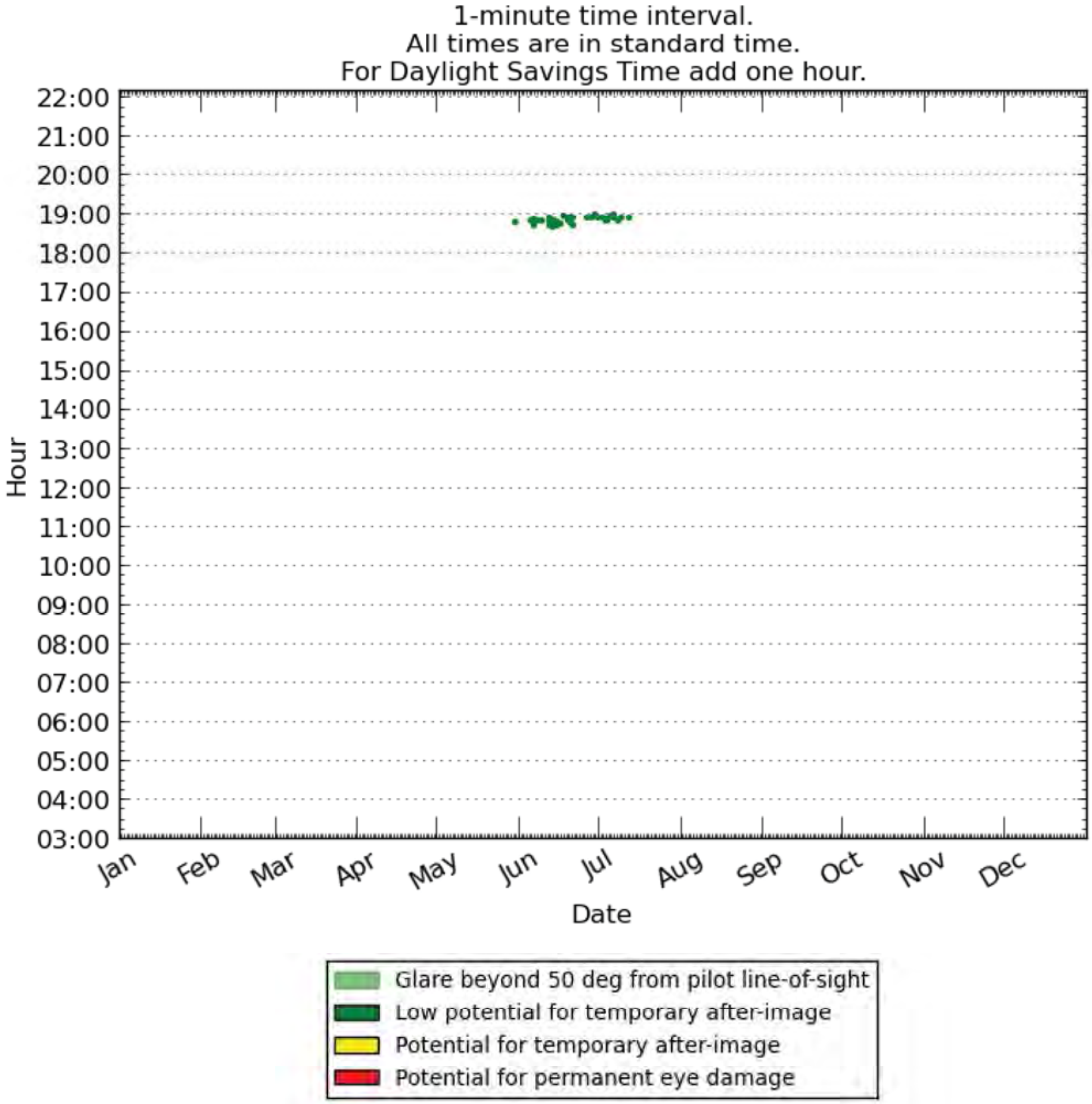
Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 1	35.138938	-116.206434	1499.73	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.

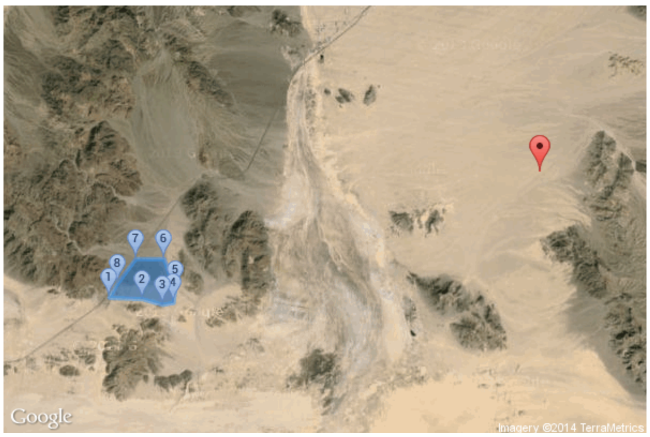


Solar Glare Hazard Analysis Report

Generated Sept. 26, 2014, 6:58 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

G.2-130

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

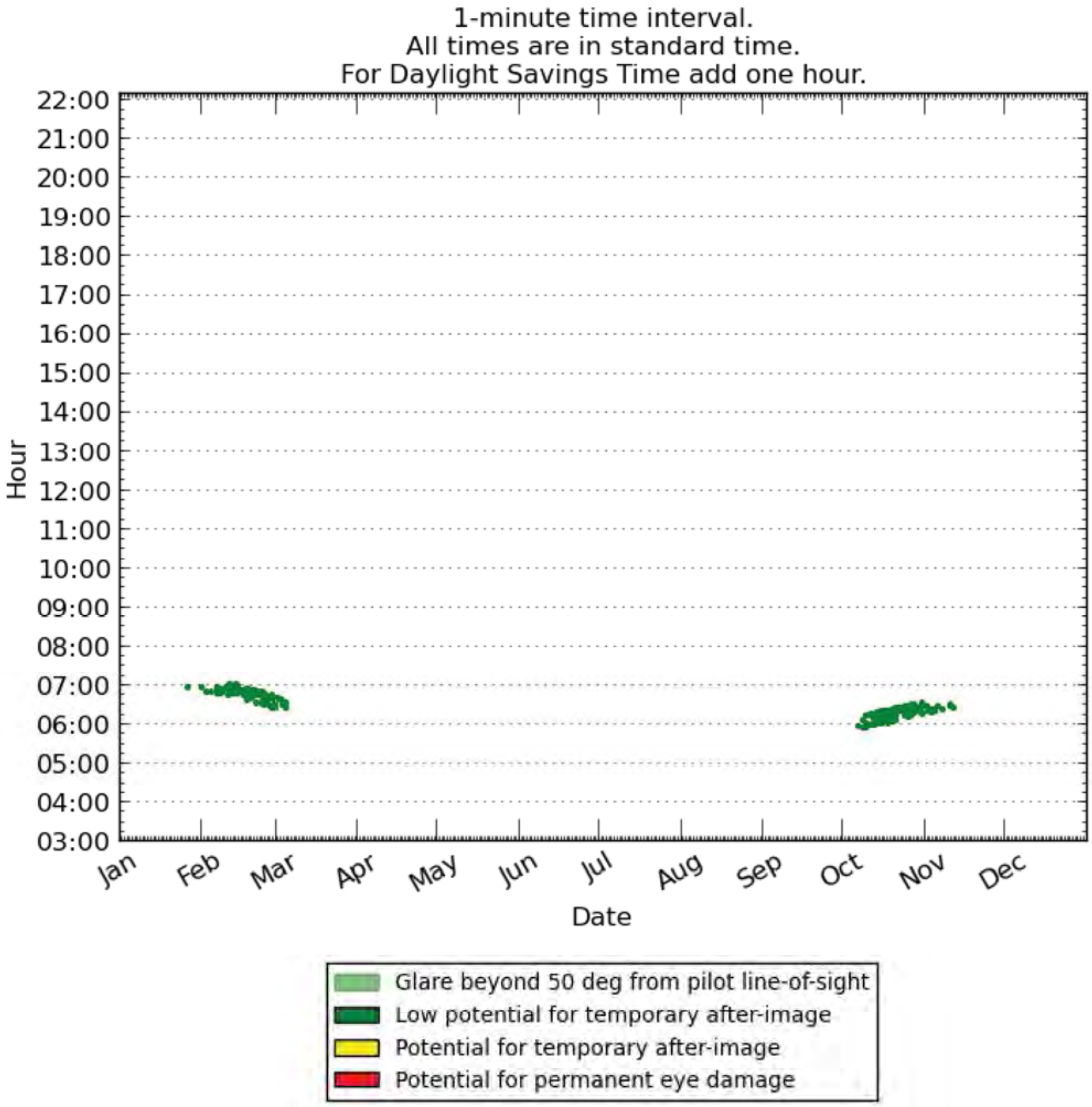
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 33	35.199816	-115.933395	1525.76	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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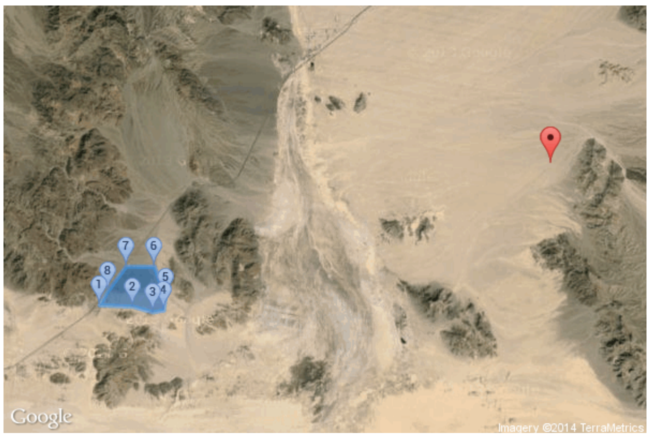
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 26, 2014, 6:57 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

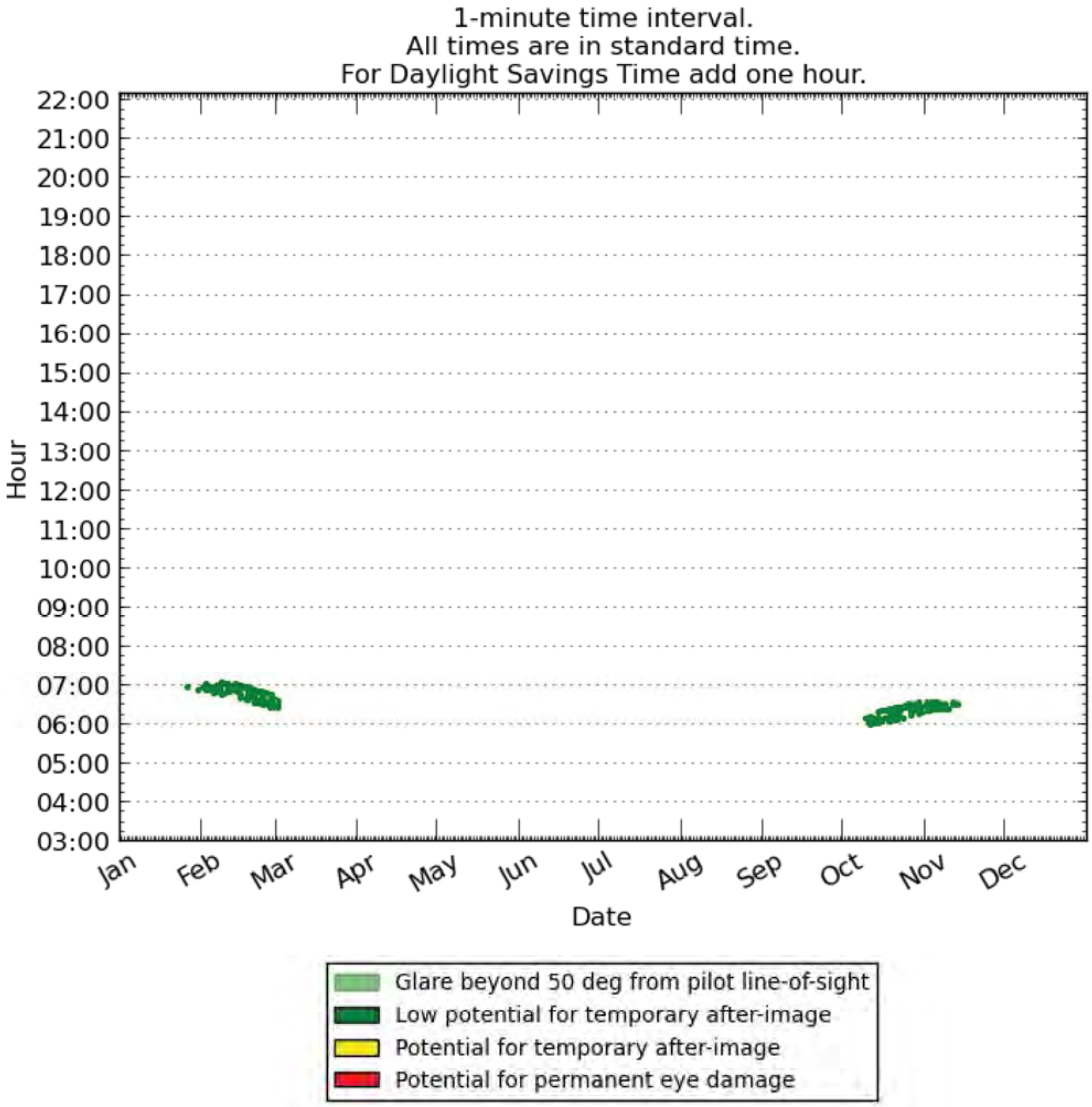
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 32	35.207974	-115.920394	1654.32	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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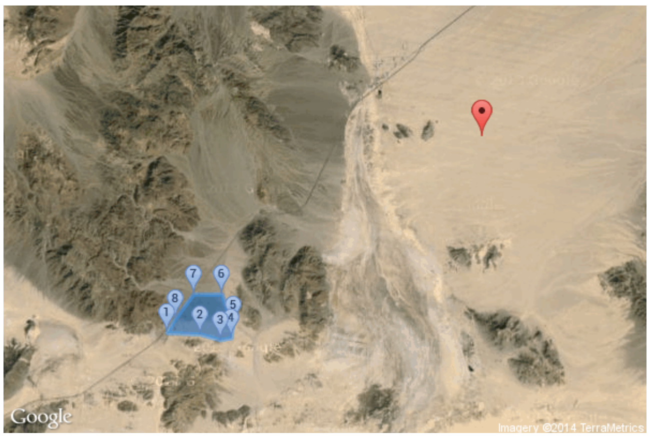
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 26, 2014, 6:57 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

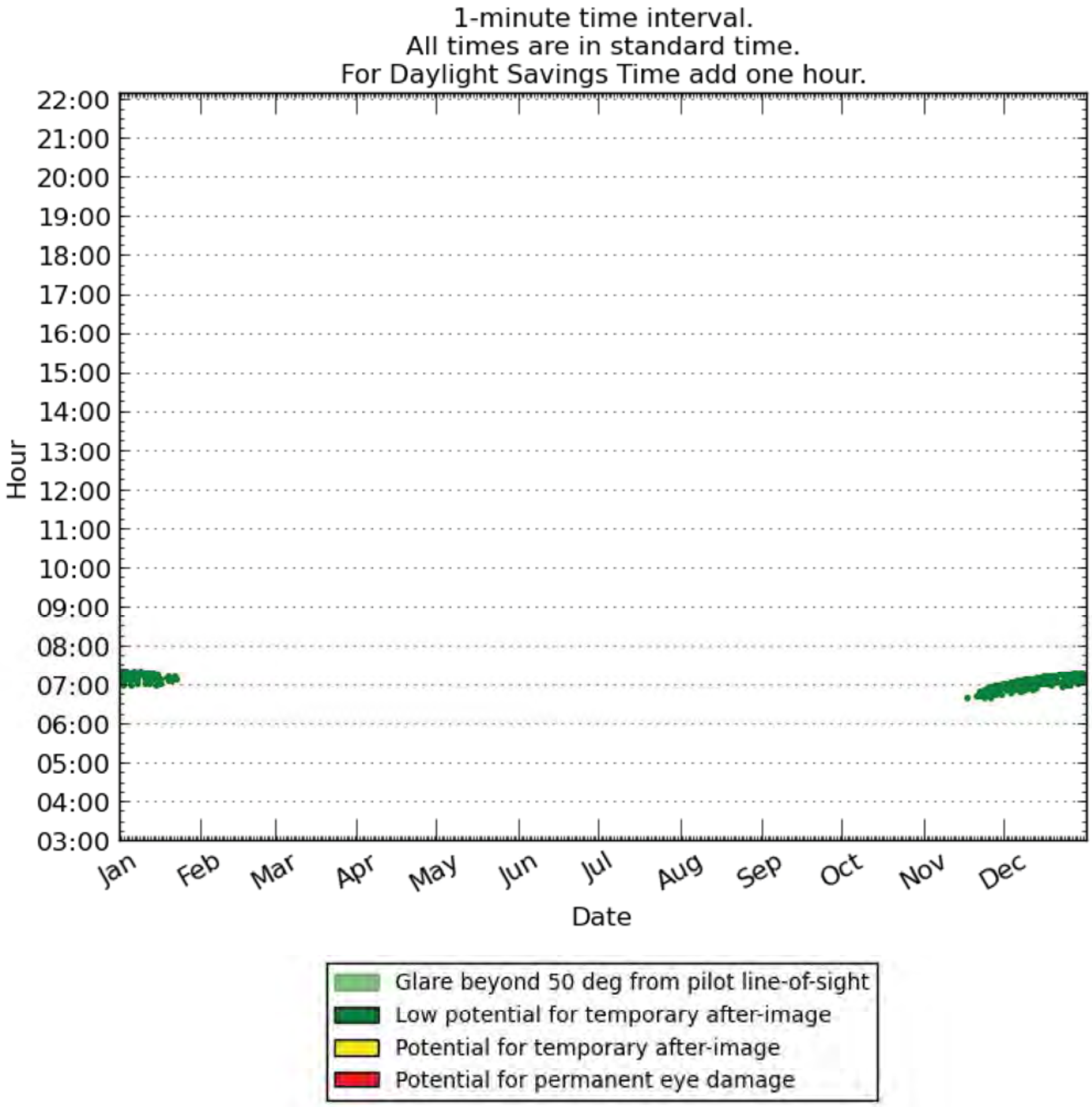
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 31	35.236588	-116.007326	1164.78	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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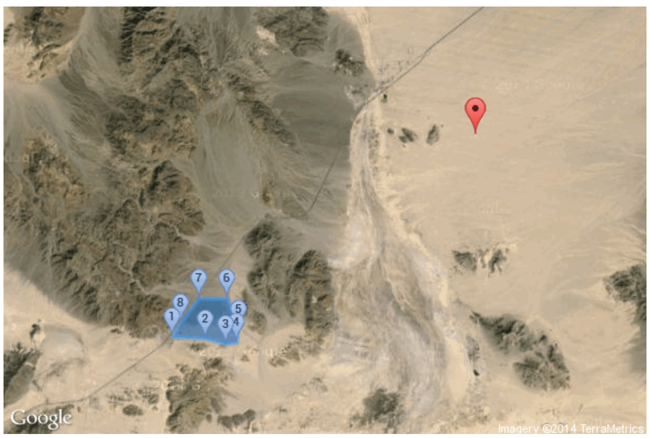
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 26, 2014, 6:56 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

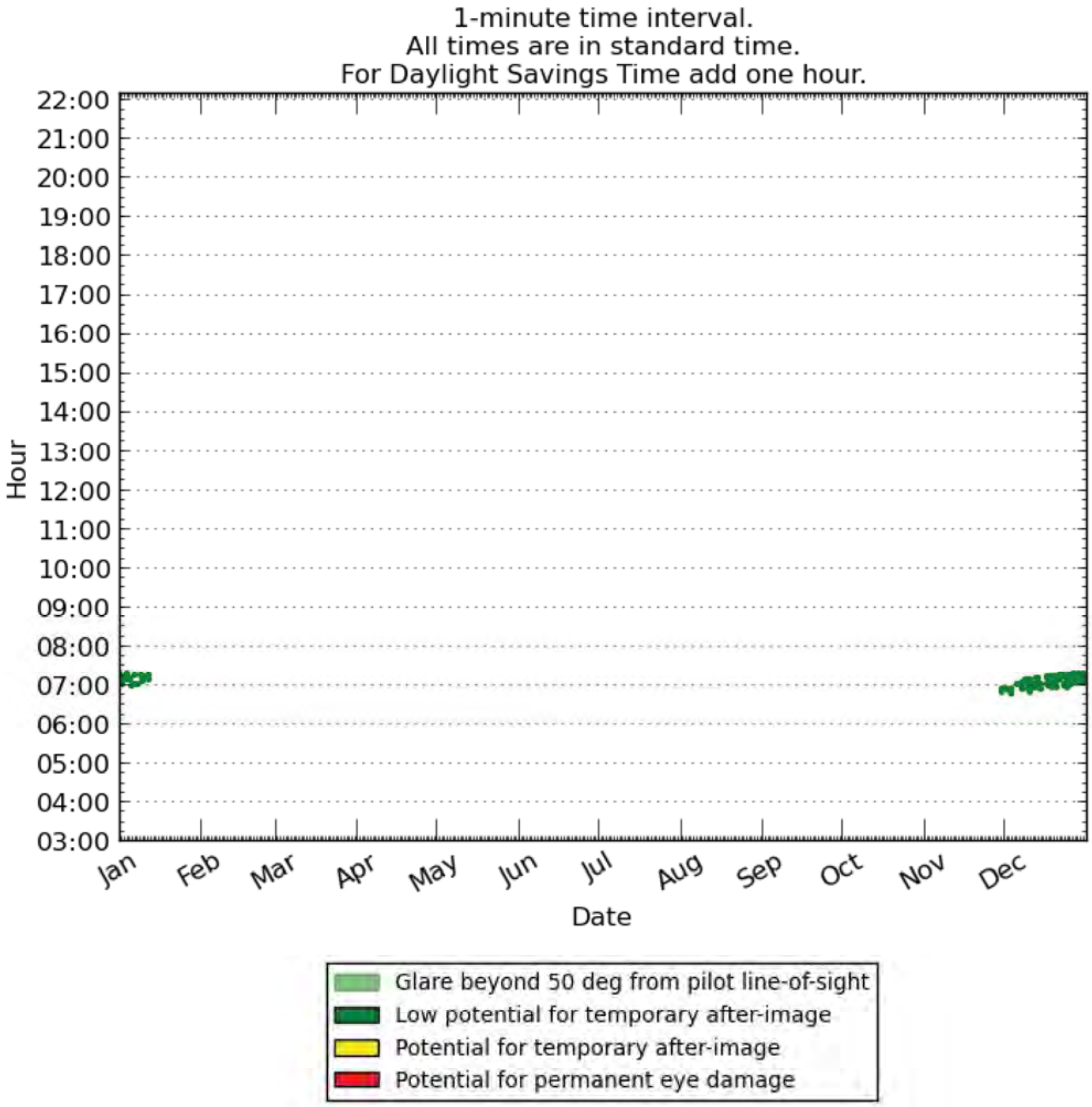
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 30	35.23987	-116.015094	1132.65	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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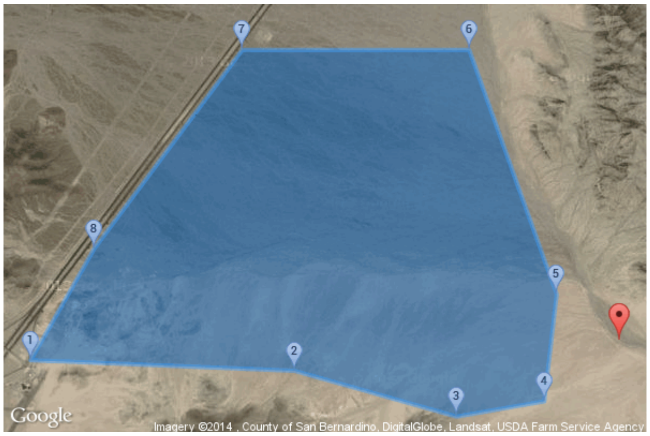
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:55 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 29	35.135	-116.162	1234.19	5.0

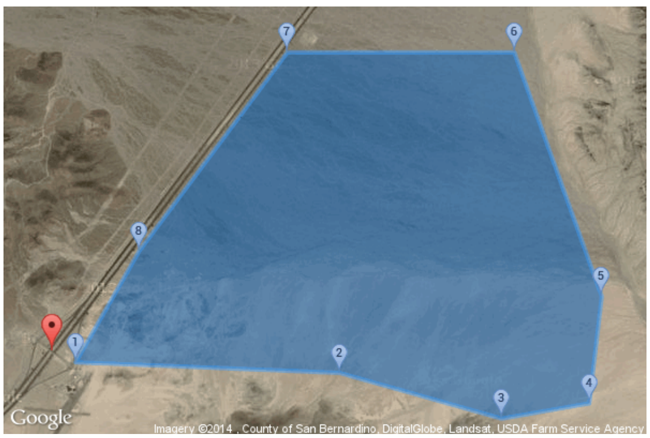
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:55 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

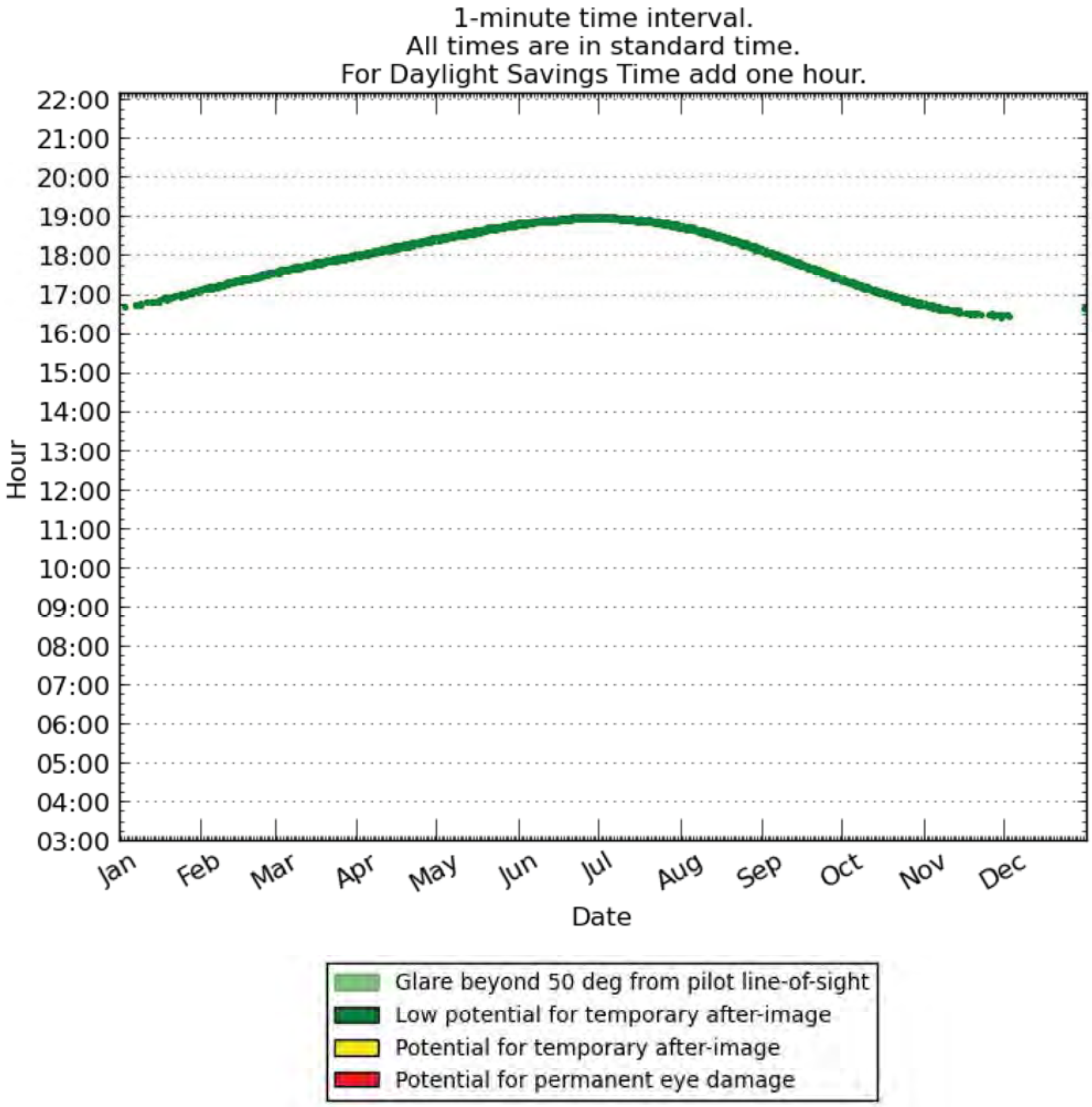
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 28	35.134447	-116.21098	1499.65	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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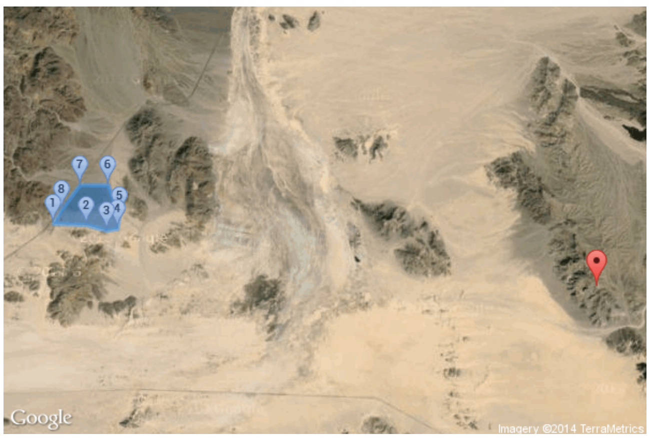
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:53 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

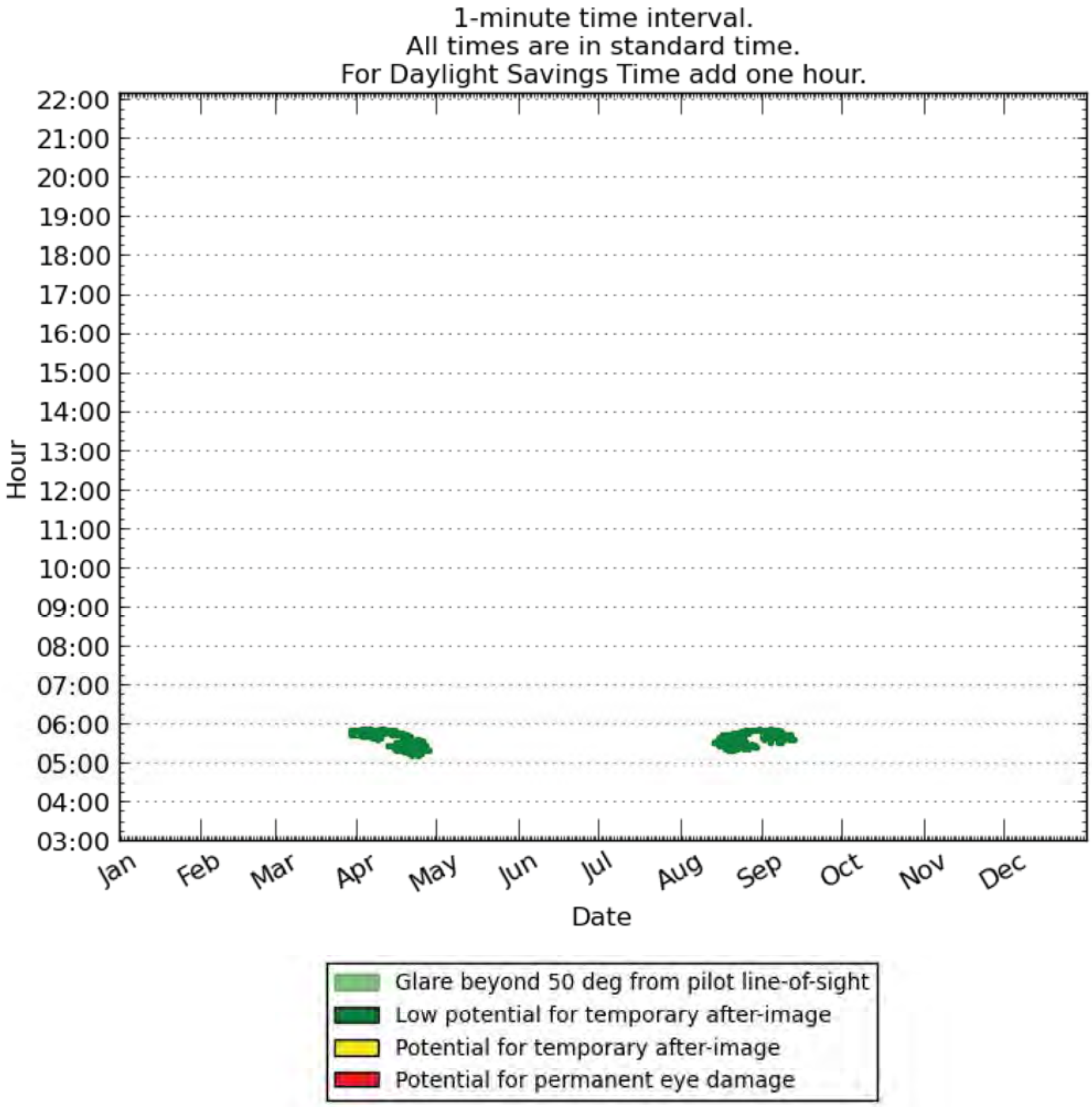
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 19	35.100986	-115.861413	4234.28	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:51 p.m.

Glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

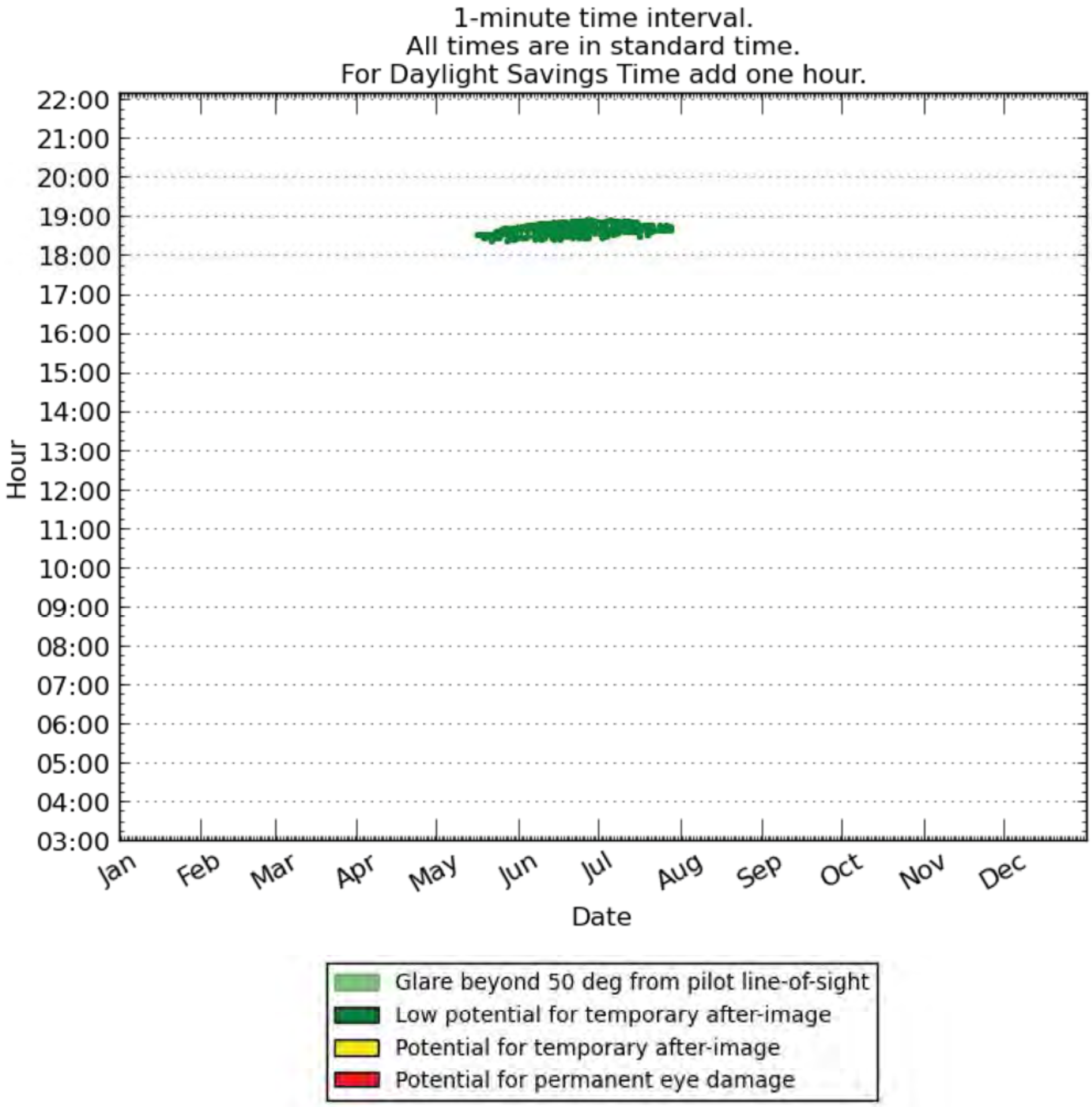
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 17	35.070904	-116.323399	3605.85	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
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Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 11:52 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 14	35.184083	-116.15366	2274.08	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:19 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 13	35.194403	-116.150074	1262.06	5.0

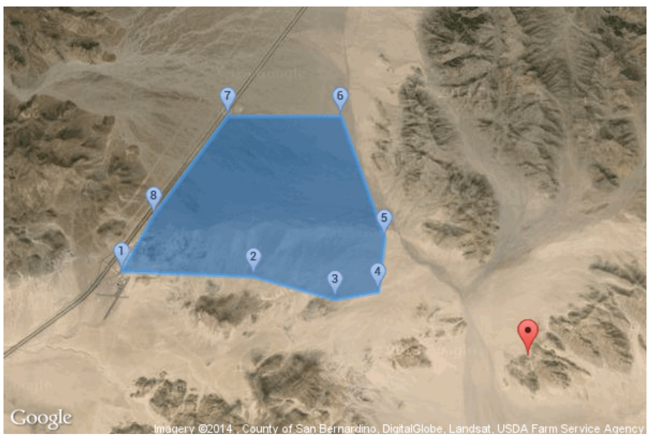
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:18 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

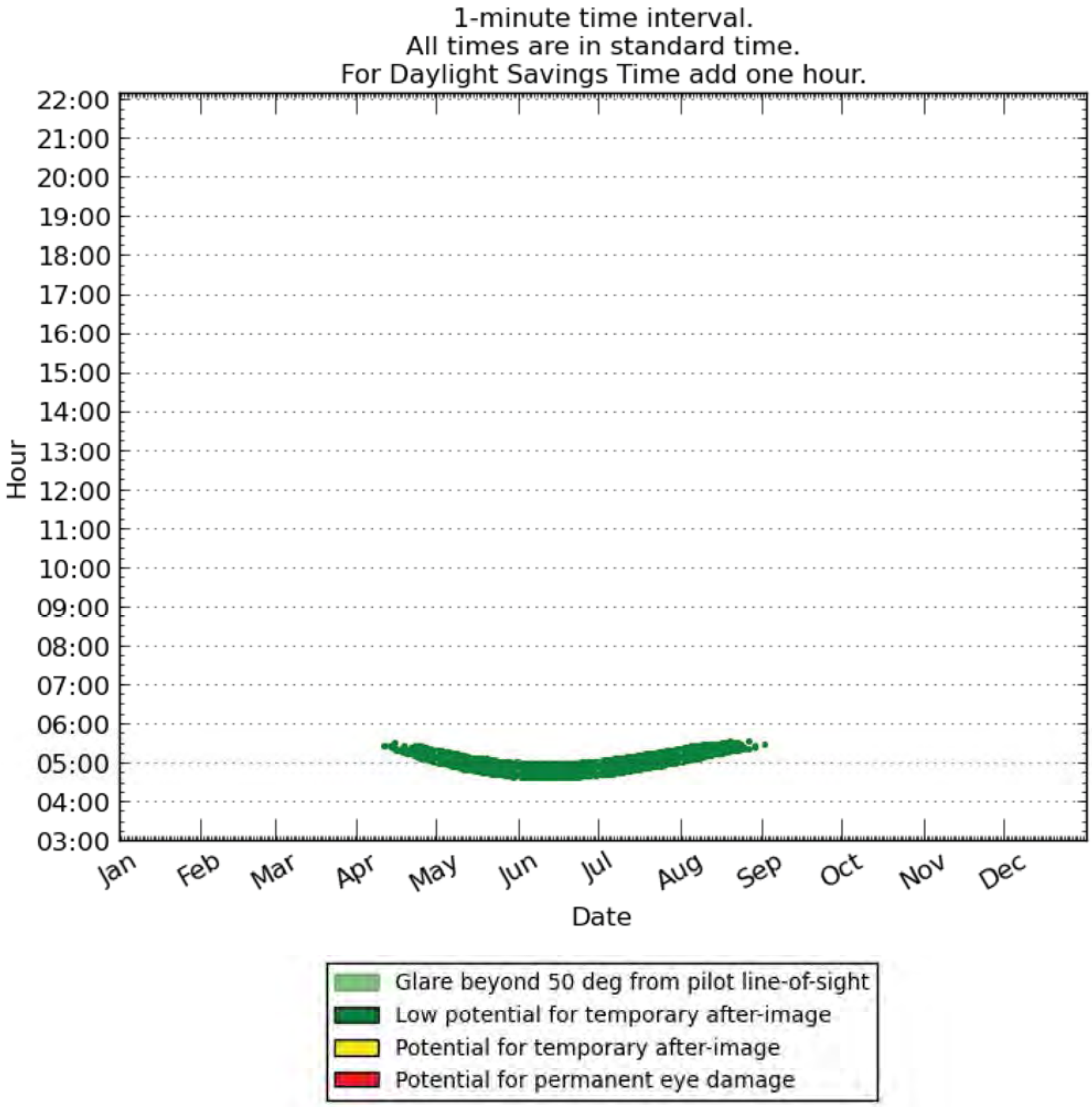
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 8	35.1226	-116.144016	1375.26	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
Hour
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:18 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 7	35.216133	-116.17	1623.29	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:17 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 6	35.241008	-116.190772	1384.93	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:17 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 5	35.192936	-116.153899	1270.18	5.0

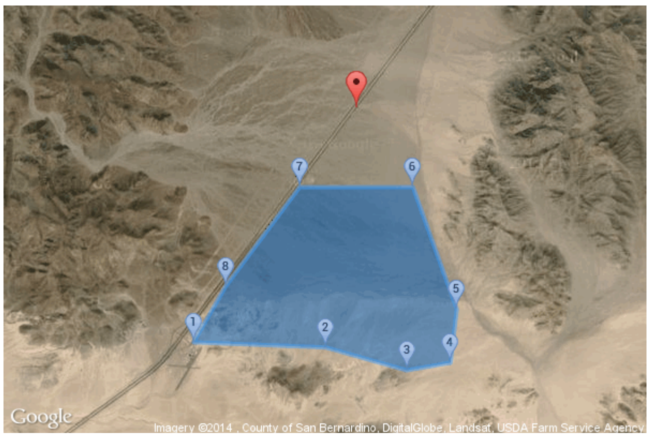
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:16 p.m.

No glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 4	35.164427	-116.182954	1397.16	5.0

No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:15 p.m.

No glare found

g Print

Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 2	35.197162	-116.129516	1158.29	5.0

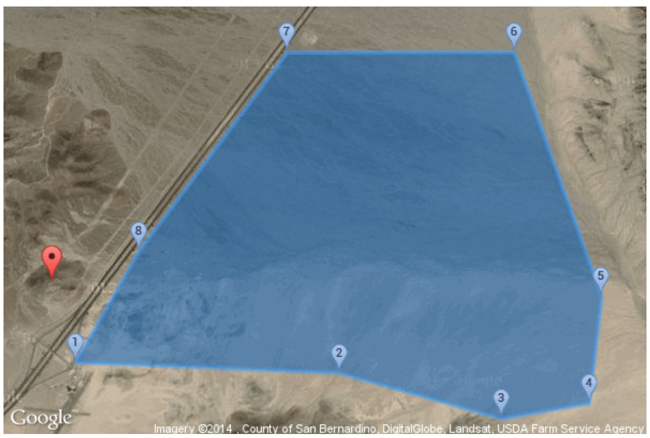
No glare found.

Solar Glare Hazard Analysis Report

Generated Sept. 25, 2014, 6:13 p.m.

Glare found

g Print



Inputs

Analysis name	Soda Mountain Solar - South Only
PV array axis tracking	single
Tilt of tracking axis (deg)	0.0
Orientation of tracking axis (deg)	0.0
Offset angle of module (deg)	0.0
Limit rotation angle?	True
Maximum tracking angle (deg)	90.0
Rated power (kW)	0.0

Vary reflectivity	True
PV surface material	Smooth glass without ARC

Timezone offset	-8.0
Subtended angle of sun (mrad)	9.3
Peak DNI (W/m^2)	1000.0
Ocular transmission coefficient	0.5
Pupil diameter (m)	0.002
Eye focal length (m)	0.017
Time interval (min)	1
Slope error (mrad)	10.0

PV array vertices

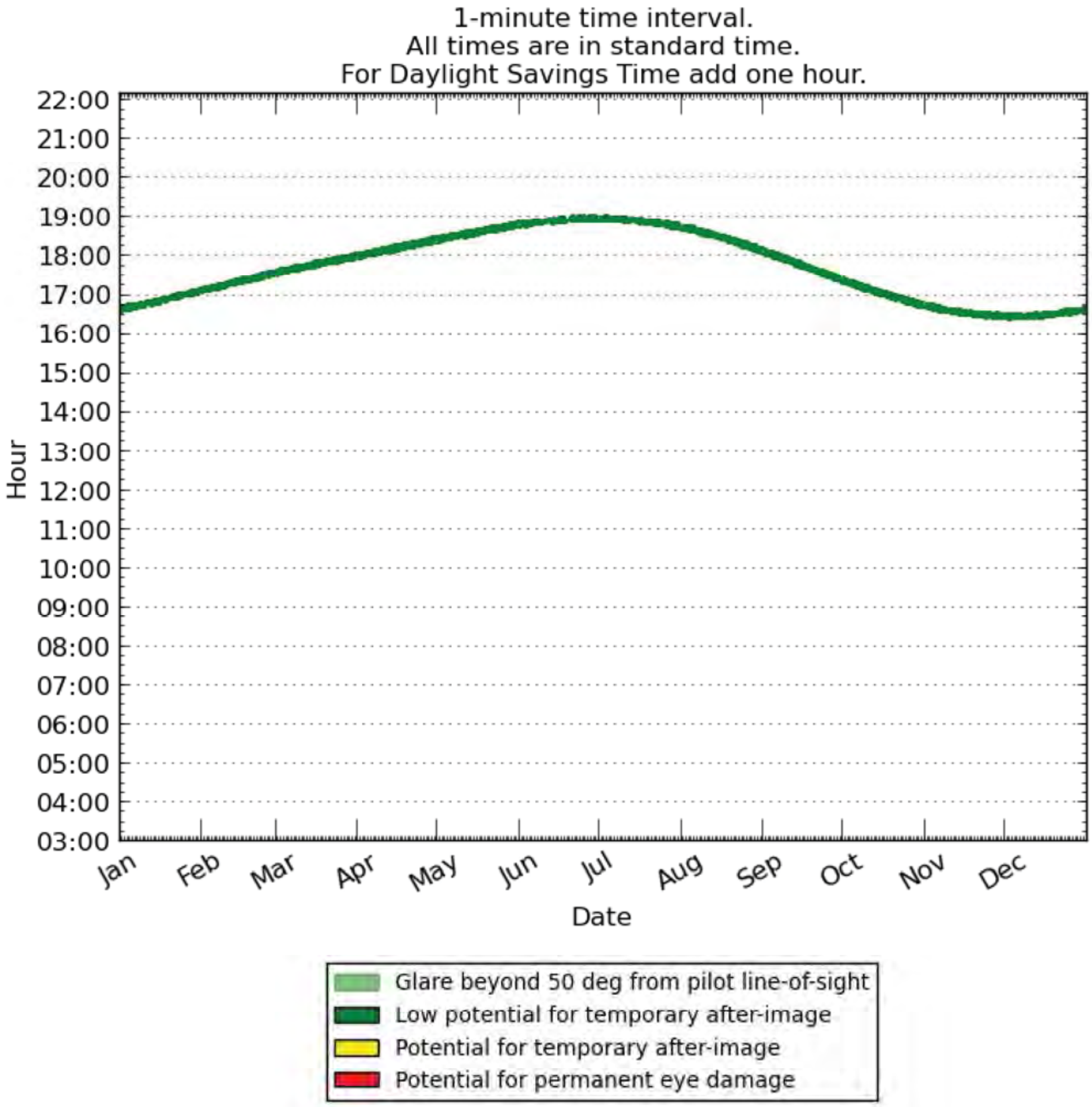
id	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Height of panels above ground (ft)	Total elevation (ft)
1	35.13369	-116.2091	1515.38	10.0	1525.38
2	35.133	-116.188	1430.58	10.0	1440.58
3	35.13	-116.175	1390.04	10.0	1400.04
4	35.131	-116.168	1307.54	10.0	1317.54
5	35.138	-116.167	1308.1	10.0	1318.1
6	35.154	-116.174	1368.88	10.0	1378.88
7	35.154	-116.19215	1464.46	10.0	1474.46
8	35.141	-116.204	1476.79	10.0	1486.79

Observation Points

	Latitude (deg)	Longitude (deg)	Ground Elevation (ft)	Eye-level height above ground (ft)
KOP 1	35.138938	-116.211018562	1499.73	5.0

Glare Occurrence Plot

All times are in standard time. For Daylight Savings Time add one hour.


1-minute time interval.
All times are in standard time.
For Daylight Savings Time add one hour.
Hour
22:00
21:00
20:00
19:00
18:00
17:00
16:00
15:00
14:00
13:00
12:00
11:00
10:00
09:00
08:00
07:00
06:00
05:00
04:00
03:00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Glare beyond 50 deg from pilot line-of-sight
Low potential for temporary after-image
Potential for temporary after-image
Potential for permanent eye damage

APPENDIX H
Water Resources

H-1. Water Supply Assessment

H-2. Hydrogeologic Conditions and Groundwater Modeling Report

H-3. Hydrogeologic Conditions and Groundwater Modeling Report Addendum

H-4. Sensitivity Analysis

H-5. Alternative Water Source Memo

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APPENDIX H-1
Water Supply Assessment

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Water Supply Assessment

Soda Mountain Solar Project
San Bernardino County, CA

January 2013

PANORAMA
ENVIRONMENTAL, INC.

One Embarcadero Center, Suite 740 San Francisco, CA 94111 650-373-1200
www.panoramaenv.com

Water Supply Assessment

Soda Mountain Solar Project
San Bernardino County, California

Submitted by:
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January 2013

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1 INTRODUCTION

This Water Supply Assessment (WSA) has been prepared for the proposed Soda Mountain Solar Project (Project) in accordance with the requirements for a WSA provided in the California Water Code §10910. The WSA has been prepared by Soda Mountain Solar, LLC for consideration by San Bernardino County. Soda Mountain Solar, LLC submitted an application for a groundwater well permit to the County in September 2012. The groundwater well permit application was prepared in accordance with §33.06554 of the County Code of Ordinances. The groundwater well permit is a discretionary permit under the California Environmental Quality Act (CEQA).

Table 1 identifies the location of this required information in the WSA. The WSA includes specific groundwater information because the Project will obtain all of its water supply from groundwater. The WSA also addresses:

- Projected water availability for the Project under normal water years, dry water years, and multiple-dry water years (i.e., during droughts)
- Projected water demand for the Project over a 20-year period
- Adequacy of projected supplies to serve existing demand, demand from the project, and demand from planned future uses

Table 1: Guide to Water Supply Assessment

Water Code Section 10910	Page No.
Documenting Groundwater Supply	
(f) If a water supply for a proposed project includes groundwater, the following additional information shall be included in the water supply assessment: (1) Review any information contained in the urban water management plan relevant to the identified water supply for the proposed project.	14
(2) Describe any groundwater basin or basins from which the proposed project will be supplied. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), of the efforts being undertaken in the basin or basins to eliminate the long-term overdraft condition.	8 to 13

Table 1 (*Continued*): Guide to Water Supply Assessment	
Water Code Section 10910	**Page No.**
Documenting Groundwater Supply	
(3) Provide a detailed description and analysis of the amount and location of groundwater pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), for the past five years from any groundwater basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.	N/A
(4) Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), from any basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.	17 to 18
(5) Analyze the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project. A water assessment shall not be required to include the information required by this paragraph if the public water system determines, as part of the review required by paragraph (1), that the sufficiency of groundwater necessary to meet the initial and projected water demand associated with the project was addressed in the description and analysis required by paragraph (4) of subdivision (b) of Section 10631.	24
Documenting Existing Entitlements	
(e) If no water has been received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts, the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall also include in its water supply assessment pursuant to subdivision (c), an identification of the other public water systems or water service contract holders that receive a water supply or have existing water supply entitlements, water rights, or water service contracts, to the same source of water as the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has identified as a source of water supply within its water supply assessments.	10 and 12
Documenting Capacity to Meet Demand During Normal and Dry Water Years and Cumulative Uses	
(c)(3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single-dry, and multiple-dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.	17 to 23
Documenting Normal, Dry Year(s), and 20-Year Supply	
(c)(4) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water assessment for the project shall include a discussion with regard to whether the public water system’s total projected water supplies available during normal, single-dry, and multiple-dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system’s existing and planned future uses, including agricultural and manufacturing uses.	23

Table 1 (*Continued*): Guide to Water Supply Assessment	
Water Code Section 10910	**Page No.**
Is the Projected Water Supply Sufficient or Insufficient for the Proposed Project and Cumulative Uses?	
(c)(5) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single-dry, and multiple-dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.	24

2 REGULATORY BACKGROUND

2.1 STATE OF CALIFORNIA

California groundwater law provides an overlying landowner or groundwater appropriator the right to pump and use local groundwater for reasonable and beneficial uses. The State of California does not have a permit process for regulation of groundwater use; however groundwater rights may be adjudicated by court decree. The groundwater rights within the groundwater basin underlying the Project area have not been adjudicated, and are considered available for use. Groundwater use is considered an overlying use if pumped for use on the parcel where the water is pumped. Groundwater use is appropriative if the appropriator pumps and delivers water for use off of the parcel where the water is pumped. Generally, overlying landowners have priority. An appropriative user, however, may put "surplus" groundwater to beneficial use. "Surplus" groundwater is water available under natural conditions on an average annual basis in an amount greater than average annual demand. Use of groundwater for the proposed Project would be considered overlying, and available for use on the parcels above the aquifer. The Project would pump water for reasonable and beneficial uses, including construction and operation uses.

Senate Bill (SB) 901 was enacted in 1995 to ensure that cities and counties assess the adequacy of available water supplies to meet projected water demand prior to approving certain types of new land development projects. SB 901, also known as the WSA law, requires that before a project is granted approval, the city or county must request preparation of a WSA by the public water supplier that will serve the proposed project. The provisions of SB 901 were codified in Water Code §10910 through §10915.

SB 610 was enacted in 2001 to improve the WSA process and expand the scope of development projects triggering the WSA procedure. The primary goal of SB 610 was to improve the linkage between water use and land use planning to ensure that land use decisions for specific large development projects have adequate information to assess whether sufficient water supplies are available to meet project demands. The 2001 bill also required additional information with respect to groundwater supplies. In 2011, SB 267 was enacted to revise the definition of a project to include new renewable energy projects. Section 10912(a)(7)(B) of the Water Code specifies that a proposed photovoltaic generation facility is not a “project” subject to the provisions of SB 610 if the facility would demand no more than 75 acre-feet of water annually.

The operational water demand for the Soda Mountain Solar Project is 7 acre-feet per year (AFY). The construction water demand of the Soda Mountain Solar Project is 192 AFY for three years. Because the annualized water demand of the Soda Mountain Solar Project is approximately 26 AFY over 30 years, it demands less than 75 acre-feet of water annually and is not subject to the provisions of SB 610. This WSA has nonetheless been prepared to assist the BLM and San Bernardino County in the evaluation of Project water supply impacts under the National Environmental Policy Act and the California Environmental Policy Act.

2.2 SAN BERNARDINO COUNTY

Water resources within San Bernardino County are subject to the San Bernardino County Groundwater Management Ordinance (Ordinance, Article 5, §33.06554). The County's Groundwater Management Ordinance requires a well permit application to be filed for the use of groundwater. The County has discretionary authority to issue the groundwater well permit. In issuing a permit, the County must find, "based upon the available data, the well(s) constructed and operated as proposed, would not result in exceeding the groundwater safe yield of the relevant aquifers." (*Id*.) The County may include in the permit "conditions and requirements" found to be "reasonably necessary to accomplish the purposes of [the Ordinance], including . . . conditions requiring groundwater management, mitigation and monitoring by the applicant." (*Id*.)

3 PROJECT DESCRIPTION

3.1 PROPOSED PROJECT

The Project consists of a 350-megawatt (MW) photovoltaic (PV) solar generating facility located within an approximately 4,500-acre right-of-way (ROW) on U.S. Bureau of Land Management (BLM) administered land. The majority of the ROW will be occupied by solar array fields and the remaining area will be used for stormwater control, access roads, ancillary buildings, and reserve land. One or more groundwater supply wells are proposed to supply water for the Project. Project construction is estimated to require approximately 192 acre-feet per year (AFY) of water over the 3-year construction period. Project operation is estimated to require approximately 7 AFY of water during the operation of the Project.

3.2 PROJECT LOCATION

The Project is located approximately 6 miles southwest of Baker, California, along Interstate 15 (I-15). The site location and neighboring terrain are presented on Figure 1. The north array is accessible from Zzyzx Road. The south and east arrays are accessible from Rasor Road.

The Project lies within an intermontane desert valley composed of alluvial fan deposits and surrounded by the Soda Mountains. Elevations in the Project area range from approximately 1,550 feet in the north to 1,250 feet in the southeast. The Soda Mountains north and west of the Project area reach an elevation of approximately 3,600 feet. Lower mountains to the south and east of the Project area form a discontinuous border reaching elevations of approximately 2,400 feet.

3.3 PROPOSED GROUNDWATER USE AND REQUIREMENTS

3.3.1 Project Construction

Groundwater will be used for dust control and soil compaction during Project construction. Construction will occur continuously for a period of about 3 years. Water will also be pumped and stored for fire protection. Groundwater will be extracted continuously over this 3-year period at an estimated average rate of 200,000 gallons per day (gpd) (192 AFY[1]) with periodic peak use at an estimated rate of 300,000 gpd.

[1] Water use is estimated to be up to 6 days per week during the period of construction.

Figure 1: Project Location

SOURCE: ESRI 2012 and Panorama Environmental, Inc. 2012

Scale: 1:1,500,000

LEGEND

Proposed Project ROW

Miles 0 20 40

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3.3.2 Project Operation

Groundwater will be used primarily for PV panel washing during the Project operation phase. Panel washing will be conducted once or twice per year over an estimated 21-day period and will require 5.4 AFY (41,895 gallons per day for 42days). Other water needs during Project operation will include fire suppression and, possibly, potable water supply for the operations and maintenance building. A 22,500-gallon water tank will be maintained on site for fire suppression and will periodically be refilled as needed (i.e., at irregular intervals) during Project operation. Potable water needs are estimated at 1.5 AFY (1,339 gallons per day for 365 days). Assuming that panel washing will occur twice per year, approximately 7 AFY will be extracted from the site water supply wells during Project operation.

4 GROUNDWATER BASIN/SUPPLY

The primary source of water for the Project would be groundwater from the aquifer underlying the Project area. This section provides a description of the groundwater basin including groundwater supply and availability.

4.1 GROUNDWATER BASIN

4.1.1 Soda Lake Valley Groundwater Basin

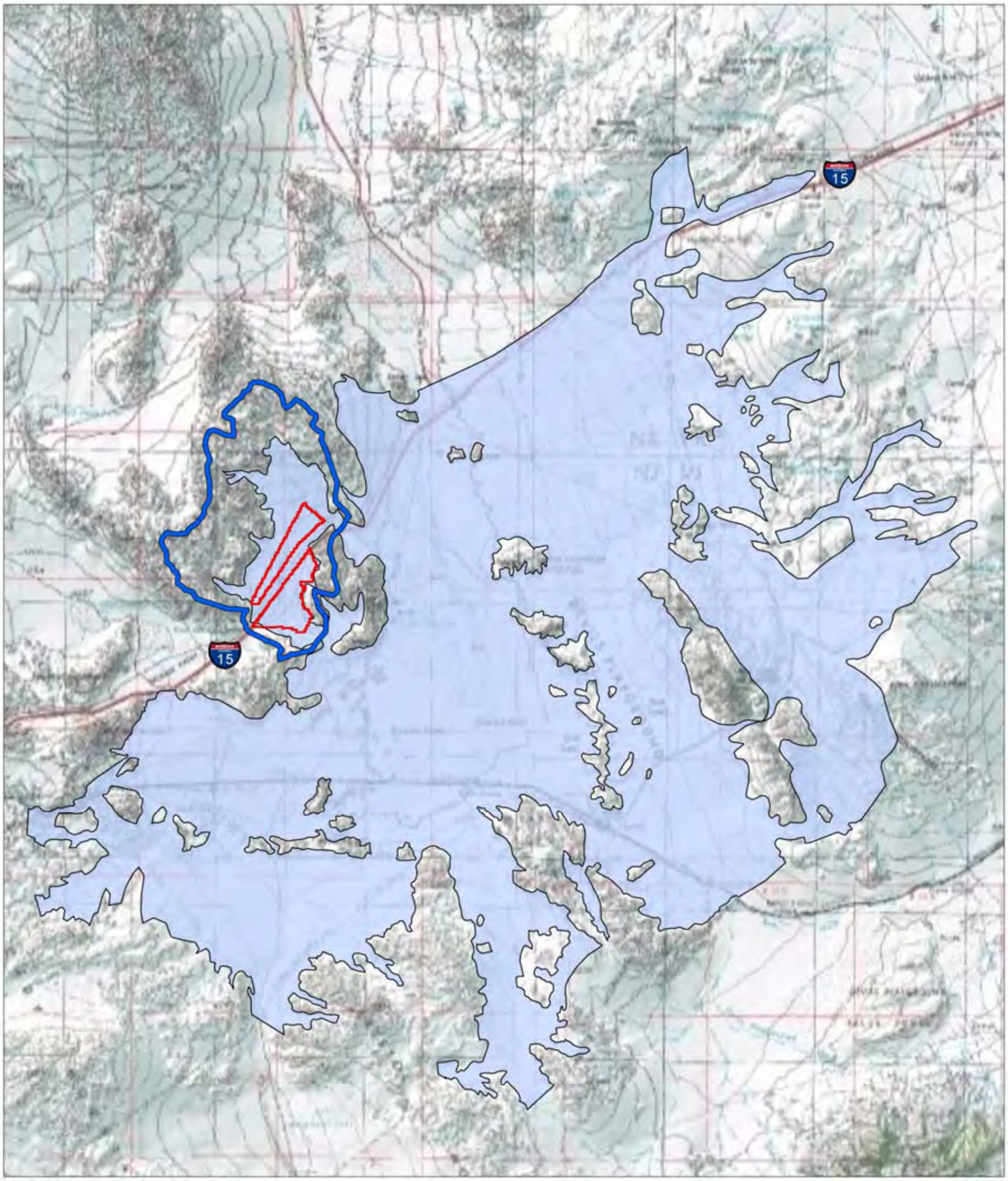
The 381,000-acre Soda Lake Valley Groundwater Basin (Basin No. 6-33; California Department of Water Resources [DWR] 2004) is located in a valley in northeast San Bernardino County (Figure 2). The basin is bounded by the non-water-bearing Mark and Kelso Mountains on the east, the Bristol and Cady Mountains on the south, the Soda and Cave Mountains on the west, and a low divide with the Silver Lake Basin on the north. These areas drain towards Soda Dry Lake (DWR 2004). Annual precipitation in the valley ranges from 3 to 5 inches. The Project ROW is located in the west portion of the basin, surrounded by the Soda Mountains.

4.1.2 Soda Mountains Subbasin

The Project is located within a subbasin of the Soda Lake Valley Groundwater Basin. The subbasin is generally separated from the rest of Basin No. 6-33 by mountains to the south and east. The direction of groundwater flow within the subbasin is expected to generally mimic surface water flow. Surface water from the South Array area flows to the southeast and the North and East arrays drain to the northeast. Groundwater flow in the northeast portion of the subbasin is expected to be toward the Town of Baker to the northeast and Soda Lake to the east. Groundwater flow in the southwest portion of the subbasin is expected to be toward the terminus of the Mojave wash to the southeast.

Geologic mapping indicates that the alluvium in the subbasin is surrounded by volcanic and granitic geologic units (Figure 3). These geologic units are impermeable, although fractures may allow some limited groundwater permeability (Dubois 2012). Because the subbasin is surrounded by mountains, groundwater is likely funneled to Basin No. 6-33 through small breaks in the mountains to the east and south. It is hypothesized that there is interbasin flow throughout the historic Great Basin, though it does not occur uniformly between all basins (Belcher et al. 2009).

Figure 2: Groundwater Basins



SOURCE: ESRI 2012, CA Department of Water Resources 2003, and Panorama Environmental, Inc. 2012

Scale: 1:500,000

LEGEND

- Proposed Project ROW
- Proposed Project Groundwater Basin Area
- Soda Lake Valley Groundwater Basin

0 2.5 5 10 15 20 Miles

N

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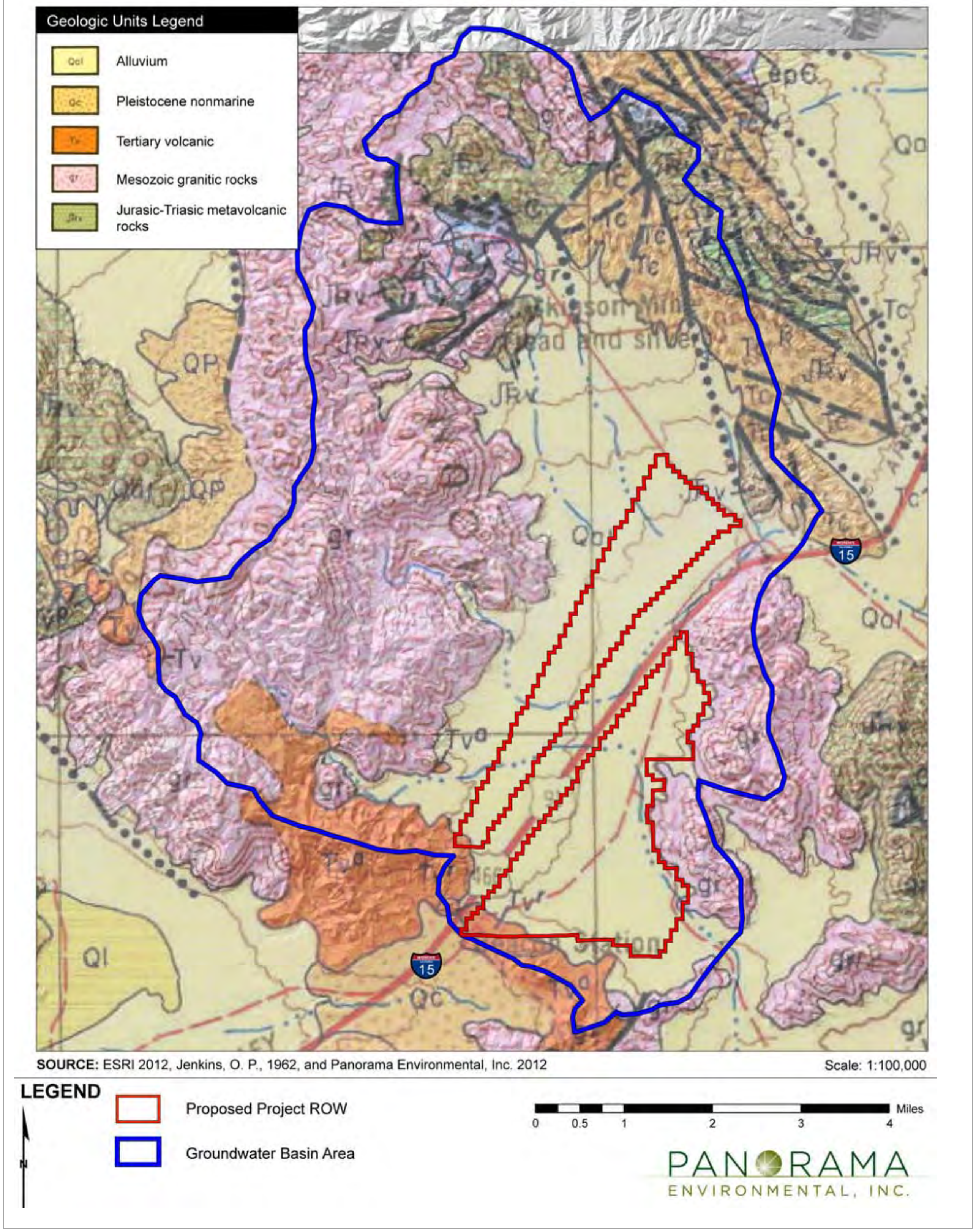
Figure 3: Geologic Map of Soda Mountain Subbasin



The subbasin is topographically higher than areas to the east (RMT 2011). Groundwater elevations within the subbasin estimated from geophysical data (Terraphysics 2010 in Wilson Geosciences 2011) are approximately 150 to 300 feet higher than those measured by the U.S. Geological Survey (USGS) in Basin No. 6-33. Specifically, the estimated depth to groundwater for the project area is 1,232 to 1,170 feet amsl in the subbasin while groundwater levels outside the subbasin measured by USGS at wells located on Rasor Road in Basin No. 6-33 range from 945 feet to 958 feet (USGS wells #012N008E35A; 012N008E27N). Similarly, Zzyzx spring is located on the bank of Soda Lake within Basin No. 6-33 at an elevation of approximately 948 feet.

The largely impermeable volcanic and granitic geologic mountains surrounding the subbasin and its higher topographic and groundwater elevations indicate that the Soda Mountains subbasin is a physically distinct basin within the larger Basin No. 6-33. The outer boundaries of the two watersheds identified in the project area further support this conclusion because they mirror the subbasin boundary, consistent with the principle that surface water drainage divides generally represent groundwater divides (*see,* Soda Mountain Solar Project Plan of Development 2011).This separation indicates that the groundwater resources within the subbasin should be analyzed separately from those within Basin No. 6-33. Working from the smaller subbasin also yields a more conservative safe-yield estimate, particularly since the project would not be able to draw groundwater resources from the larger Soda Lake Basin (Basin No. 6-33) due to its lower elevation and separation by impermeable rocks.

Aquifer Geology

The subbasin is approximately 32,946 acres. Geologic mapping from the State of California indicates that the Project area overlies alluvium, which is the primary water-bearing geologic unit in the subbasin (Gutierrez 2010). This finding was confirmed by geophysical and geotechnical data collected in the Project area (Wilson Geosciences Inc. 2011; TerraPhysics 2010). The alluvium within the subbasin is located within the valley and covers an area of approximately 12,632 acres. The average thickness of the alluvium, as estimated from site-specific geophysical data, is approximately 423 feet (Terraphysics 2010). The remaining 20,314 acres within the subbasin consist of the mountains surrounding the valley (Gutierrez 2010). There is an existing groundwater well at the Rasor Road service station that is located within the bedrock. This well has low yield and is located within volcanic rock formations (Young 2012).

Storage

Subsurface geologic conditions within the subbasin were evaluated using the results of geophysical study performed in the Project area (Terraphysics 2010). The results indicate that the depth to bedrock in the northern portion of the aquifer is approximately 332 feet below ground surface (bgs) ±26 feet and the water table is present within alluvium at approximately 182 feet bgs ±13 feet. In the southern portion of the aquifer, bedrock was estimated to be at least 500 feet bgs and the water table is present within alluvium at approximately 354 feet ±30 feet or deeper. The aquifer is unconfined, as determined from available geotechnical boring and geophysical data (DYA 2010 and Terraphysics 2010).

The storage volume of the subbasin was estimated by multiplying the total volume of the aquifer by the specific yield for the basin. The acreage of the alluvium is 12,632 acres, the average thickness of the saturated alluvium (as estimated from the geophysical sounding results) is approximately 99 feet, and the specific yield of the aquifer is estimated at 0.1 (RMT 2011). The storage of the subbasin is thereby estimated to be approximately 125,000 acre-feet.

Recharge

Many studies have been conducted to determine mountain-front recharge. A 2004 study (Wilson and Guan) included an analysis of quantitative assessments of mountain-front recharge using multiple methods. Recharge rates ranged from 38 percent for highly permeable rock to 0.2 percent for a system where recharge was dominated by streamflow. In systems similar to the project area and consisting of weathered and fractured granitic rock and metamorphic rock, recharge ranged from 7.8 to 8.8 percent. Studies within the Mojave Basin and Death Valley found that 10 percent of runoff becomes recharge (Izbicki 2002 and Hevesi et al. 2003). An estimate of 7.8 percent for mountain-front recharge was used in this analysis and is conservative based on the results of these studies.

Precipitation data for the Project area were obtained from PRISM (PRISM Climate Group 2012) and overlain on the bedrock portions of the subbasin (Figure 4). Only bedrock areas were considered for recharge because valley floor precipitation does not contribute consistently to recharge (Danskin 1998). It is possible that valley recharge in the project area is greater than zero, however no valley recharge was assumed to be conservative. Acreages for each data cell were calculated and the precipitation values were weighted by area to determine a weighted precipitation value for the subbasin. The 20,314-acre mountainous portion of the subbasin receives approximately 4.855 inches (0.405 foot) of rain annually (weighted average), which equates to 8,219 AFY of precipitation.

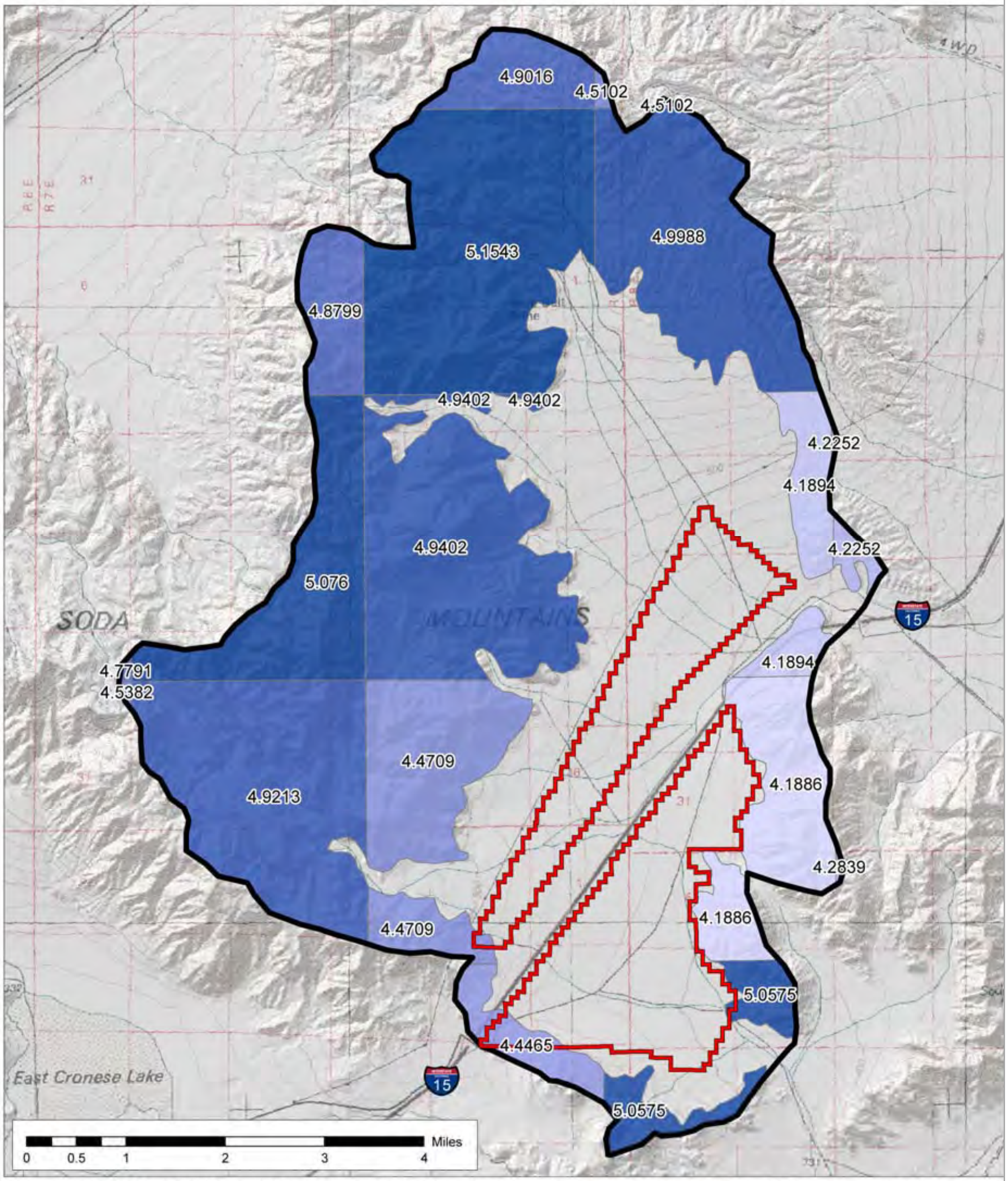
Data analysis for arid basins in the U.S. southwest indicates that approximately 7.8 percent or more of mountain precipitation becomes mountain-front recharge, as stated above. Mountain-front recharge is estimated at 641 AFY using a recharge rate of 7.8 percent.

The Soda Mountains subbasin is geographically and topographically isolated and does not receive much, if any, inflow from adjacent groundwater basins. It is hypothesized that there is interbasin flow throughout the historic Great Basin, though it does not occur uniformly between all basins (Belcher et al. 2009). It is likely that there is some permeability to the Soda Mountains and that the area is part of a regional groundwater flow system. This groundwater input is not included in estimates of groundwater available for use by the project because regional interbasin flow into the basin is likely similar to regional interbasin flow out of the basin.

Safe Yield

Safe yield is defined in San Bernardino County’s Desert Groundwater Management Ordinance as “(t)he maximum quantity of water that can be annually withdrawn from a groundwater aquifer (i) without resulting in overdraft (ii) without adversely affecting aquifer health and (iii) without adversely affecting the health of associated lakes, streams, springs and seeps or their biological resources." (Ordinance, Art. 5, § 33.06553.) "Overdraft" is defined in the Ordinance as

Figure 4: Soda Mountain Precipitation



SOURCE: ESRI 2012, PRISM Climate Group, Oregon State University 2012, and Panorama Environmental, Inc. 2012

Scale: 1:100,000

LEGEND

- Proposed Project ROW
- Groundwater Basin Area

PRISM Precipitation Data (1971-2000 annual totals in inches)

4.1886 – 5.1543

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"(t)he condition of a groundwater supply in which the average annual amount of water withdrawn by pumping exceeds the average annual amount of water replenishing the aquifer in any ten year period, considering all sources of recharge and withdrawal." (*Id*.) "Aquifer health" is defined as the "geologic integrity of the affected aquifer, its storage capacity and the quality of water within the aquifer." (*Id*.)

Groundwater inflows to the subbasin through precipitation recharge as described above. Groundwater leaves the subbasin through groundwater flow to Basin No. 6-33 through gaps or lower elevations in the bedrock (Figure 3). The only existing groundwater use in the subbasin is the pumping of a groundwater well installed at the Rasor Road service station (southwest corner of South Array on Figure 1), which is screened in bedrock and is hydrologically separated from the saturated alluvium in the valley (RMT 2011). No wells are known to exist in the interior of the valley. The amount of water = estimated to be used at the Rasor Road service station over the past five years is approximately 10 to 12 gallons per minute (gpm) (16 to 19 AFY) (pers. comm. Terry Young, August 23, 2012). There are no other uses of groundwater within the subbasin and no existing uses within the aquifer.

The safe yield is calculated as follows:

Recharge – Rasor Road Well Extraction = Safe Yield

641 AFY – 19 AFY = 622 AFY

This calculation is conservative because it assumes:

- No recharge from precipitation on the valley floor,
- No input from regional groundwater flow
- 19 AFY is extracted from bedrock and is considered to be isolated from the alluvial aquifer

4.2 GROUNDWATER MANAGEMENT/ADJUDICATION

Basin No. 6-33 has not been adjudicated by the State of California and there is no evidence of current or projected overdraft conditions within the Basin (DWR 1980). . The existing service station well is the only current user of water from the subbasin and the subbasin aquifer is not currently in a state of overdraft, nor is it projected to be. No Urban Water Management Plan or other groundwater management plan has been adopted for Basin No. 6-33 or the subbasin.

San Bernardino County manages water resources within the County under the Desert Groundwater Management Ordinance. Under the Ordinance, "no person, district or other entity . . . shall locate, construct, operate or maintain any new groundwater well within the desert region of San Bernardino County . . . without first filing a written application to do so with the enforcement agency and receiving and retaining a valid permit as provided herein." (Groundwater Management Ord. § 33.06554(a). A groundwater well permit application was filed for the proposed project in September 2012. The groundwater well permit application provides information specified in the Ordinance § 33.06554(b).

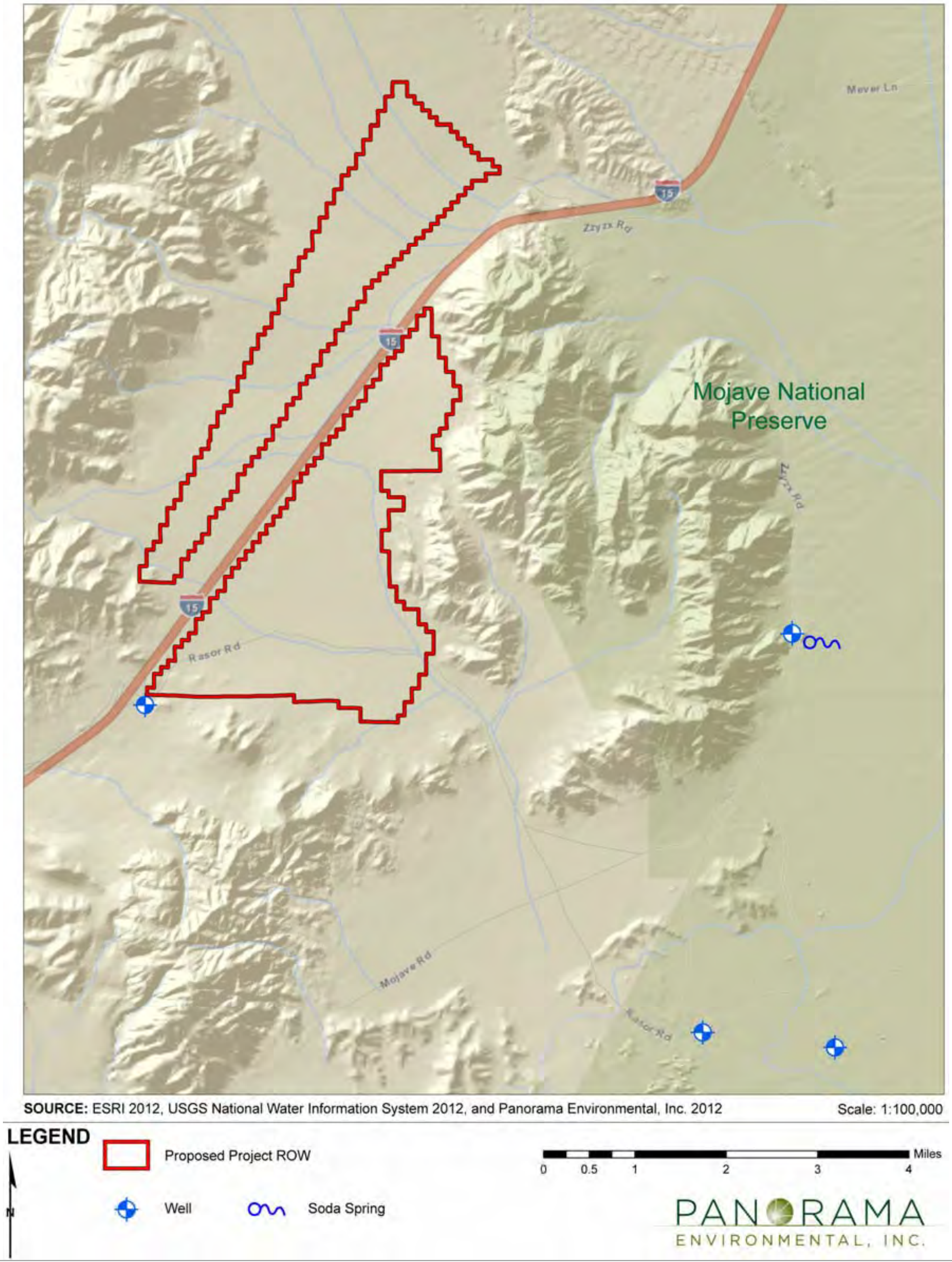
4.3 EXPECTED GROUNDWATER QUALITY

Limited water quality data are available for the Project area due to the absence of wells in the valley. The September 2010 geophysical survey collected subsurface resistivity data that can be used to estimate water quality. Resistivity is the inverse of conductivity. Conductivity is directly correlative to total dissolved solids (TDS) (i.e., higher conductivity is indicative of higher TDS and, conversely, lower resistivity is also indicative of higher TDS). Data from the geophysical investigation indicate that the resistivity of the saturated subsurface differs between the northern and southern portions of the valley, consistent with the interpretation of different groundwater flow directions in the two portions of the valley (RMT 2011), as discussed in the groundwater report. Groundwater at the northern data collection location (i.e., between W-1 and W-2) has very low resistivity (4 ohm-meters), indicating a high conductivity and a high concentration of TDS. Groundwater in the southern portion of the valley (i.e., across I-15 from W-4) has slightly higher resistivity values (15 ohm-meters), indicating relatively high TDS concentrations but lower than at the northern location.

Other groundwater wells in the vicinity of the Project were analyzed to determine measured water quality in the area. Four wells are located within 5 miles of the Project area. These wells are shown on Figure 5.

Water quality at the Rasor Road service station well has TDS concentrations of approximately 3,000 mg/L and requires use of a reverse osmosis system to produce potable water (Young 2012). The Desert Studies Center is located along Zzyzx Road on the east side of the Soda Mountains, on the west margin of Soda Dry Lake and southeast of the Project ROW. A well located at the Center was sampled in May 2000. The Center is located on the other side of the Soda Mountains from the Project ROW, outside of the subbasin. TDS in the well is 1,890 mg/L. Water quality data from the well are not likely representative of water quality at the Project well locations due to the separation of the Desert Studies Center from the Project area by mountains. Several wells are present in the region surrounding the Project ROW although none are located within the subbasin.

Figure 5: Groundwater Wells



SOURCE: ESRI 2012, USGS National Water Information System 2012, and Panorama Environmental, Inc. 2012

Scale: 1:100,000

5 PROJECT DEMAND ANALYSIS

5.1 EXISTING USES

The well at the Rasor Road service station is located in the Soda Mountain subbasin. This well is located in bedrock and is not in the alluvial aquifer. No wells are known to exist that are screened in the alluvial aquifer. The amount of water that is estimated to be used at the Rasor Road service station is approximately 16 to 19 AFY. There are no other uses of groundwater within the subbasin and no existing uses within the aquifer.

5.2 PLANNED FUTURE USES

There are no planned future uses of groundwater within the subbasin. Groundwater withdrawal at the Rasor Road service station would be expected to remain constant due to the limited well productivity. The solar panels of the Project would cover about 21% of the alluvium within the valley.

2,691 acres of panels ÷ 12,632 acres of alluvium = 21% of alluvial area

5.3 PROPOSED USE

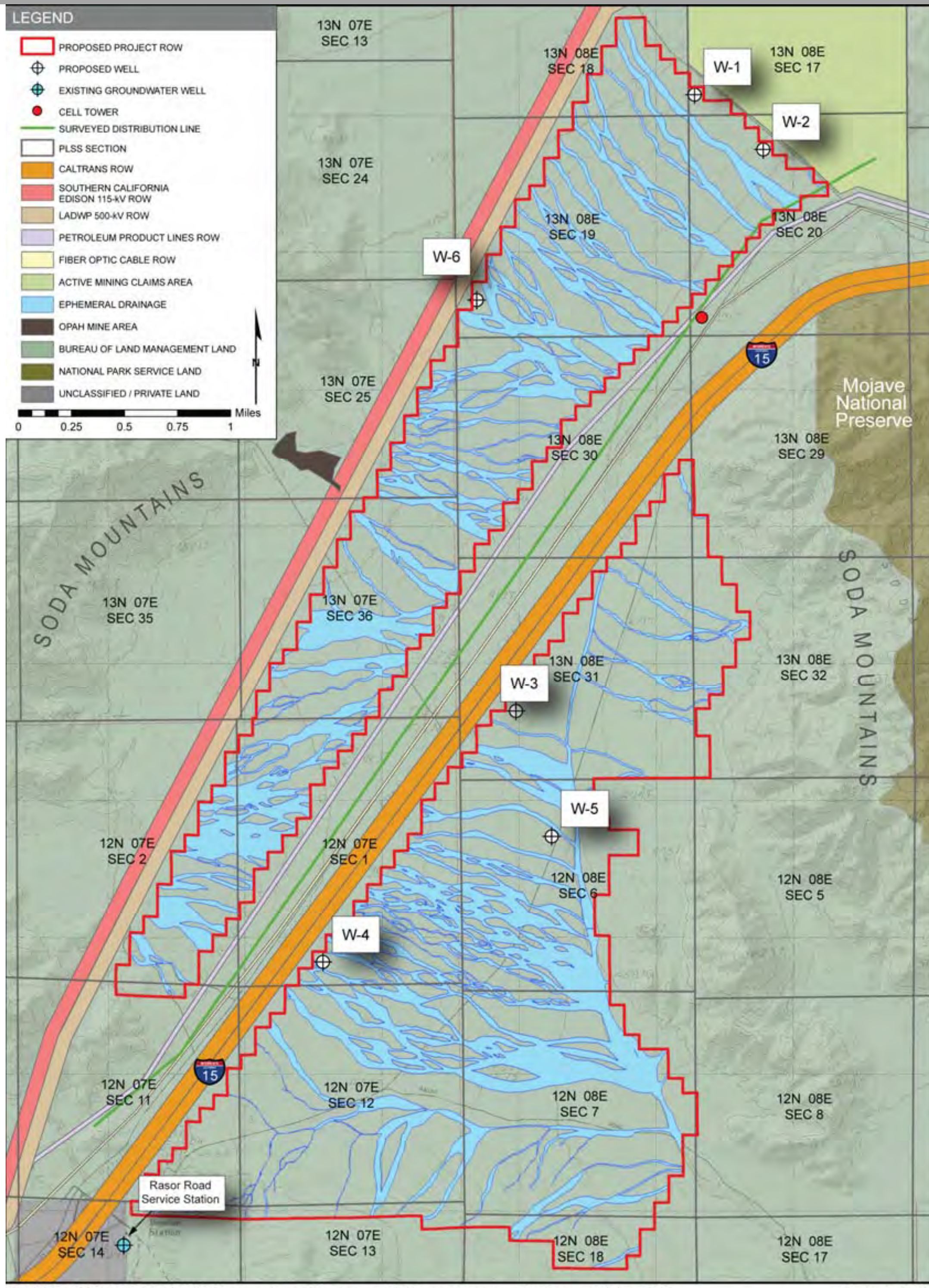
5.3.1 Location

It is anticipated that two to four wells will be constructed to provide the water supply for the proposed Project. Multiple wells will be required for the Project to provide spatial coverage over the 4,500-acre ROW on both sides of I-15 and also to provide redundancy when a Project well is out of service for scheduled or unscheduled maintenance. Six possible well locations have been identified to provide siting flexibility (Figure 6).

5.3.2 Quantity

During Project construction, extracted groundwater will be used primarily for dust control and soil compaction. Additional water will be extracted and stored for fire suppression. The quantity of water to be used is estimated to be approximately 192AFY, equivalent to a volume of 200,000 gpd when pumped 24 hours/day, 6 days/week. Pumping rates may periodically peak at 300,000 gpd but the amount of water pumped annually would equate to an average of 192AFY. Water will be applied directly to the ground surface by either a water truck or workers using hoses. Water used for dust control may be mixed with a dust suppressant prior to application (the dust suppressant would be determined by construction contractor). Dust control and soil compaction will be necessary throughout the entire 3-year construction period.

Figure 6: Potential Well Locations



SOURCE: ESRI 2012, URS 2009, Bureau of Land Management 2011, and Panorama Environmental, Inc. 2012

Scale: 1:40,000

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During Project operation, extracted groundwater will be used primarily for PV panel washing. Other water needs during Project operation will include fire suppression and, possibly, potable water supply for the operations and maintenance building. Approximately 7 AFY would be extracted from the site water supply wells during the operational phase. Approximately 5.4 AFY would be used for panel washing and 1.5 AFY would be used for potable water uses at the operations and maintenance buildings. Water will be applied directly to the panels through use of a panel cleaning system. Details of the cleaning system will be determined later in the Project development process. Panel cleaning will be necessary throughout the lifespan of the Project but will only occur once or twice each year during an estimated 21-day period. The total annual water demand for the Project is summarized in Table 2.

Table 2: Project Water Demand

Activity	Annual Water Demand (AFY)	Period of Performance	Total (AF)
Construction	192	3 Years	576
Operation	7	30 Years	210
Total Water Demand Over Life of Project			**786**

6 GROUNDWATER SUPPLY AVAILABILITY

This section assesses Project and non-Project water needs over a 20-year future projection to determine whether there are sufficient supplies to serve the Project over the next 20 years. The assessment considers average-year (“normal” year), single-dry year, and multiple-dry year (drought) conditions. A multiple-dry year scenario is assumed to be 3 years long for the purpose of this analysis.

Project water demand for a projected 20-year period is summarized in Table 3. Project water demand would be greatest during the 3-year construction period. Total Project water use would be approximately 695 acre-feet for the 20-year period following the initiation of construction.

The subbasin is estimated to receive approximately 8,219 acre-feet of precipitation under normal-year conditions. The amount of mountain-front recharge within the subbasin is approximately 641 AFY, which is the precipitation recharge value used to represent normal-year conditions. Normal year conditions were estimated using PRISM (2012).

The precipitation monitoring station closest to the Project area is in Baker (#040436), about 6 miles to the northeast. Baker rainfall data for the years 1971 through 2012 were analyzed to determine single-dry year, and multiple-dry year precipitation based on measured (i.e., not modeled) data in the Project vicinity (Western Regional Climate Center [WRCC] 2012). Average annual precipitation in Baker between 1971 and 2012 is 4.009 inches. Precipitation in Baker is estimated to be approximately 0.846 inch less than that in the Soda Mountains subbasin (PRISM

Table 3: 20-year Project Water Use Projections (acre-feet)

Year	1	2	3	4	5	6	7	8	9	10
Water Use	192	192	192	7	7	7	7	7	7	7
5-year Average	--	--	--	--	118	--	--	--	--	7
Total	**192**	**384**	**576**	**583**	**590**	**597**	**604**	**611**	**618**	**625**
Year	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Water Use	7	7	7	7	7	7	7	7	7	7
5-year Average	--	--	--	--	7	--	--	--	--	7
Total	**632**	**639**	**646**	**653**	**660**	**667**	**674**	**681**	**688**	**695**

2012). Baker is located 6 miles from the Project in an area with lower elevation than the Project site (elevations in Baker range from about 950 to 1,000 feet and in the project area the range is 1,250 to 1,550 feet). The difference in the estimated average rainfall between Baker and the Project site is attributed to the difference in elevation and topography between the two areas. The western Soda Mountains reach 3,600 feet.

6.1 SINGLE DRY-YEAR

A probability-based estimate is used to determine water availability during a single dry-year. Single dry-year rainfall is estimated as a year with a 10 percent probability of occurrence (DWR 2003). The predicted rainfall for a single dry-year is 1.726 inches or 43 percent of normal-year rainfall in Baker. Within the Soda Mountains subbasin, 43 percent of the normal-year rainfall of 4.855 inches is 2.088 inches. A single dry-year would not affect the safe yield of the basin. The aquifer would be expected to rebound following a single dry-year, when rainfall increases.

6.2 MULTIPLE DRY-YEAR

Multiple dry-years are estimated using historical precipitation analysis. Rainfall is estimated for the driest three-year period on record (DWR 2003). The 2005 to 2008 water years are the driest three-year period on record. Between 2005 and 2008 precipitation at the Baker monitoring station was measured as follows:

- Year 1: 1.34 inches (2005-2006 water year)
- Year 2: 3.83 inches (2006-2007 water year)
- Year 3: 1.83 inches (2007-2008 water year)

The Year 2 rainfall is less than 0.2 inch lower than the normal-year value; however, it occurs within the lowest 3-year period of precipitation during the recorded history. The Year 1, Year 2, and Year 3 precipitation values represent 33 percent, 96 percent, and 46 percent of average annual rainfall, respectively. Within the Soda Mountains subbasin this equates to precipitation values of 1.602 inches, 4.661 inches, and 2.233 inches, respectively.

6.3 DRY YEAR SUPPLY

Precipitation recharge in the subbasin during normal-, single dry-, and multiple dry-years is summarized in Table 4.

Under a single-dry year scenario the subbasin would be expected to have approximately 57 percent less recharge than during a normal water year. Under multiple-dry year conditions, the SM subbasin would have an average of 41 percent less recharge (over the 3 year period) than during normal water years.

Table 4: Precipitation Recharge to Soda Mountains Subbasin		
Climate Scenario	**Precipitation Recharge (AFY)**	**Percent of Normal Year**
Normal Water Year[1]	641	100%
Single Dry-water Year[2]	276	43%
Multiple Dry-water Years[3]		
Year 1	212	33%
Year 2	615	96%
Year 3	295	46%

1 Normal water year precipitation recharge is based on the 40-year average rainfall between 1971 and 2000 for the mountainous areas of the subbasin (PRISM Climate Group 2012).

2 Single dry-year precipitation recharge is scaled from the 2001-2002 water year for the Baker gauging station (WRCC 2012).

3 Multiple-dry water year precipitation recharge is scaled from the 3-year period between 2005 and 2008 for the Baker gauging station (WRCC 2012). Although Year 2 precipitation is only slightly less than that for the normal water year, the 3-year period had the lowest precipitation overall on record for the data collection period.

6.4 DRY YEAR DEMAND

Water supply availability projections for a 20-year period are presented in Tables 5 and 6. Table 5 presents projections for the 3-year construction period with the highest Project related water use (192 AFY). Table 6 presents projections for the subsequent 17-year operational period. The existing pumping data refers to the estimated pumping rate for the Rasor Road service station well. It was assumed for the purpose of the analysis that the pumping rate at this well would remain constant because it is a low-producing well and the maximum pumping rate could not increase.

Table 5: Groundwater Availability Projections for Years 1 through 3 (Construction)					
Climate Scenario	**Precipitation Recharge (AFY)**	**Existing Pumping (AFY)[1]**	**Project Pumping (AFY)**	**Total Demand (AFY)**	**Balance (AFY)**
Normal Year	641	19	192	211	430
Single-dry Year	276	19	192	211	65
Multiple-dry Years					
Year 1	212	19	192	211	1
Year 2	615	19	192	211	404
Year 3	295	19	192	211	84
Multiple Dry-Year Balance					**489**

1 Existing pumping is from the Rasor Road service station well, the only well known to exist in the subbasin.

Table 6: Groundwater Availability Projections for Years 4 through 20 (Operation)					
Climate Scenario	**Precipitation Recharge (AFY)**	**Existing Pumping (AFY)[1]**	**Project Pumping (AFY)**	**Total Demand (AFY)**	**Balance (AFY)**
Normal Year	641	19	7	26	615
Single-dry Year	276	19	7	26	250
Multiple-dry Years					
Year 1	212	19	7	26	186
Year 2	615	19	7	26	589
Year 3	295	19	7	26	269

1 Existing pumping is from the Rasor Road service station well, the only well known to exist in the subbasin.

The groundwater balance for construction and operation is positive under all water year conditions.

7 COMPARISON OF PROJECTED WATER SUPPLY AND DEMAND

The Project would use approximately 786 acre feet of water during construction and the estimated life of the project (33-year period). This volume of water is less than 1 percent of the estimated storage (125,000 AF) of the Soda Mountain subbasin.

The Soda Mountains subbasin is not currently in overdraft. Project construction needs (192 AFY) represent 30 percent of the estimated amount of subbasin recharge during a normal water year (641 AFY) and will be short-term (approximately 3 years) in duration. The subbasin would not result in overdraft during either a single dry-year or multiple dry-year scenario. Water use would significantly decrease during Project operation. Project operation needs of 7 AFY represent about 1 percent of the normal-year subbasin recharge and will be long-term in duration (up to 30 years or more). Overdraft conditions, if they were to occur, would be temporary, and the aquifer would recover from the potential negative water balance year(s) after construction is completed.

Water supply needs for both construction and operation can be met with the groundwater resources of the Soda Mountains subbasin. There is sufficient water available for the proposed Project under normal-year, single dry-year, and multiple dry-year conditions. The Project would not result in adverse impacts associated with groundwater supply or water supply reliability. Any potential negative water balance would be limited to extreme drought conditions with less than 10 percent chance of occurrence. The aquifer would subsequently rebound during normal water years and throughout operation of the project.

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APPENDIX H-2
Hydrogeologic Conditions and Groundwater Modeling Report

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Hydrogeologic Conditions and Groundwater Modeling Report

SODA MOUNTAIN SOLAR PROJECT

BLM Case Number - CACA49584

Proposed Caithness Soda Mountain Solar Facility Near Baker, San Bernardino County, California

March 1, 2011

Prepared for:

United States Department of the Interior
Bureau of Land Management
California Desert District Office
22835 Calle San Juan De Los Lagos
Moreno Valley, CA 92553

Submitted by:

Caithness Soda Mountain, LLC
565 Fifth Avenue, 29th Floor
New York, NY 10017

Prepared by:

RMT, Inc.
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San Mateo, CA 94402

RMT

Hydrogeologic Conditions and Groundwater Modeling Report

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1: Project Description and Groundwater Modeling Objectives

1.1 Project Description

The Caithness Soda Mountain Solar Project (Project) will include the installation, operation, and maintenance of approximately 1.5 million polycrystalline silicon solar photovoltaic (PV) panels for a 350-megawatt electric generating facility (Caithness, 2009). The Project Area is located in a small valley on federal lands managed by the U.S. Department of the Interior, Bureau of Land Management (BLM), approximately 6 miles southwest of the town of Baker in San Bernardino County, California (Figure 1.1-1).

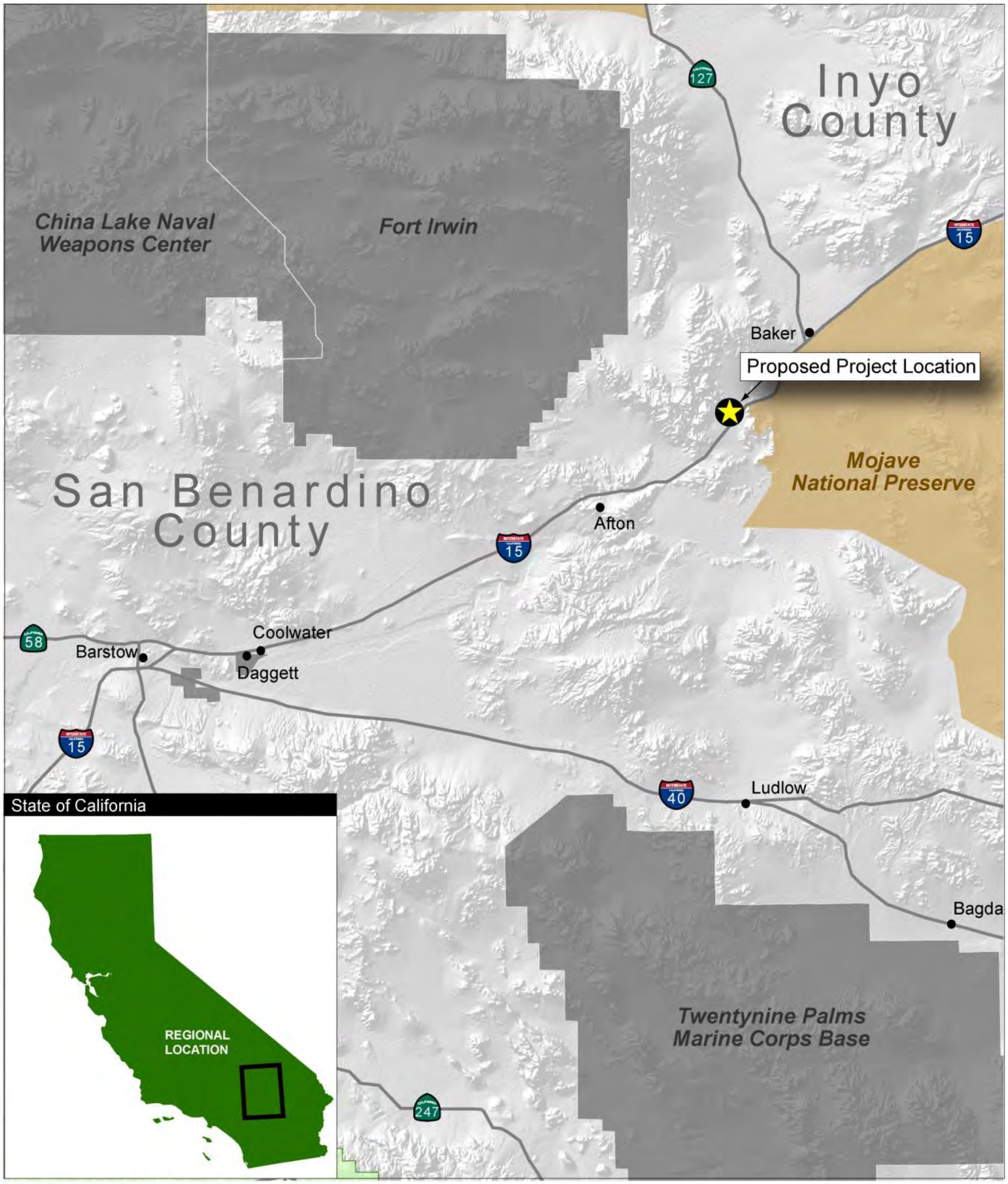
Caithness Soda Mountain LLC submitted an application for a right-of-way grant to the BLM to construct and operate the proposed solar project. The project is defined in a Plan of Development (POD), submitted to BLM on December 1, 2009 (Caithness, 2009). A revised POD will be submitted in March 2011.

The currently defined Project Area right-of-way consists of approximately 4,397 acres of land. Approximately 2,691 acres would be occupied by the solar arrays, with a portion of the remainder of the area used for access roads, storm water drainage, project-related buildings, and other project uses.

The goal of this report is to assist the BLM in its evaluation of the Plan of Development for the Project, and to provide the Project Applicant with an evaluation of the feasibility of obtaining the needed water supplies for the Project. Groundwater modeling was used to help evaluate whether the hydrogeologic conditions at the Project site could sustain the withdrawal of water needed during construction, operation, and maintenance of the proposed facility, without causing impacts to adjacent water users.

Numerical groundwater modeling is an effective tool to evaluate the effects of groundwater withdrawal, because the model can be constructed to represent the three-dimensional geometry of the aquifer, with realistic estimates of key aquifer parameters. The equations of groundwater flow are then applied using site-specific hydraulic parameters, aquifer geometry, and boundary conditions, and the resulting hydraulic head distribution can be compared to measured hydraulic heads. The calibration process involves adjusting aquifer parameters and boundary conditions within reasonable limits until there is a match between measured heads and model-predicted heads. Once the model is calibrated to existing conditions, it can then be used in a predictive mode to test for future effects of a stress, such as groundwater withdrawal. When hydrogeologic data are scarce, the model can be used to test specific questions using the upper and lower ends of a reasonable range of aquifer parameter values. Specific groundwater modeling objectives are described in Section 1.2.

Figure 1.1-1: Regional Location Map



SOURCE: ESRI 2006 and RMT, Inc. 2009

1.2 Modeling Objectives

The objectives of the groundwater flow modeling were as follows:

- To evaluate whether subsurface conditions would likely allow for one or more groundwater wells to successfully be installed that would yield sufficient quantities of water for Project construction and operation activities
- To evaluate whether groundwater withdrawals needed to support Project construction and operation activities would interfere with water use and springs located elsewhere in the region, such as the Town of Baker, Zzyzx Spring, and the Rasor Road Service Station
- To estimate the number of groundwater wells that may be required to obtain the desired water supplies
- To identify area(s) within the Project Area where conditions may be favorable for installing one or more water supply wells

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2: Hydrogeologic Setting

2.1 Topography and Surface Water Drainage

The valley in which the Project Area is located is surrounded by low mountains, with broad and deep alluvial fans overlying the bedrock (Figure 2.1-1). The valley is part of the South Lahontan Hydrologic Study Area and is part of the Soda Lake Watershed, but is not part of any formal groundwater basin (Department of Water Resources, 2003). The Soda Lake Valley and Silver Lake Valley Basins are located east and northeast of the Project Area, respectively, and the Cronise Lake Valley Basin is west of the Project Area, across a surface water divide (Figure 2.1-2). The valley includes two drainage basins (Basin A and Basin B shown on Figure 2.1-2, and encompasses a combined area of approximately 32,946 acres. Figures 2.1-3 and 2.1-4 are Google Earth images of the valley looking north and southwest, respectively, showing steeply sloping alluvial sediments in the upper reaches of the alluvial fans gradually leveling off as they approach the floor of the valley.

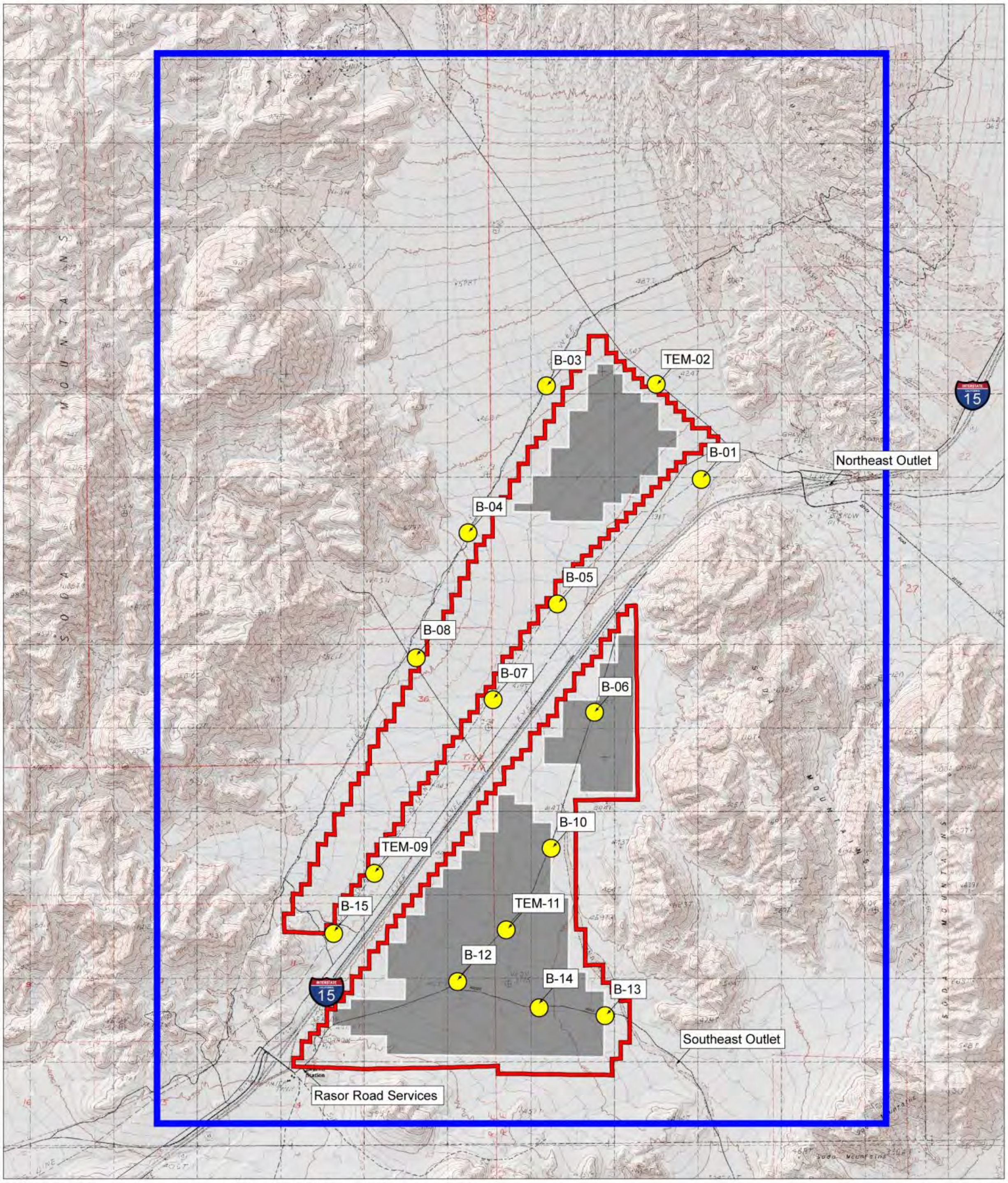
There are two ephemeral surface water outlets to the valley, located northeast and southeast of the Project Area (Figure 2.1-1). During storm events, precipitation runoff from Basin A in the northern portion of the drainage basin is funneled into the northeast outlet, and runoff from Basin B in the southern portion of the basin flows through the southeast outlet.

2.2 Hydrogeologic Conditions Based on TEM Data

There are limited data in the Project Area from which to evaluate deep subsurface geologic conditions (i.e., below approximately 100 feet below ground surface [bgs]). Three locations within the Project Area were investigated using Transient Electromagnetic Resistivity (TEM) soundings in September 2010. The results of the TEM investigation were discussed in the Geologic Characterization Report (Wilson Geosciences, 2011) and the Geophysical Characterization Report (Terra Physics, 2010) prepared for the Project. The three TEM locations are presented on Figure 2 in the Geophysical Characterization Report (Terra Physics, 2010): TEM-02, located at the northwest boundary of the project area, and TEM-09 and TEM-11, located in the southwest and southeast portions of the project area, respectively. The locations are shown in this report on Figure 2.1-1

The geophysical data for TEM-02 were interpreted to indicate that coarse-grained alluvium is present from ground surface to approximately 67 feet bgs, under which fine-grained alluvium is present (Table 2.1-1). The water table was interpreted to be present at 182 feet bgs, with saturated alluvium below that depth. Bedrock was interpreted to occur at a depth of approximately 332 feet bgs. At TEM-09, the boundary between shallower coarse-grained alluvium and deeper fine- to coarse-grained alluvium was interpreted to be at a depth of approximately 143 feet bgs, with the water table estimated to be at a depth of approximately 354 feet bgs. Bedrock at TEM-09 was estimated to be at least 500 feet bgs. Similarly, the bedrock was interpreted to be deep (436 feet bgs) at TEM-11, with the upper 436 feet composed of dry, coarse- and fine-grained alluvium. The water table was undetected at TEM-11, and was estimated to be at least 386 feet bgs.

Figure 2.1-1: Project Area and Model Domain



SOURCE: Wilson Geosciences 2010, ESRI 2011, and RMT Inc. 2011

Scale = 1:74,000

LEGEND

USGS Quads: West of Soda Lake, Soda Lake North, Soda Lake South, and Crucero Hill

Project Boundary

Model Domain

Array Areas

Borehole

Miles: 0, 0.5, 1, 2, 3, 4

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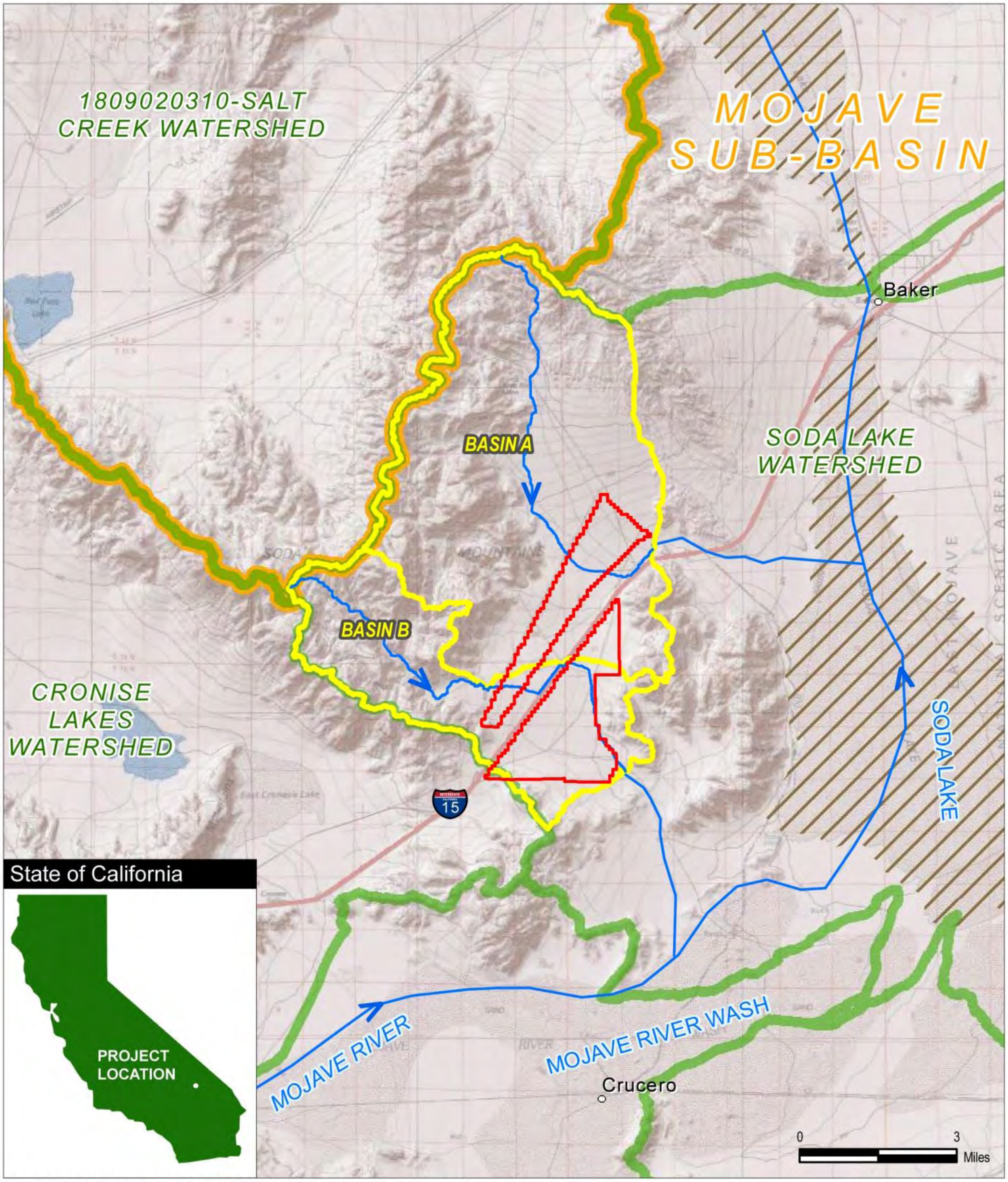
Figure 2.1-2: Drainage Basins of Project Area



SOURCE: RMT Inc. 2011, FEMA 2011, USGS 2008/2011, ESRI 2011

Map Scale = 1:190,080

LEGEND

- Project Boundary
- Flood Hazard Area
- Interstate Highway
- Selected Flow Lines
- Major Road
- Project Valley Watershed Boundary
- Watershed Boundary
- Sub-basin Boundary

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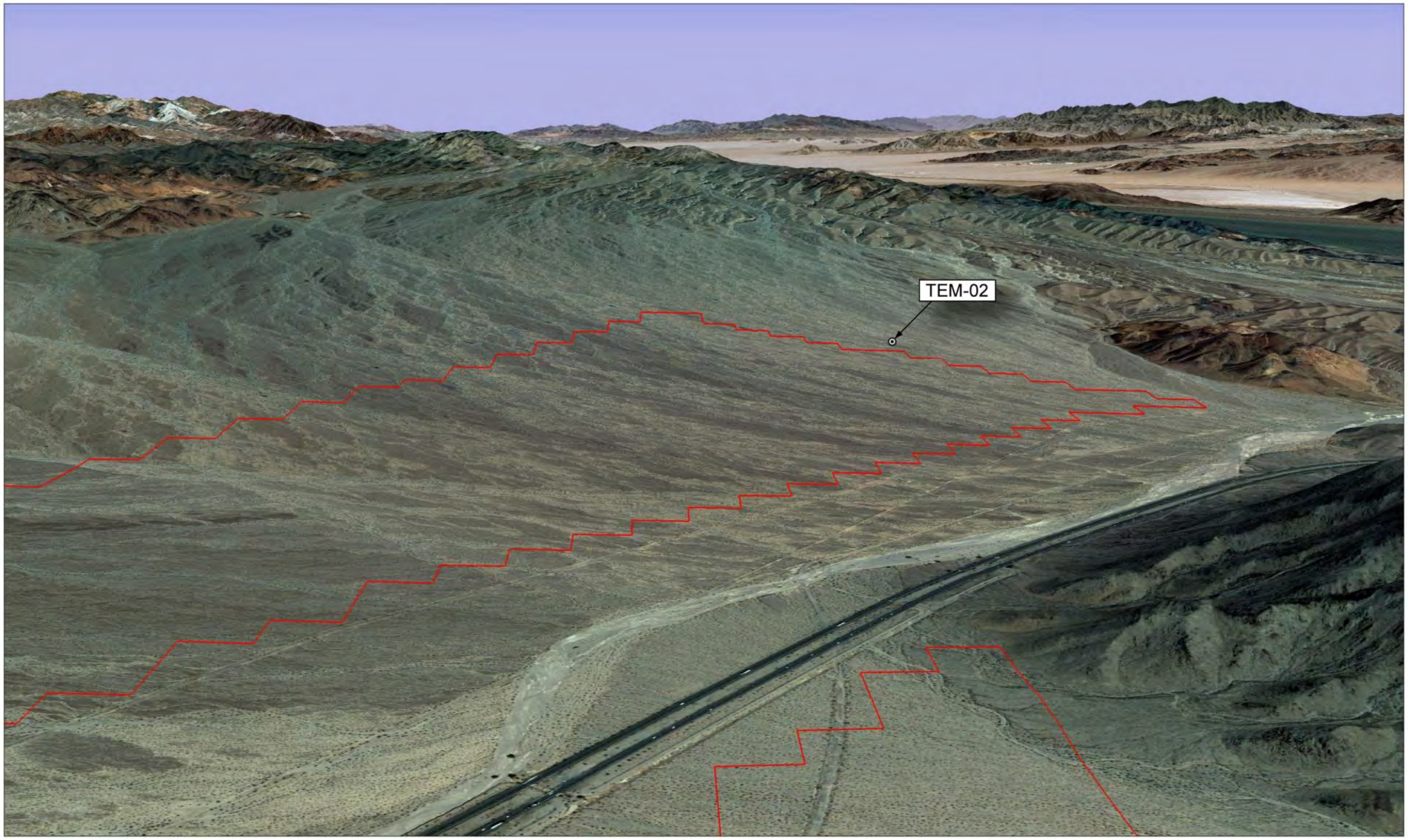
Figure 2.1-3: Project Area Valley, Aerial View North



SOURCE: RMT Inc. 2011, Google Earth Pro 2010, Digital Globe 2011

Project Boundary

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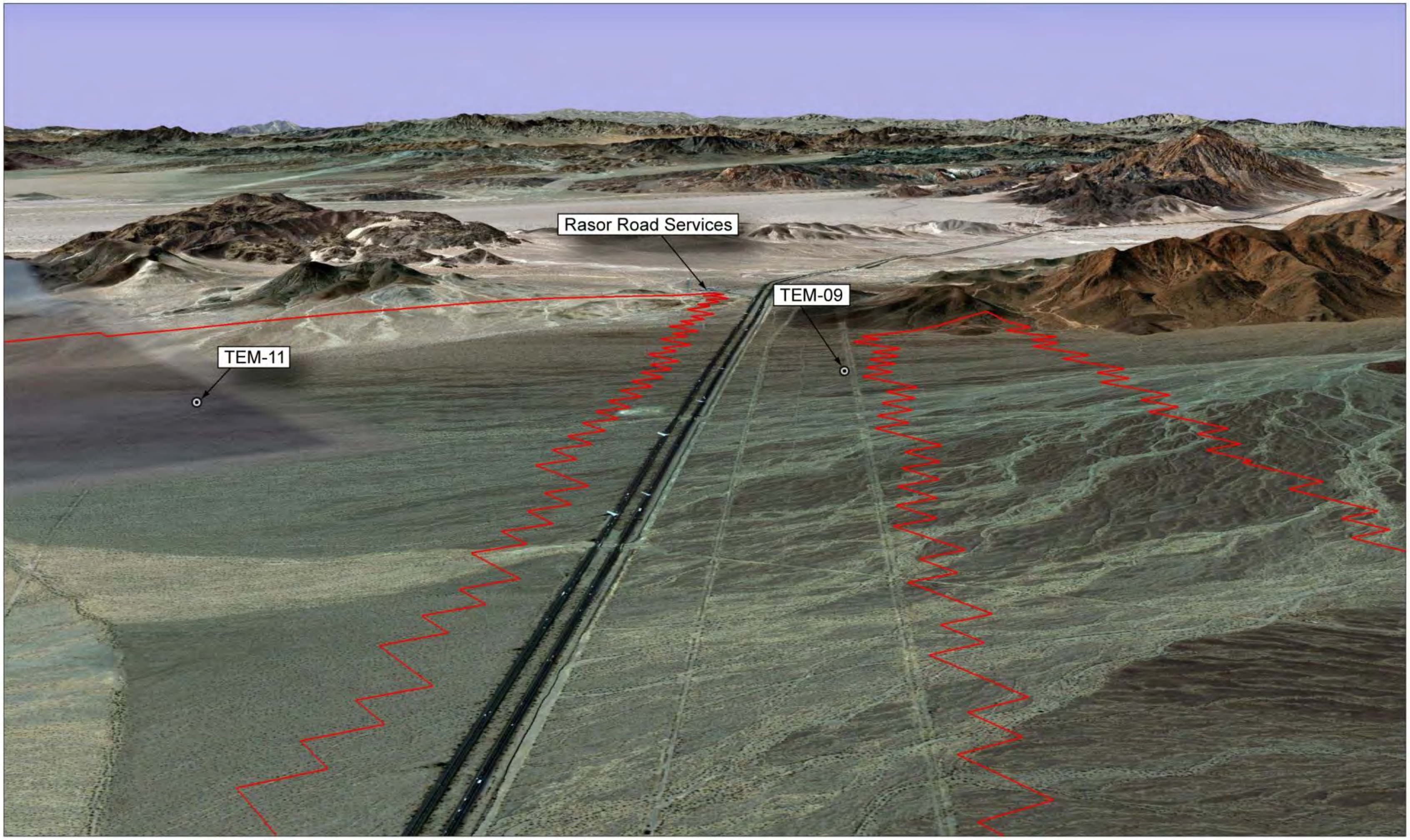
Figure 2.1-4: Project Area Valley, Aerial View Southwest



SOURCE: RMT Inc. 2011, Google Earth Pro 2010, Digital Globe 2011

Project Boundary

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Table 2.1-1: Hydrogeologic Conditions from TEM Survey Results

Sounding	Depth Range (feet)	Elevation Range (feet)	Electrical Resistivity (ohm-meters)	Stratigraphy Inferred from TEM Results
TEM-02	0±00 to 67±14	1414±00 to 1347±14	330±40	DRY,COARSE-GRAINED ALLUVIUM
	67±14 to 182±13	1347±14 to 1232±13	37±10	DRY TO VERY MOIST, FINE-GRAINED ALLUVIUM
	182±13 to 332±26	1232±13 to 1082±26	4±0.8	SATURATED ALLUVIUM
	BELOW 332±26	BELOW 1082±26	530±100	BEDROCK
TEM-09	0±00 to 143±36	1524±00 to 1381±36	360±50	DRY, COARSE-GRAINED ALLUVIUM
	143±36 to 354±30	1381±36 to 1170±30	98±20	DRY, COARSE- & FINE-GRAINED ALLUVIUM
	BELOW 354±30	BELOW 1170±30	15±03	SATURATED ALLUVIUM
	---	---	---	ESTIMATED BEDROCK IS AT LEAST 500 FEET DEEP
TEM-11	0±00 to 436±49	1358±00 to 922±49	80±12	DRY, COARSE- AND FINE-GRAINED ALLUVIUM
	BELOW 436±49	BELOW 922±49	610±92	BEDROCK
				GROUNDWATER WAS NOT DETECTED. IF IT IS PRESENT THEN THE ESTIMATED MAXIMUM UNDETECTABLE THICKNESS IS ABOUT 50 FEET. THEREFORE, GROUNDWATER WOULD BE BELOW AN ELEVATION OF 972 FEET.

SOURCE: Terra Physics, 2010

2.3 Hydrogeologic Conditions Based on Well and Boring Data

A 760-foot-deep bedrock well is located on the Rasor Road Services property, which lies at the southern boundary to the valley, as shown on Figures 2.1-1 and 2.1-4. The well bore encountered bedrock at or near the surface, and reportedly is capable of delivering approximately 1,500 gallons per day (personal communication, Terry Young, owner, September 15, 2009). The Rasor Road Services well is the only known well in the vicinity of the Project Area. Because it is screened in bedrock and no saturated alluvium was encountered in the well bore, the well is interpreted to be hydrogeologically separated from the saturated alluvium in the valley. The well yields only small amounts of water derived from fractures in the bedrock, which also provides evidence of hydraulic separation between the Rasor Road bedrock well and the valley alluvial sediments. No wells are known to exist in the interior of the valley.

During August through November 2010, TEM geophysical surveys were conducted and 15 soil borings were drilled to a maximum depth of 100 feet bgs in the Project Area (Terra Physics, 2010). The geologic data collected from this investigation were evaluated in the construction of hydrogeologic cross sections (see Section 2.4 below). However, data from the soil borings were of limited usefulness because of the shallow depths explored and because groundwater was not encountered at any of the boring locations. As a result, the hydrogeologic interpretations presented on the cross sections relied heavily on the data collected from the three TEM locations, and on the interpreted configuration of the bedrock extrapolated into the subsurface from the mountain outcrops in the Project vicinity.

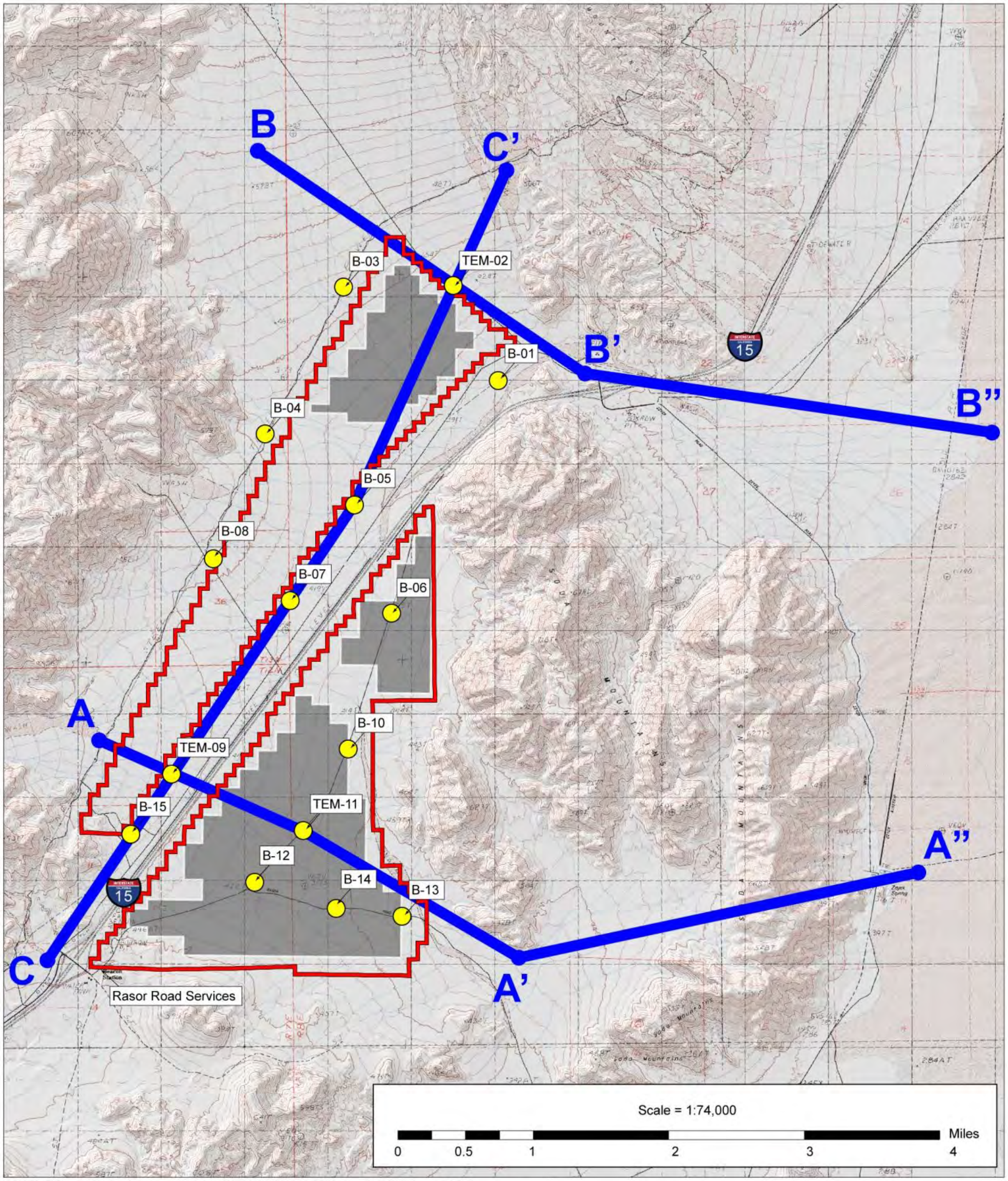
2.4 Hydrogeologic Cross Sections

A cross section location map is presented on Figure 2.4-1. Cross sections A-A′, B-B′, and C-C′ are presented on Figures 2.4-2, 2.4-3, and 2.4-4.

Cross section A-A′ extends west to east and incorporates data from TEM-09 and TEM-11 located near the southern end of the valley (Figure 2.4-2). The cross section extends eastward across the mountain range to Zzyzx Spring, located on the eastern slope of the eastern Soda Mountains, above Soda Lake. Bedrock occurs at depths of 500 feet or more bgs at TEM-09 and 436 feet bgs at TEM-11, and then outcrops on the slopes of the eastern mountain range. The water table occurs at an elevation of approximately 1,170 feet amsl at TEM-09, and appears to be below an elevation of approximately 922 feet amsl at TEM-11. The apparently much lower water table at TEM-11 suggests that there is an outlet for groundwater southeast of TEM-11 that allows the water table to drain to this lower elevation. A surface water outlet is present in the southeast portion of the valley (Figures 2.1-1 and 2.1-4), and it is reasonable that a buried bedrock valley may have been carved into the bedrock in the geologic past by floodwaters, then filled with alluvial sediments, allowing groundwater outflow from the valley. This conceptual model satisfies the need for a groundwater outlet to occur in the southeast portion of the valley, where the water table is apparently much lower than elsewhere, as seen at TEM-11.

Cross section B-B′ extends west to east along the northern boundary of the Project Area, and shows a similar topographic slope to the east as was shown on cross section A-A′, paralleling the surface water outlet to the east (Figure 2.4-3). Drainage from large alluvial fans converges into the surface water outlet that flows through a relatively narrow valley between low mountains to the north and south (Figure 2.4-1). The funneling of the surface water outflow suggests that, as for cross section A-A′, there may be a buried bedrock valley at this location that was carved by floodwaters in the geologic past, and subsequently filled with alluvium. The funneling of surface

Figure 2.4-1: Cross Section Locater Map



SOURCE: Wilson Geosciences 2010, ESRI 2011, and RMT Inc. 2011

LEGEND

N W E S

Project Boundary

Array Areas

A A'

Cross Section Line

Borehole

USGS Quads: West of Soda Lake, Soda Lake North, Soda Lake South, and Crucero Hill

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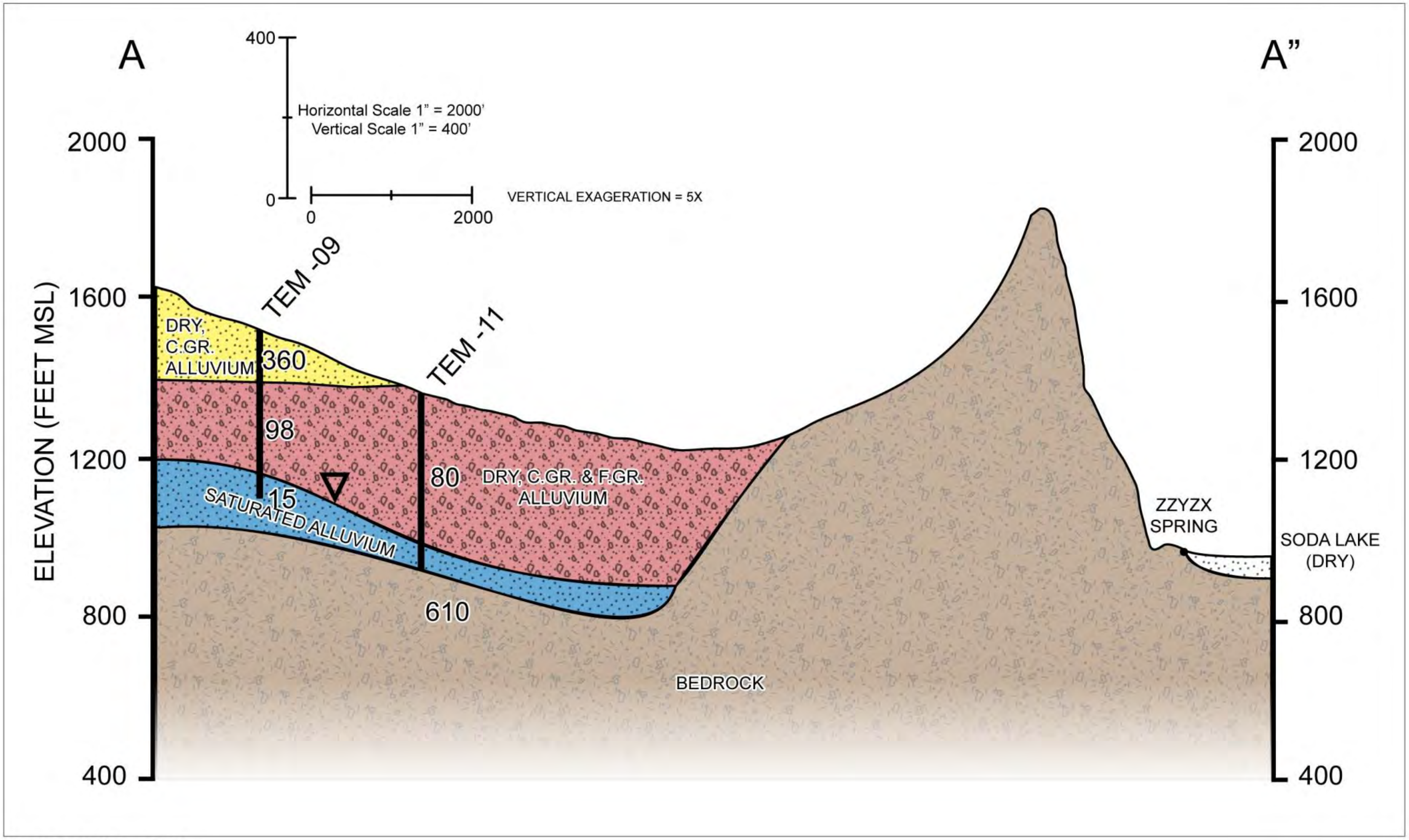
Figure 2.4-2: Hydrogeologic Cross Section A-A'



SOURCE: RMT Inc. 2011

LEGEND

Stratigraphic Boundary (Dashed Where Inferred)

80 Resistivity (ohm-meters), TEM Survey

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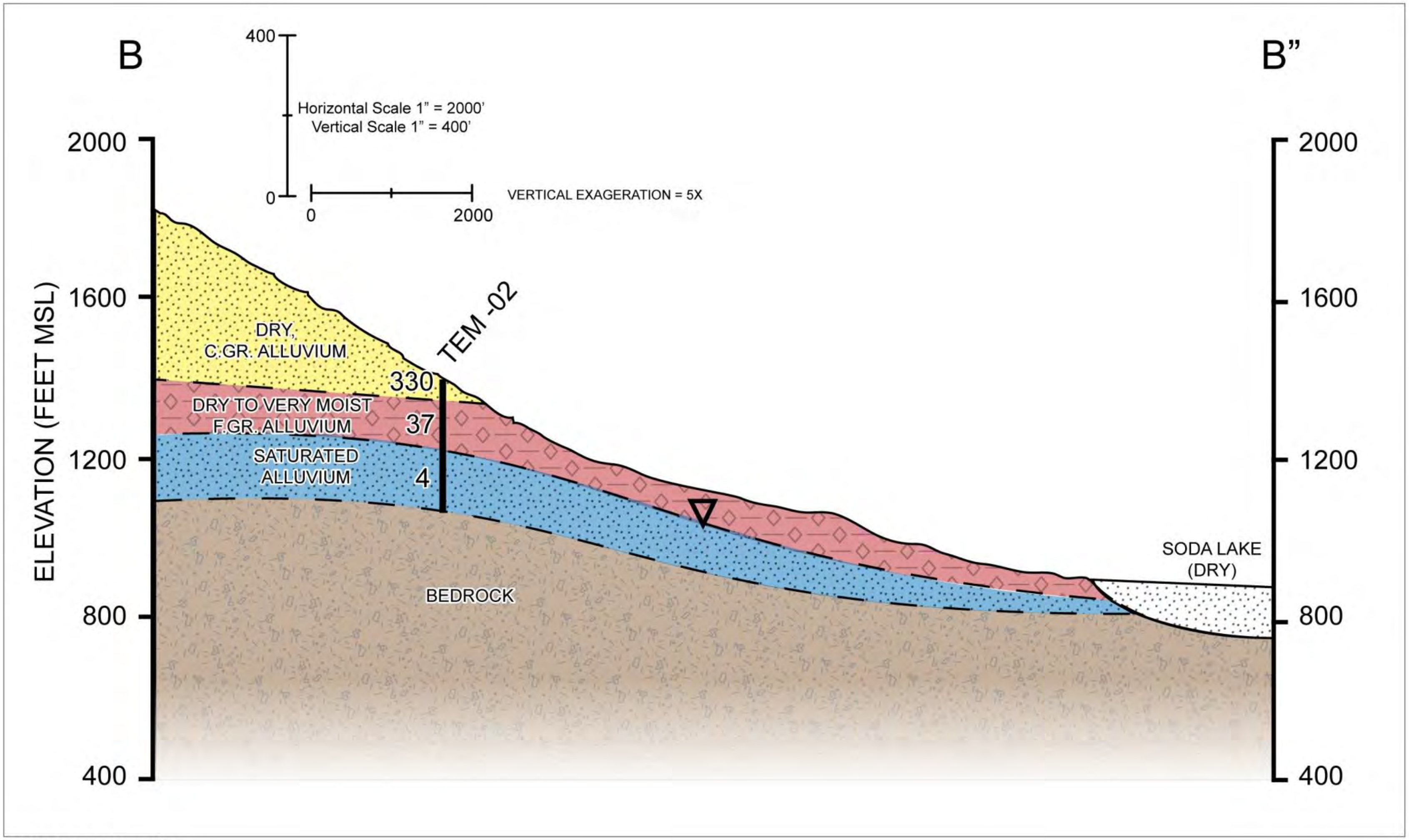
Figure 2.4-3: Hydrogeologic Cross Section B-B'



SOURCE: RMT Inc. 2011

LEGEND

Stratigraphic Boundary (Dashed Where Inferred)

80 Resistivity (ohm-meters), TEM Survey

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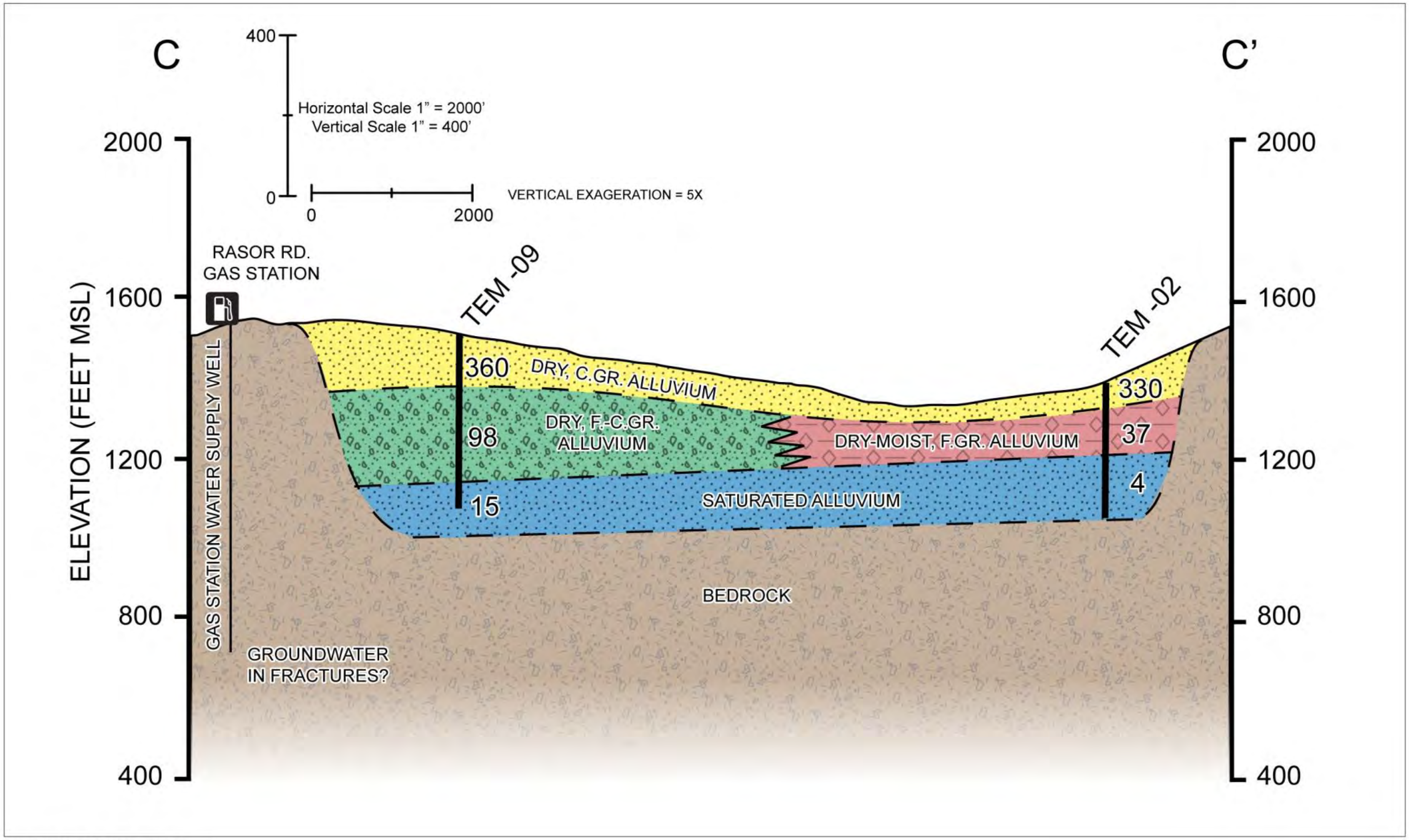
Figure 2.4-4: Hydrogeologic Cross Section C-C'



SOURCE: RMT Inc. 2011

LEGEND

Stratigraphic Boundary (Dashed Where Inferred)

80 Resistivity (ohm-meters), TEM Survey

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water through this narrow gap suggests that there may be coarser sediments within the valley fill at this location.

The water table is interpreted to be at a depth of approximately 182 feet bgs at TEM-02 (elevation of 1,232 feet amsl), the shallowest groundwater occurrence of any of the three TEM locations. The groundwater elevation at TEM-02 is approximately 300 feet higher than the water table in the Soda Lake plain located east of the valley (Figure 2.1-2), based on available U.S. Geological Survey (USGS) data. The conceptual model illustrated on cross section B-B′ is that the water table slopes steadily eastward from the upper reaches of the alluvial fans to the base of the valley. Groundwater is channeled through the relatively narrow buried valley outlet located near the northeast corner of the Project Area, flowing eastward toward the Soda Lake lowlands.

Cross section C-C′ extends northeast to southwest down the longitudinal axis of the valley (Figure 2.4-4). A surface water divide located approximately 1.5 miles north of TEM-11 separates water flowing to the northeast outlet from that flowing to the southeast outlet (Figure 2.1-2). It is likely that groundwater flow approximately mimics the surface water flow, flowing northward in the northern half of the valley, and southward in the southern half.

TEM data indicate that the resistivity of the saturated subsurface differs between the northern and southern portions of the valley, consistent with the interpretation of different groundwater flow directions in the two portions of the valley. Groundwater at TEM-02 has very low resistivity (i.e., 4 ohm-meters), indicating a high concentration of total dissolved solids (TDS). Groundwater in the southern portion of the valley exhibits higher resistivity values at TEM-09 (i.e., 15 ohm-meters), indicating relatively high TDS concentrations but lower than at TEM-02.

3: Model Setup

3.1 Model Code

The USGS modular three-dimensional finite-difference groundwater flow model (MODFLOW) (MacDonald and Harbaugh, 1988) was used to simulate hydrogeologic conditions in the Project valley. MODFLOW has been thoroughly tested and widely used for groundwater simulations, and has become a standard upon which other models are compared. It has the capability to accurately simulate a wide variety of aquifer conditions for porous media such as the saturated alluvial aquifer that occurs in the Project valley.

3.2 Model Layers

A single layer model was used to simulate the valley aquifer. The results of the TEM survey suggest that the entire thickness of unconsolidated sediment below the water table can be considered a single hydrologic unit, justifying the use of a single model layer. No low-permeability layers such as clays or caliche units were found below the water table, based on limited TEM results.

3.3 Model Domain and Boundary Conditions

The model domain shown on Figure 2.1-1 encompasses the limits of saturated alluvium in the valley that surrounds the Project Area. Reasonable projections of the slope of the water table and the bedrock were used to estimate the lateral and vertical limits of saturated alluvium. The limits of the aquifer were initially set as the limits of the alluvium where it intersects the bedrock on the hillsides. Initial model runs resulted in a number of boundary nodes as "dry" (unsaturated), which was reasonable considering the depth to the water table at known locations was greater than 182 feet bgs. The outer ring of model nodes at the upper reaches of alluvial fans tended to become dry; subsequently, these nodes were set to inactive, thereby making them outside the model domain.

The northeast and southeast outlets were extended 4,000 to 8,000 feet farther east than adjacent nodes that bounded the valley walls. This allowed for the model boundaries at the important outlet locations to be distant from potential water supply well locations, and to not overly constrain model results.

The water table constituted the upper boundary of the model. The lower boundary was set to be the bedrock surface, a conservative measure because it caused the model to ignore any groundwater that might be derived from the bedrock. The bedrock consists primarily of igneous intrusive and extrusive rocks, with little to no available water expected in the matrix. Fractures are likely in the rocks and may provide minor additional water supply.

The sides of the model domain were generally set to be no-flow boundaries, which is a conservative assumption that ignores any contribution from fractured bedrock. At two locations, the northeast and southeast surface water outlets, general head boundaries (GHB) were set. A limited number of nodes in the narrow outlet areas were set as GHB nodes, which allowed the model to converge on a solution. Models require a small number of constant-head boundaries or general-head boundaries to be defined in order to converge on a solution. GHBs have an advantage over a constant-head boundary because there is a limit to the flow that can move through the node, depending on the hydraulic conductivity assigned to the node, thereby keeping the flow volumes realistic. It is also important to avoid having GHBs too close to a pumping well, which could falsely constrain drawdown associated with pumping. Care was taken during the simulations to test that the proximity of the model boundary did not constrain the calculated drawdown.

The model domain was configured with a nodal array of 142 rows and 113 columns (Figure 3.3-1). Node dimensions were generally 500 feet by 500 feet. In the vicinity of the simulated water supply well, the node size was refined to as low as 1 foot for the well node to provide for a more accurate calculation of expected drawdown under pumping conditions. Small node size more realistically simulated the actual conditions inside a well that may be only 6 to 8 inches in diameter.

3.4 Model Parameters

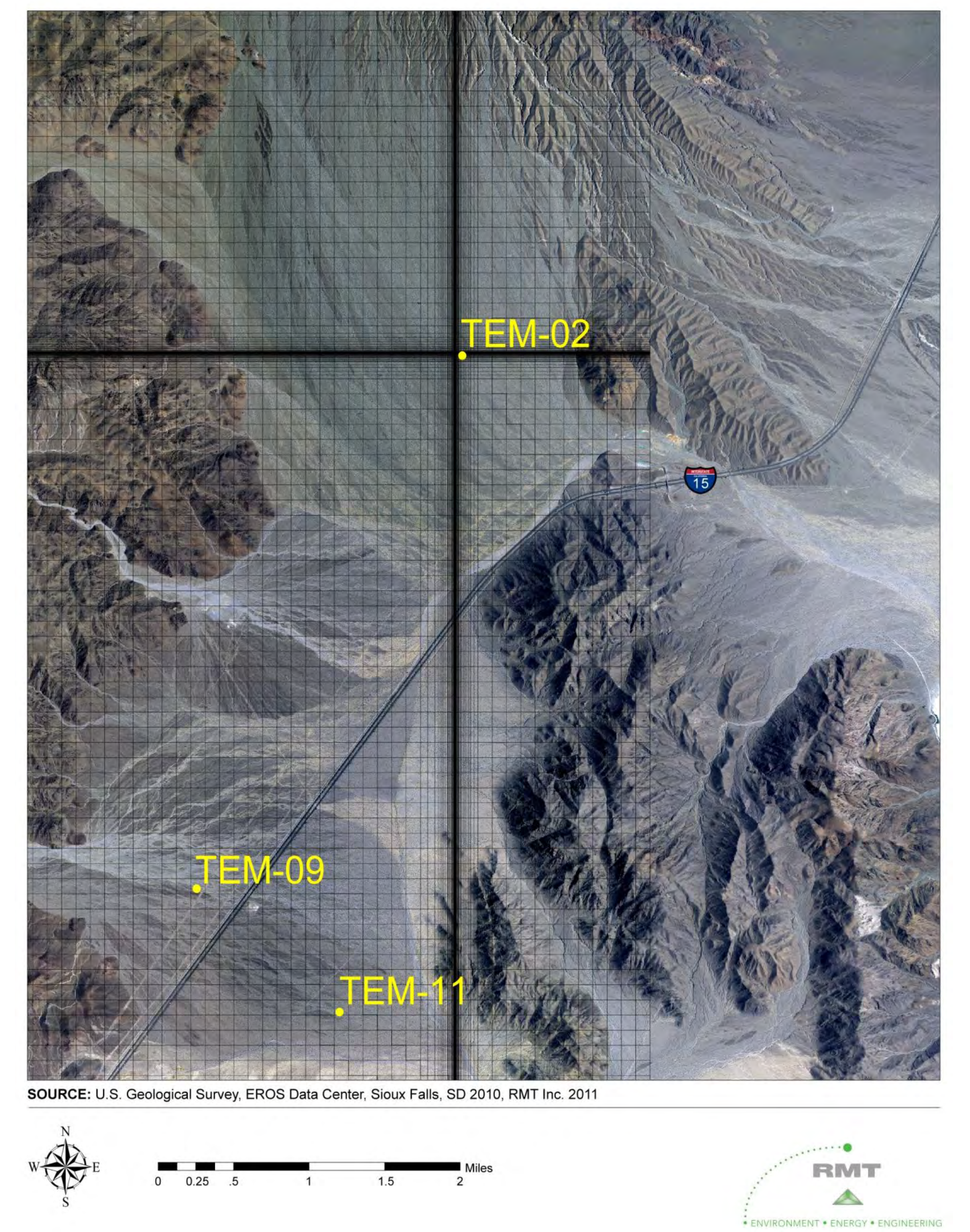
3.4.1 RECHARGE

Aquifer recharge (R) is a difficult parameter to determine directly, and is generally estimated based on area precipitation and evaporation data, or data from well-reviewed groundwater flow model simulations from similar areas. The Desert Studies Center website reports a mean precipitation value of 3.5 inches/year since 1980 for the Center, located about 4 miles east of the Project Area (http://biology.fullerton.edu/dsc/school/climate.html; accessed November 10, 2010). Danskin (1998) reported that he and others used a value of approximately 0.5 to 1.0 inch/year for R for Owens Valley, located east of the Sierra Nevada (Danskin, 1998; Danskin, 1988; Hutchinson, 1988). Lee (1912) suggested that approximately 16 percent of direct precipitation in Owens Valley infiltrated as groundwater recharge. Within the Project Area, this would equate to 0.56 inch/year. However, Danskin (1998) argued that the actual recharge may be lower than 16 percent of precipitation in arid regions.

For the Project Area, a range of R values was used (Table 3.4-1). At the high end, an R value of 0.5 inches/year was assigned. The low end estimate of R used in simulations was 0.125 inches/year. These values are believed to bracket the reasonable estimates of groundwater recharge from direct precipitation for the valley.

Nodes on the boundary of the model were assigned higher R values to accommodate for mountain-front runoff that infiltrated the alluvial fan at the boundaries. The precipitation falling over the drainage area in the mountains was assumed to result in about 0.5 inch/year of R. This rate was totaled for the drainage area in the mountains, and added into the boundary nodes as mountain-front recharge. Similarly, for the low-end model, an estimated 0.125 inch/year of R was assumed for all of the mountain area, and this total amount was allocated to the boundary nodes. As a result, the boundary nodes were assigned R values that were 26 times as high on average as the interior nodes, to account for all the runoff from the bedrock outcrop that would be transported to the boundary nodes. This approach is consistent with the work of others in

Figure 3.3-1: Model Grid



SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 2010, RMT Inc. 2011

Table 3.4-1: Selected Model Parameters			
Aquifer Parameters			
Parameter Set Name	*Hydraulic Conductivity (K) (feet/day)*	*Groundwater Recharge (R) (inches/year*	*Storage Coefficient (unitless)*
High End	4	0.5	0.1
Low End	1	0.125	0.1
Note: Values given are for main body of model domain. Nodes at the model boundaries have higher R values. Nodes near the northeast and southeast outlets have higher K values.			

southeastern California, such as Danskin (1998), who noted that mountain-front recharge was significantly higher than areal recharge in Owens Valley.

No additional recharge from infiltration from ephemeral streams was assumed. This approach may underestimate the actual amount of recharge in the valley, and thus would be a conservative assumption. Using this approach, the high end estimate of recharge from direct precipitation and mountain front runoff is 1,373 ac-ft/yr. The low-end estimate of recharge is 343 ac-ft/yr. In comparison, the expected highest water use, which would occur during construction, would be 61.6 ac-ft/yr (55,000 gpd), which equals 4.5 percent of the high-end recharge estimate, and 18 percent of the low-end recharge estimate.

3.4.2 HYDRAULIC CONDUCTIVITY

Hydraulic conductivity (K) values were estimated based on:

- Mean K value of 10 feet/day for shallow in-field permeability tests at 20 locations in the Project Area (Diaz-Yourman and Associates, 2010)
- TEM data from three sites to depths of up to 500 feet bgs (Terra Physics, 2010)
- Observations of grain size from 15 on-site borings, including one deeper boring to 100 feet bgs (Diaz-Yourman and Associates, 2010)

The in-field K values and field observations indicate that shallow soils can be characterized with a relatively high K value, with a mean K value of 10 feet/day (Diaz-Yourman and Associates, 2010). Values for soils at depth are less certain because of the lack of K tests and direct observations of soil samples. TEM data suggest that there may be somewhat finer-grained sediments at TEM-02, and alternating coarse-grained and fine-grained sediments at TEM-09 and TEM-11.

Calibration of a numerical model is highly dependent on values of K and R. Several combinations of K and R can result in a suitable “match” to the existing measured heads. To account for the uncertainty in K and R values, high-end and low-end values were used in calibrating the model to measured heads. The high-end and low-end values were chosen based their ability to reach calibration within a reasonable range of values for K and R.

Calibration of the model indicated that a high-end K value of 4 feet/day resulted in a reasonably good fit to known head values. This K value was less than the 10 feet/day recorded as a mean K value for shallow sediments, but was still a relatively high value, consistent with the presence of coarse sediments noted at the TEM locations. Attempts to increase the K value higher than 4 feet/day resulted in predicted head values that were too low for the valley, even when coupled with the upper-end recharge values (0.5 inch/year). The 4 feet/day value for K was selected as a high-end K value for the model.

For the second parameter set, a low-end K value of 1 foot/day was assigned. This K value allowed the model to reach calibration to the measured head values when coupled with the low-end R estimate of 0.125 inch/year. Attempts to reach calibration using lower values of K were not successful when coupled with the low-end R estimate.

For both the low-end and high-end models, zones of relatively higher K values were input into the model near the northeast and southeast outlets. Coarser sediments would be expected near the outlets, where funneling of surface water likely winnows out finer-grained sediments. The model was not able to achieve a good match to the measured heads without the presence of the higher K zones near the outlets. Values of K that were 2.5 to 5 times higher than the rest of the model domain were input for the areas near the outlets.

Vertical hydraulic conductivity (Kv) values were set to be 10 percent of the horizontal hydraulic conductivity (K) values. Values of Kv are commonly in the range of 10 percent of K (Freeze and Cherry, 1979). A single-layer model is generally insensitive to Kv values because there is no interlayer (vertical) transfer of water.

3.4.3 STORAGE COEFFICIENT

A storage coefficient of 0.1 was assigned to the entire model domain. This is a reasonable value for an unconfined aquifer (Davis, 1969). There are no data to indicate that the aquifer is confined with any low-permeability unit; therefore, it was assumed to be unconfined. The 0.1 value is consistent with values used by Danskin (1998) in Owens Valley for the upper sequence of sediments.

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4: Model Results

4.1 Calibration

The steady-state hydraulic head distribution for the calibrated model is presented on Figure 4.1-1 for the high-end set of K and R. Figure 4.1-2 portrays the head distribution for the low-end set of K and R. The steady-state head distributions are virtually identical. Table 4.1-1 shows the results of the calibration, comparing model results to heads estimated from TEM results.

Predicted head values at TEM-02 were 1,232 feet amsl, matching the value estimated based on TEM results. The predicted head value for TEM-09 in the model (1,156 feet amsl) was well within the range of uncertainty for the estimated value based on TEM results (1,170±30 feet amsl). For the TEM-11 location, the model prediction was 1,089 feet amsl, almost 100 feet higher than the TEM result of less than 992±49 feet amsl. The TEM value at TEM-11 was not judged to be reliable because the water table was not detected and because the head value predicted by TEM results (below 992 feet amsl) was anomalously low, nearly as low as the head values measured in the Soda Lake area, which is located 4 miles east and 500 feet lower in ground elevation.

Mass balance errors were extremely low for the calibrated model, at 6×10^{-4} percent. All water entering the model is derived from areal recharge. Outflow is through the northeast and southeast outlets, through GHB nodes assigned to those locations. In general, the match of the model values to the two "measured" values was considered adequate for an area with such sparse hydrogeologic data.

Table 4.1-1: Predicted Hydraulic Heads Versus "Measured" Heads from TEM Results

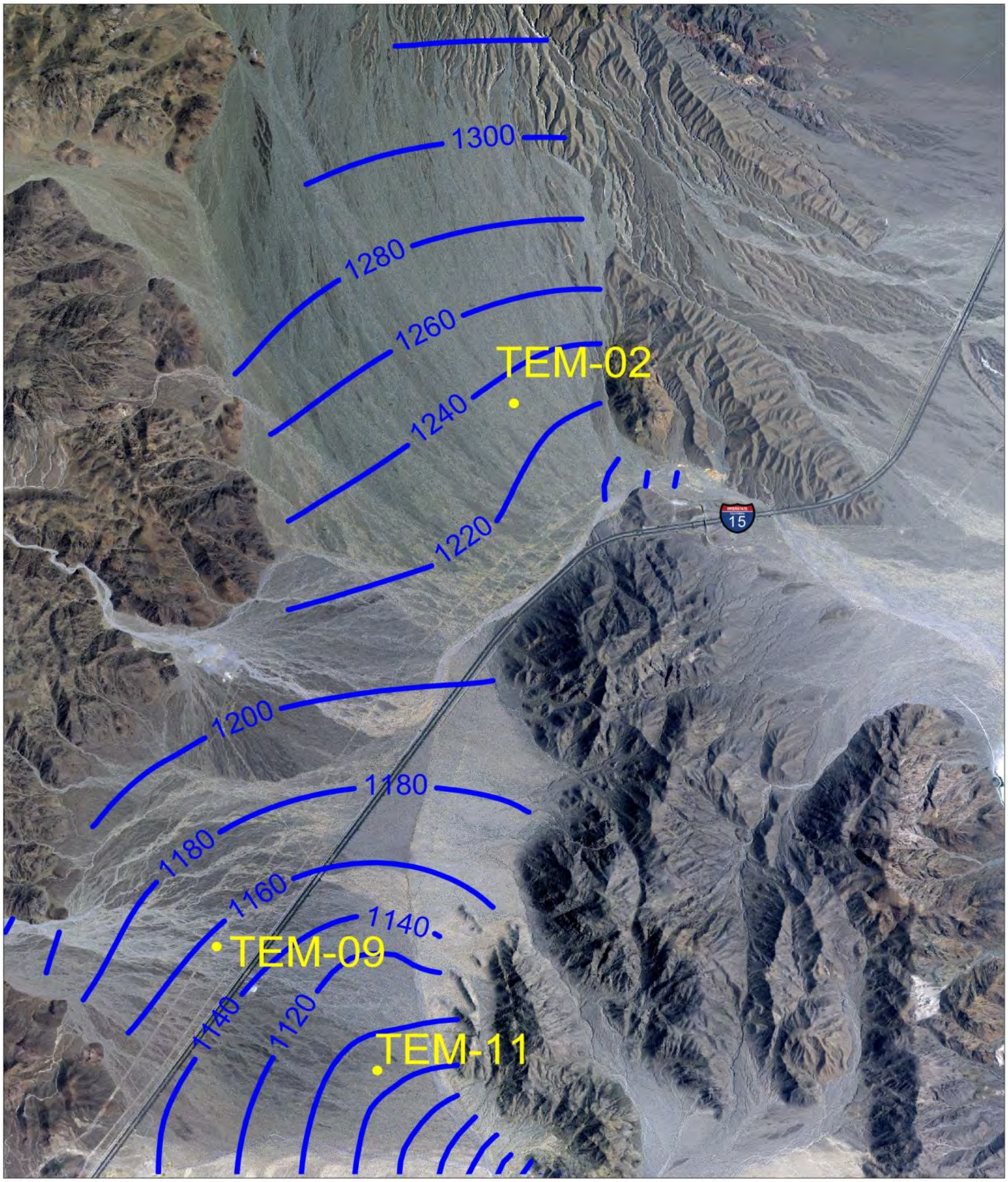
	High-End Parameter Set		Low-End Parameter Set	
Measurement Location	*Predicted Head (feet amsl)*	*Measured Head (feet amsl)*	*Predicted Head (feet amsl)*	*Measured Head (feet amsl)*
TEM-02	1,232	1,232±13	1,229	1,232±13
TEM-09	1,156	1,170±30	1,154	1,170±30

Note: Measured head values were estimated based on TEM survey results from Terra Physics (2010).

4.2 Effects of Groundwater Extraction

The effects of pumping a water supply well at the rate needed for construction and operation were evaluated by conducting transient flow simulations. Transient flow simulations take into account the change in hydraulic heads over time in a dynamic condition of pumping, where the cone of depression spreads downward and outward over time. Simulations were conducted using the calibrated high-end and low-end models. The model grid spacing was refined in the vicinity of the simulated well to as small as 1 foot, so that a more accurate estimate of drawdown in the well itself could be obtained.

Figure 4.1-1: Steady State Calibration Run, High End Parameter Set



SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 2010, RMT Inc. 2011

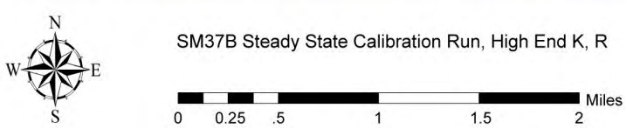


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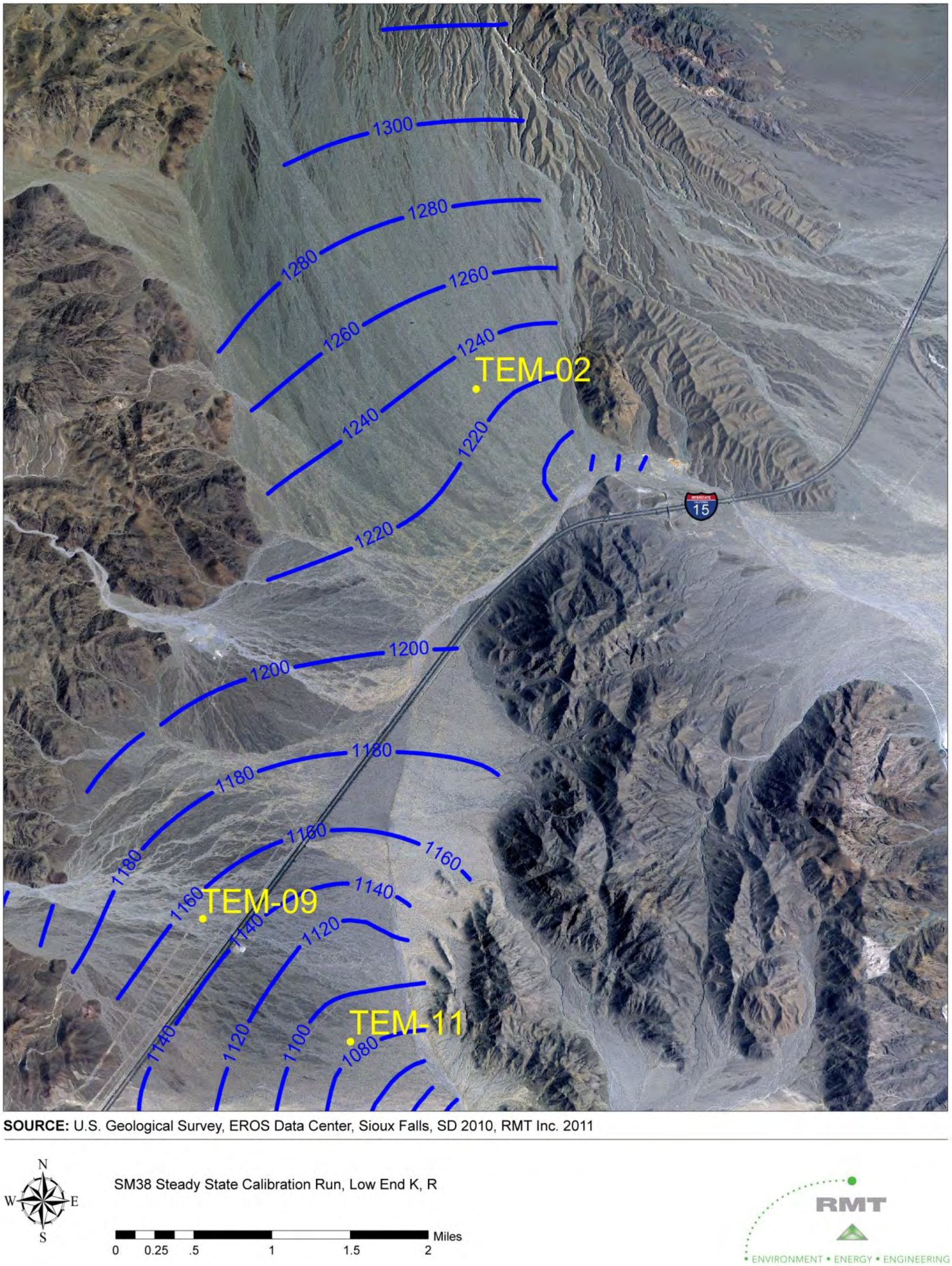
Figure 4.1-2: Steady State Calibration Run, Low End Parameter Set



SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 2010, RMT Inc. 2011

4.2.1 PUMPING RATES NEEDED FOR CONSTRUCTION AND OPERATION

Water needs for construction were estimated to be approximately 55,000 gallons/day (7,352 cubic feet per day [ft^3/day]) for a duration of two to three years (RMT, 2009). Water needs for operation and maintenance (i.e., for PV panel cleaning) were estimated to be approximately 42,000 gallons/day (5,615 ft^3/day), over a 21-day period occurring twice per year (RMT, 2009). Other water needs (domestic uses) during the operation and maintenance phase are expected to be much lower that than the water needs during construction.

4.2.2 SELECTED LOCATION OF WATER SUPPLY WELLS

Examination of hydrogeologic data from TEM locations and borings indicates that the north end of the Project Area is likely to yield sufficient quantities of groundwater for the Project. The interpreted depth to the water table at TEM-02 near the north end of the Project Area is about 182 feet bgs, with approximately 150 feet of saturated alluvium overlying bedrock. Locations at the south end of the Project Area (i.e., TEM-09 and TEM-11) apparently have a much deeper water table (354 feet bgs at TEM-09 and more than 386 feet bgs at TEM-11), making these locations less desirable. At TEM-09 there is an estimated 150 feet or more of saturated alluvium overlying bedrock, indicating that a well could be placed there to withdraw from a substantial thickness of aquifer. However, given that the water table is substantially shallower at location TEM-02, the north end of the Project Area was judged to be more favorable for the location of one or more water supply wells.

A water supply well was simulated near the location of TEM-02, operating under the conditions expected during construction. Specifically, a well was simulated to be pumping continuously at a rate of 55,000 gallons/day (7,352 ft^3/day) over a period of three years, the upper estimate of construction time.

4.2.3 RESULTS OF SIMULATED GROUNDWATER WITHDRAWALS

High-End Parameter Set

Figure 4.2-1 shows the resulting drawdown predicted around a water supply well after three years of pumping at 55,000 gallons/day, or 61.6 ac-ft/yr (representing the construction phase), for the high-end parameter set. For the high-end K and R parameter set, the results indicate a predicted maximum drawdown of about 20 feet in the well node after three years of pumping at 55,000 gallons/day (Table 4.2-1). The cone of depression contours extend generally less than 3,000 feet from the well, with a slightly elongated extension to the bedrock lying to the east.

Low-End Parameter Set

Figure 4.2-2 shows the drawdown predicted after three years of pumping at 55,000 gallons/day (representing the construction phase), for the low-end parameter set. With low-end values of K and R, the predicted drawdown is much higher than with the high-end parameter set, with a maximum drawdown of about 81 feet in the well node. The radius of drawdown was generally less than 3,000 feet, similar to that of the high-end parameter set.

Figure 4.2-1: Predictive Run – High End Parameter Set - Drawdown After 3 years of Pumping

SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 2010, RMT Inc. 2011

N W E S

Run SM37b Transient - High End K, R - Drawdown of Water Table
After 3 Years of Pumping at 55,000 gallons per day

Miles
0 0.25 .5 1 1.5 2

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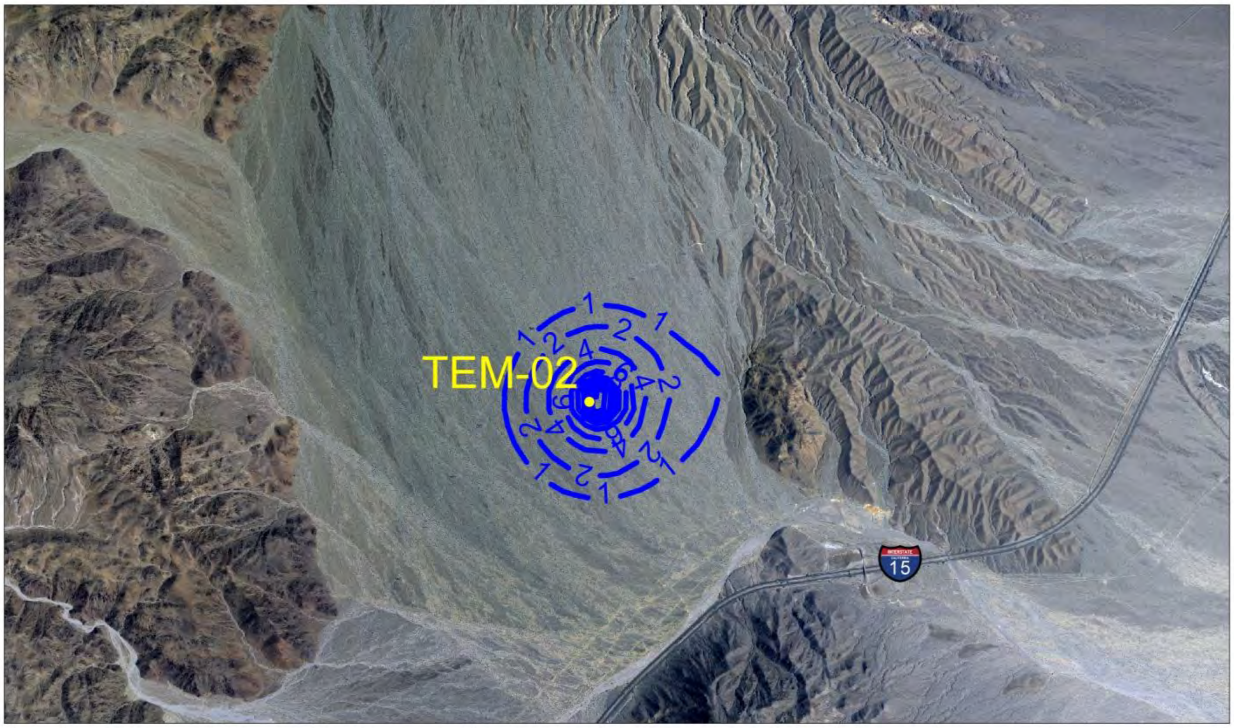
Table 4.2-1: Effects of Groundwater Withdrawals at Maximum Withdrawal Rates

Parameter Set Name	*Maximum Predicted Drawdown near Well (feet)*	*Radius of Area with Drawdown Greater than 1 Foot(feet)*
High End	20	2,500 – 3,800
Low End	81	2,400 – 3,050

Note: Maximum drawdown inside the well itself will likely be somewhat higher than predicted for the aquifer near the well because of typical well inefficiencies.

Figure 4.2-2: Predictive Run – Low End Parameter Set - Drawdown After 3 years of Pumping



SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 2010, RMT Inc. 2011

N W E S

Run SM38 Transient - Low End K, R - Drawdown of Water Table
After 3 Years of Pumping at 55,000 gallons per day

0 0.25 .5 1 1.5 2 Miles

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Simulations of operating conditions indicate that drawdown would be much lower than during the construction phase because the rate of pumping would be lower, and would have a much shorter duration. As stated earlier, it is expected that 42,000 gallons/day, for 21 days, twice per year, would be needed for PV panel cleaning and other activities. The results indicate that minor drawdown would occur, less than 25 percent of that which would occur with the higher rates of pumping under construction conditions. Because the drawdown under operating conditions would be substantially less than that under construction conditions, only the drawdown results during construction are shown on Figure 4.2-2.

5: Conclusions

Groundwater modeling results indicate that conditions are favorable for obtaining sufficient water to conduct construction and operation activities on site that require non-potable water. Conservative estimates of groundwater recharge are between 343 and 1,373 ac-ft/yr, compared to an expected use of 61.6 ac-ft/yr. for a period of three years. The modeling results indicate that one or two wells screened in alluvium near the northern end of the Project Area, near TEM-02, would likely be capable of supplying sufficient water required during construction for dust control and other construction-related activities. Drawdown values for the area near the modeled water supply well range from 20 feet for the high-end parameter set to 81 feet for the low-end parameter set. Actual drawdown inside a well will likely be higher than the aforementioned values because of well inefficiencies that are caused by frictional losses in the well screen and turbulent flow in the well.

Water needs for long-term operation of the site would be much less than during construction, and one or two wells would be expected to be capable of supplying the water required for PV panel cleaning and other non-potable water needs. Water needs for potable uses are not intended to be obtained from the aquifer and, therefore, were not simulated.

Drawdown impacts in excess of 1 foot are not expected to extend more than about 3,000 feet from the well(s) that would be installed, at the projected pumping rates. In comparison, the town of Baker lies more than ten times as far from the Project Area as the drawdown impacts would extend, approximately 33,000 feet northeast of the recommended location of the water supply well(s) near TEM-02. Similarly, Zzyzx Spring is located approximately 29,000 feet from TEM-02, and the Rasor Road Services well is located approximately 30,000 feet southwest of TEM-02. No impacts from groundwater withdrawals would be expected to be measurable at these three locations. No other groundwater users are known to exist in the Project valley or anywhere close to the estimated cone of depression of the recommended well(s).

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6: Recommendations

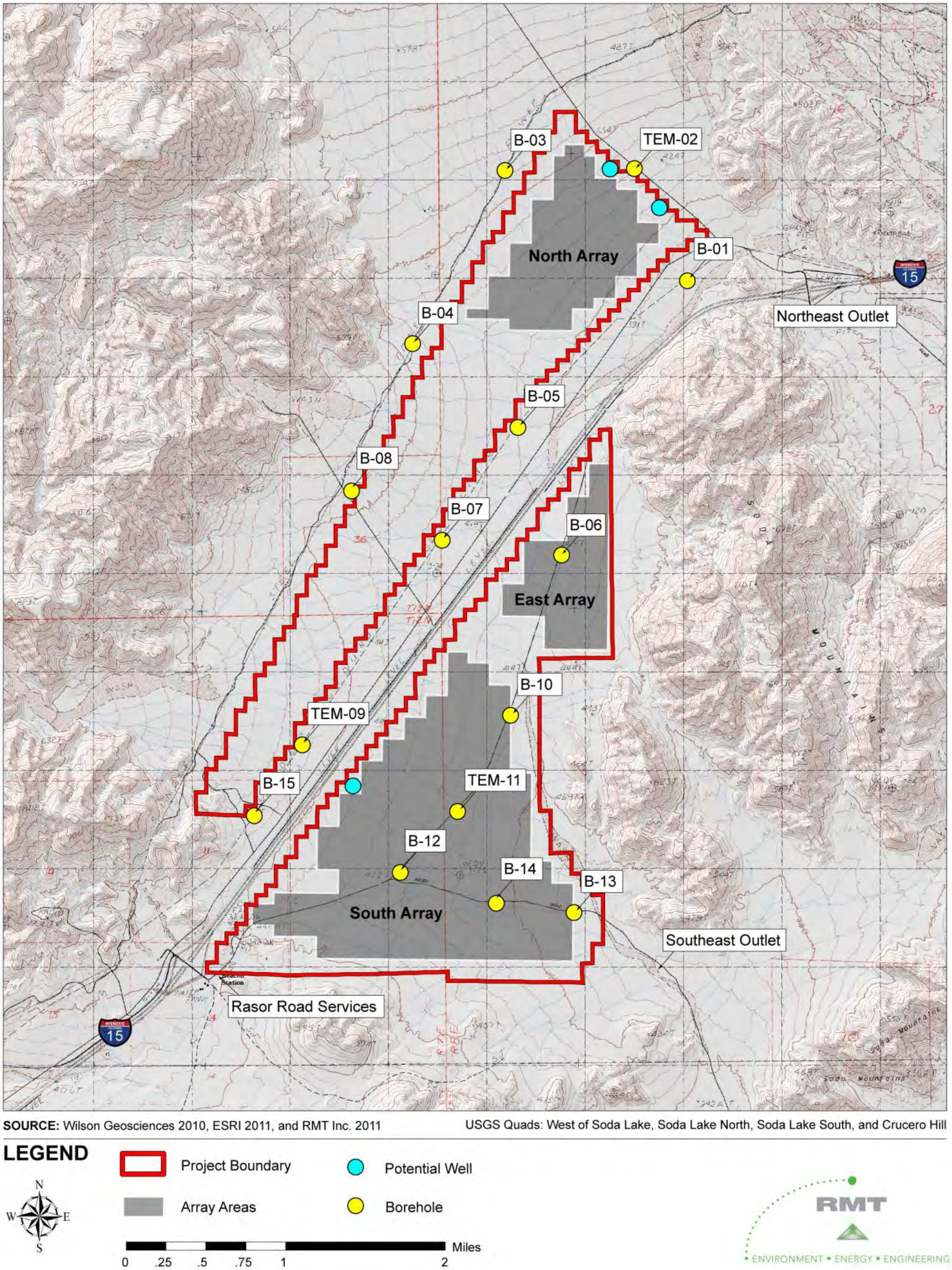
RMT recommends that two water supply wells should be planned for, to be located in the vicinity of TEM-02, at a location that is convenient for access. To minimize well interference, the two wells should ideally be separated by a distance of 2,000 feet or more. Drawdown effects from one well on the other well would be expected to be insignificant at this separation distance. Although the model results indicate a single well would be adequate for the high-end K and R conditions, and a single well may also be adequate for the low-end K and R conditions, planning for a second well to be installed has distinct advantages:

- A second well would be available in case well or pump repair is required, without shutting down planned activities (especially during construction) that require water
- A second well may be needed if significantly more water per day is required for certain days than the average rate
- A second well may be needed if the actual K is near or below the low-end K value of 1 foot/day

Data gathered during drilling of a well will be valuable in evaluating whether the soils at the location of the well are at least as permeable as the low-end K values used in this modeling. While it is expected that the K and thickness of saturated sediments would be sufficient to yield the required amounts of water, if actual conditions encountered during drilling indicate a lower K or thinner thickness of saturated soils than expected, extending the borehole into the bedrock to intercept potential water-bearing fractures may be an effective solution.

Location of a second well nearer to the southeast portion of the Project area may be desirable to provide water to the planned Operations Building for non-potable uses, and for fire-suppression. The planned location of the Operations Building near Rasor Road Services is not judged to be a favorable location for a well because bedrock is close to the surface and there apparently is no saturated alluvium overlying bedrock. A more favorable location for the well would be nearer to TEM-09, but on the southeastern side of I-15 (see Figure 6.1-1). A well at this location would facilitate transport of water between the well and a water storage tank to be located at the Operations building. It is expected, based on the geologic data from TEM-09 and TEM-11 locations, that operation of a water supply well at this location would not have any negative impact on the nearest water supply users, such as Rasor Road, the town of Baker, or Zzyzx Spring. This is because the sediments appear to be of similar character to those in the northern end of the Project valley and are part of an extensive saturated alluvial sediment aquifer. It is recommended that a potential water supply well this location be simulated with the existing groundwater flow model to confirm that the predicted effects would be negligible.

Figure 6.1-1: Potential Water Supply Well Locations



7: Limitations

The accuracy of the model results is limited by the scarcity of measured hydraulic head values and other hydrogeologic data in the Project valley. "Measured" hydraulic heads were estimated values based on TEM data, with uncertainties of 13 to 30 feet or more. Measured values of hydraulic conductivity exist for shallow soils only, and K values were estimated for the deeper soil horizons based on TEM data. Similarly, depth to bedrock was derived from the limited TEM data. Recharge values were estimated based on measured rainfall and comparison to other investigation areas. Despite these limitations, the approach taken – to bracket the expected range of values of R and K with high-end and low-end data sets – represents a reasonable approach to reduce the uncertainty and obtain meaningful results. The predictions presented here were based on bulk (average) hydraulic parameter values; actual values of hydraulic conductivity can vary by an order of magnitude or more over short distances at typical sites. A localized zone of low-permeability sediments could limit the performance of an installed well.

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APPENDIX H-3
Hydrogeologic Conditions and Groundwater Modeling Report Addendum

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Hydrogeological Conditions and Groundwater Modeling Report Addendum

Soda Mountain Solar Project

BLM Case No. CACA 49584

May 2013

Hydrogeological Conditions and Groundwater Modeling Report Addendum

Soda Mountain Solar Project

BLM Case No. CACA 49584

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Appendix A NPS Comments

1 BACKGROUND

The Soda Mountain Solar Project (project) will include the installation, operation, and maintenance of a 350-megawatt electric generating facility (Caithness 2011). The project area is located in a small valley on federal lands managed by the U.S. Department of the Interior, Bureau of Land Management (BLM), approximately 6 miles southwest of the town of Baker in San Bernardino County, California (Figure 1). Groundwater modeling was used to help evaluate whether the hydrogeologic conditions at the Project site could sustain the withdrawal of water needed during construction, operation, and maintenance of the proposed solar facility, without causing impacts to nearby water users or environmental resources located within the Mojave National Preserve. The initial groundwater modeling results were presented in *Hydrogeologic Conditions and Groundwater Modeling Report* (RMT 2011) ("Model Report").

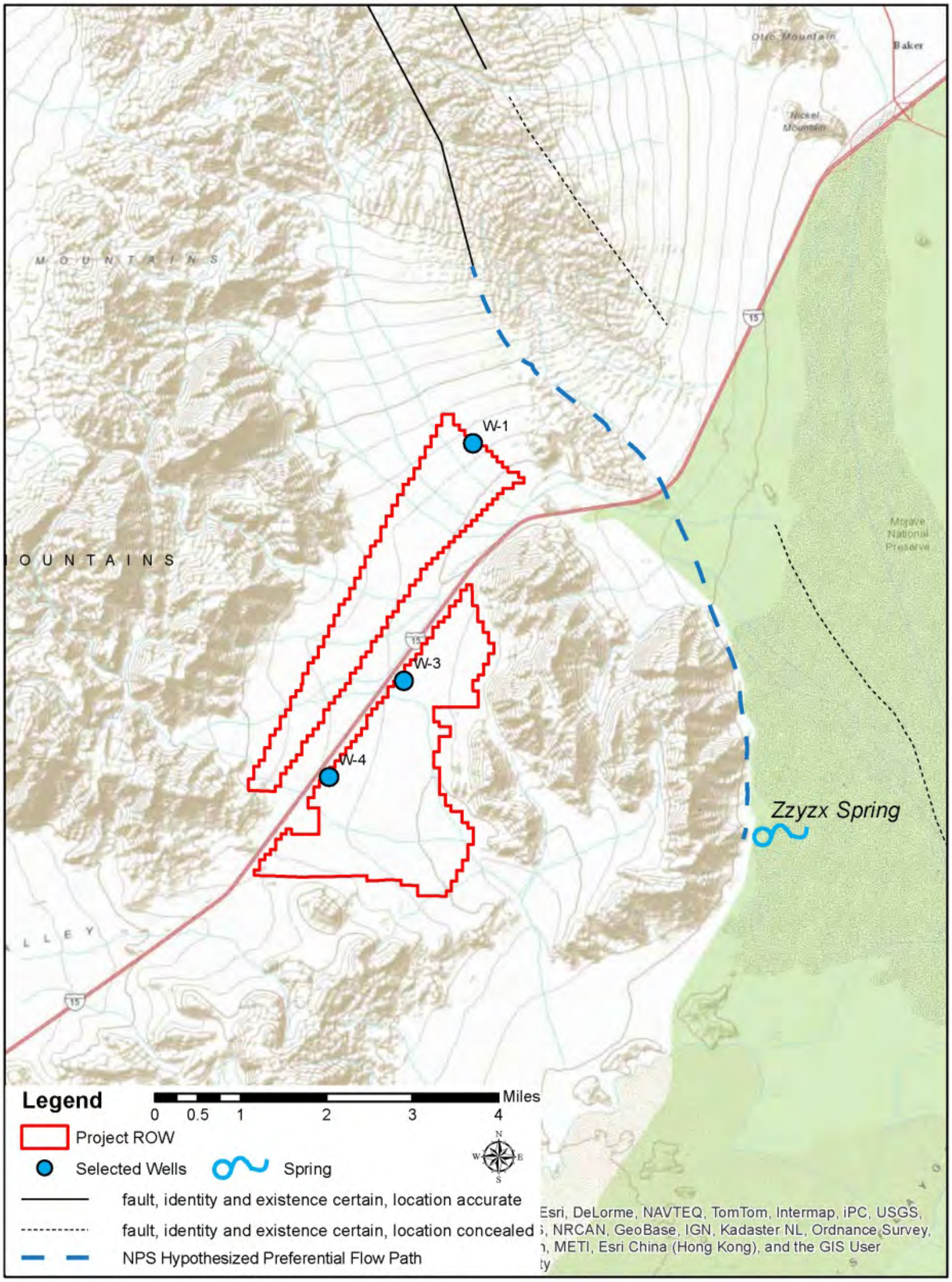
This addendum to the Model Report has been prepared to address:

1. Revised water use estimate for construction from 61 acre feet per year (AFY) to 192 AFY
2. Modeling of water use for project operation
3. Possible use of up to three groundwater wells
4. National Park Service (NPS) comments on the Model Report

NPS, Mojave National Preserve, presented scoping comments on the project in a letter dated November 21, 2012 (NPS 2012) addressed to San Bernardino County Land Services Department, Planning Division, and to the BLM, California Desert District Office, Moreno Valley (Appendix A). NPS comments on the Model Report, included:

- The modeling assumed an overly high recharge rate.
- The model did not account for the possibility of permeable bedrock to the east of the project area. NPS suggested one potential source from which Soda Springs at Zzyzx might derive significant flow is a potential preferential groundwater flow path extending from known fracture traces north and south of the Soda Springs at Zzyzx. The NPS's hypothesized preferential flow path is illustrated in Figure 1.
- The analysis did not adequately addresses potential impacts to the springs at Zzyzx.

Figure 1: Project Location



2 HYDROGEOLOGIC CROSS SECTIONS

A cross section location map is presented in Figure 2. Revised cross sections A–A′, B–B′, and C–C′ are presented in Figure 3. These cross sections were previously presented in RMT's 2011 Model Report. The revised cross sections do not display the vertical exaggeration used in the Model Report (which caused potential confusion over the distance between the springs at Zzyzx and the proposed groundwater wells). The revised cross sections also include the type and extent of bedrock units. The following discussion is derived largely from the Model Report, with additional discussion of the bedrock geology.

2.1 CROSS SECTION A–A'

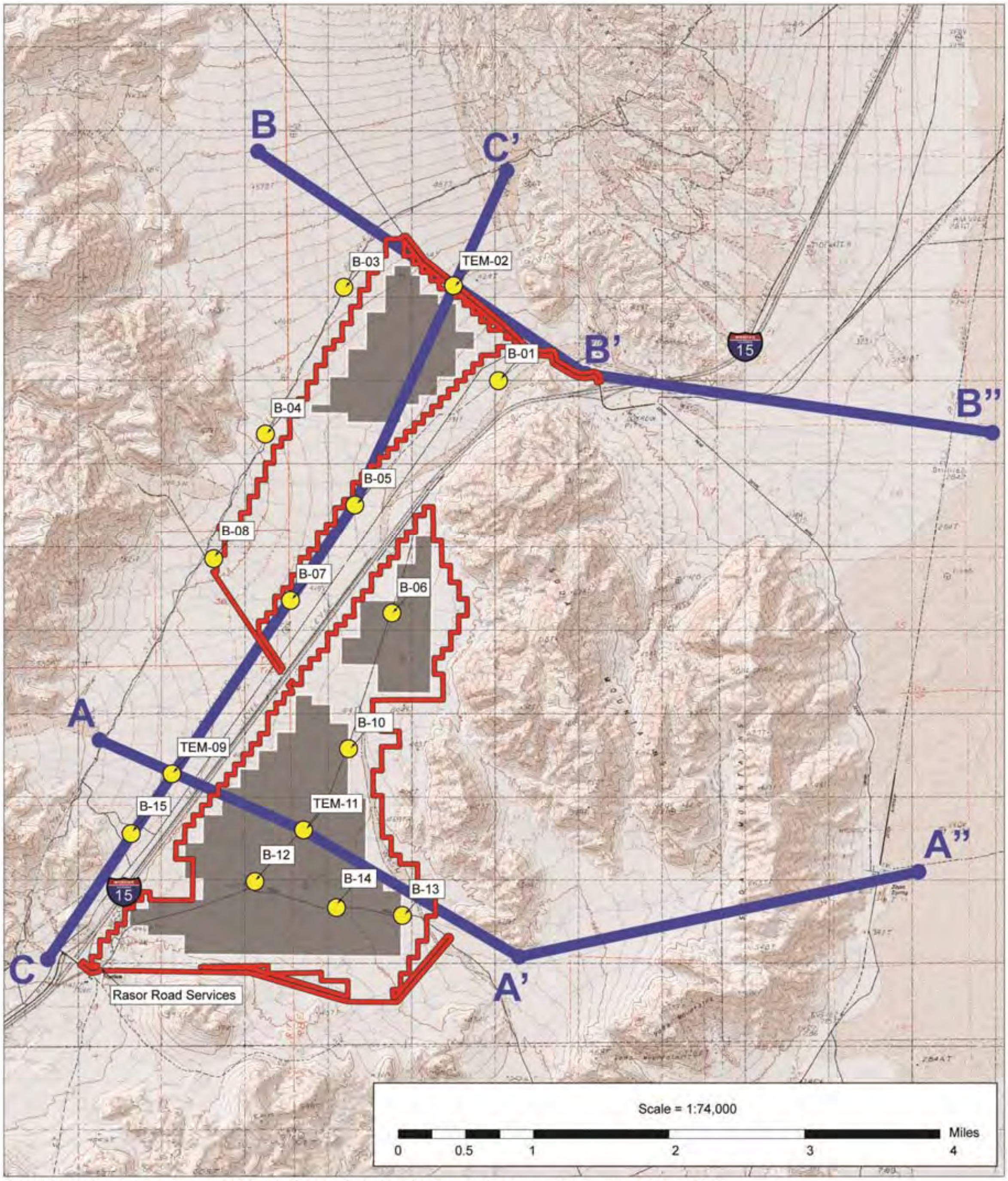
Cross section A–A′ extends west to east and incorporates geophysical data from TEM-09 and TEM-11, which are located near the southern end of the valley (Figure 3). The cross section extends eastward across the mountain range to Soda Springs at Zzyzx, located on the eastern slope of the eastern Soda Mountains, above Soda Lake. Bedrock occurs at depths of 500 feet or more below ground surface (bgs) at TEM-09 and 436 feet bgs at TEM-11. The bedrock outcrops on the slopes of the Soda Mountains. Geologic mapping from Jenkins (1962) and Wilson (2011) indicates that Mesozoic granitic rocks make up much of the subsurface bedrock, with Jurassic-Triassic metavolcanic rocks forming significant portions and higher reaches of the Soda Mountains. A localized outcrop of carbonate rock is present in the vicinity of Soda Springs at Zzyzx, but its mapped extent appears to be limited to the vicinity of the spring (Jenkins 1962).

The water table occurs at an elevation of approximately 1,170 feet amsl at TEM-09, and appears to be below an elevation of approximately 922 feet amsl at TEM-11. The apparently much lower water table at TEM-11 suggests that there is an outlet for groundwater southeast of TEM-11 that allows the water table to drain to this lower elevation. A surface-water outlet is present in the southeast portion of the valley (Figure 2), and it is reasonable to assume an alluvium valley fill bedrock cut exists at this location. This conceptual model satisfies the need for a groundwater outlet to occur in the southeast portion of the valley, where the water table is apparently much lower than elsewhere, as seen at TEM-11.

2.2 CROSS SECTION B–B'

Cross section B–B′ extends west to east along the northern boundary of the project area, and shows a similar topographic slope to the east as was shown on cross section A–A′, paralleling the surface water outlet to the east (Figure 3). Drainages from large alluvial fans converge into the surface water outlet that flows through a relatively narrow valley between low mountains to the north and south (Figure 2). The funneling of the surface water outflow suggests that, as for

Figure 2: Locations of Geologic Cross Sections



SOURCE: Wilson Geosciences 2010, ESRI 2011, RMT Inc. 2011, and Panorama Environmental, Inc. 2013

LEGEND

Project Boundary

Array Areas

A A' Cross Section Line

Borehole

USGS Quads: West of Soda Lake, Soda Lake North, Soda Lake South, and Crucero Hill

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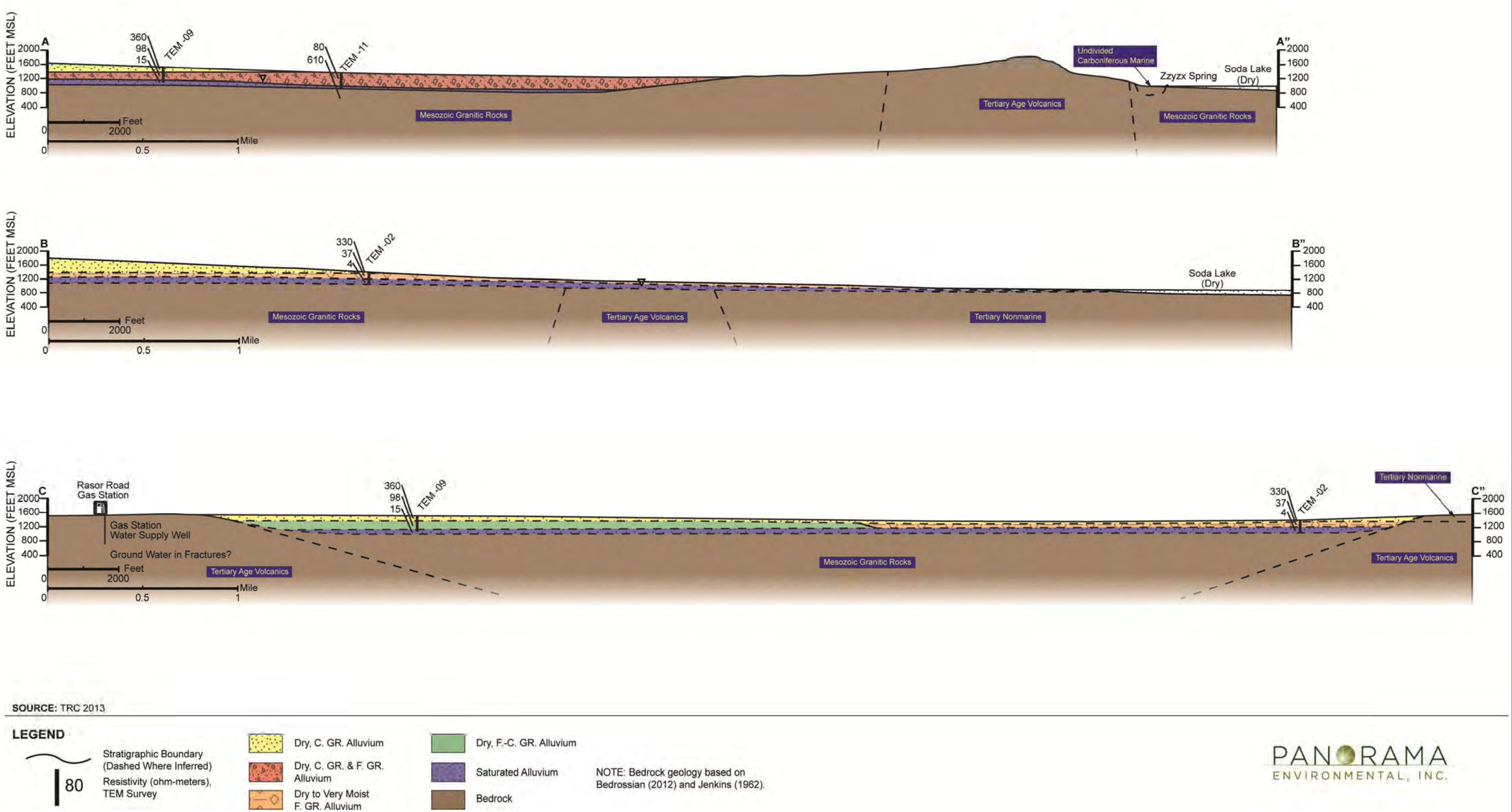
Figure 3: Geologic Cross Sections



cross section A–A′, there may be a buried bedrock valley at this location. The funneling of surface water through this narrow gap suggests that there may be coarser sediments in the valley fill at this location. A small outcrop of limestone present near Zzyzx east of Soda Mountain on cross section point A is labeled as Undivided Carboniferous Marine. Extrapolation of mapped bedrock units into the subsurface indicates that Mesozoic granitic rocks predominate in the western portion of cross section point B, and Tertiary volcanic rocks form the central portion of the cross section. Tertiary nonmarine rocks are mapped in the eastern portion of the cross section, extending to the areas beneath Soda Lake.

The water table is interpreted to be at a depth of approximately 182 feet bgs at TEM-02 (elevation of 1,232 feet amsl), the shallowest groundwater occurrence of any of the three TEM locations. The groundwater elevation at TEM-02 is approximately 300 feet higher than the water table in the Soda Lake Valley located east of the project area (Figure 2). Groundwater elevations in the Soda Lake Valley range from 945 feet amsl to 958 feet amsl based on available U.S. Geological Survey (USGS) data (USGS 2013). Soda Springs at Zzyzx is located at an elevation of 948 feet approximately 200 to 300 feet below the groundwater elevation in the Soda Mountain Valley. The conceptual model illustrated on cross section B–B′ is that the water table slopes steadily eastward from the upper reaches of the alluvial fans to the base of the valley. Groundwater is channeled through the relatively narrow buried valley outlet located near the northeast corner of the project area, flowing eastward toward the Soda Lake lowlands.

2.3 CROSS SECTION C–C’

Cross section C–C′ extends northeast to southwest down the longitudinal axis of the valley (Figure 3). From south to north, bedrock units represented in the valley include Tertiary volcanic rocks (rhyolite, andesite), Mesozoic granitic rocks, and Jurassic-Triassic metavolcanic rocks.

A surface water divide located approximately 1.5 miles north of TEM-11 separates water flowing to the northeast outlet from water flowing to the southeast outlet (Figure 2). It is likely that groundwater flow approximately mimics the surface water flow, flowing northward in the northern half of the valley, and southward in the southern half.

TEM data indicate that the saturated subsurface resistivity differs between the northern and southern portions of the valley, consistent with the interpretation of different groundwater flow directions in the two portions of the valley. Groundwater at TEM-02 has very low resistivity (i.e., 4 ohm-meters), indicating a high concentration of total dissolved solids (TDS). Groundwater in the southern portion of the valley exhibits higher resistivity values at TEM-09 (i.e., 15 ohm-meters), indicating high TDS concentrations but lower concentrations than at TEM-02.

3 MODEL REVISIONS

The existing three-dimensional MODFLOW (MacDonald and Harbaugh 1988) groundwater flow model (RMT 2011) was revised through consideration of comments by staff at NPS and BLM as well as updated water use estimates. Model revisions included the following:

- Reduction of recharge values for the high-end parameter set from 0.5 inches per year to 0.4 inches per year (10 percent of rainfall, which averages 4 inches per year), and accompanying reduction of hydraulic conductivity (K) from 4.0 to 3.2 feet/day (ft/d) for the majority of the site (see Table 1). Equivalent reductions were made in the focused recharge at the boundary nodes, simulating mountain front runoff. The rationale for the selected recharge values is presented in Section 5.1.
- Revision of recharge value for the low-end parameter set from 0.125 inches per year to 0.12 inches per year (3 percent of rainfall), and accompanying reduction of K from 1.0 ft/d to 0.86 ft/d for majority of site (Table 1). Equivalent reductions were made in the focused recharge at the boundary nodes, simulating mountain front runoff.
- Increase in estimated groundwater extraction rates during a 3-year period of construction from 61 to 192 AFY.
- Increase in estimated groundwater extraction rates during operation from 7 to 33 AFY to allow for water use in dust control mitigation during operation of the project.
- Extraction from a single well in the southern portion of the site.
- Extraction from three wells located at select locations across the site.
- Refinement of grid spacing in the vicinity of well locations for greater accuracy.

Table 1: Revised Model Parameters

Aquifer Parameters			
Parameter Set Name	***Hydraulic Conductivity (K) (ft/d)***	***Groundwater Recharge (R) (inches/year) [AFY]***	***Storage Coefficient (unitless)***
High End	3.2	0.4 in/yr [1,330 AFY]	0.1
Low End	0.86	0.12 in/yr [376 AFY]	0.1

Note: Values given are for main body of model domain. Nodes at the model boundaries have higher R values. Nodes near the northeast and southeast outlets have higher K values.

4 MODEL RESULTS

4.1 CALIBRATION

The revised model grid and model domain are shown in Figure 4. Figure 5 presents the steady-state hydraulic head distribution for the calibrated model for the revised high-end set of hydraulic conductivity (K) and recharge (R), with values of 0.4 inches per year (total of 1,330 AFY) for recharge. Figure 6 portrays the head distribution for the low-end set of K and R, with values of 0.12 inches recharge per year (total of 376 AFY). The steady-state head distributions are virtually identical for the high-end and low-end model runs. Table 2 shows the results of the calibration, comparing model results to heads estimated from TEM results.

For the high-end parameter set (10 percent recharge), predicted head values at TEM-02 were 1,233 feet amsl, nearly matching the 1,232 value estimated based on TEM results. The predicted head value for TEM-09 in the model (1,157 feet amsl) was well within the range of uncertainty for the estimated value based on TEM results (1,170 ± 30 feet amsl).

For the low-end parameter set (3 percent recharge), predicted head values at TEM-02 were 1,235 feet amsl, nearly matching the 1,232 value estimated based on TEM results. The predicted head value for TEM-09 in the model (1,157 feet amsl) was well within the range of uncertainty for the estimated value based on TEM results (1,170 ± 30 feet amsl).

Mass balance errors were low for the calibrated model, at 0.02 percent and 0.03 percent respectively for the high-end and low-end parameter sets. All water entering the model is derived from areal recharge. Outflow is through the northeast and southeast outlets, through general head boundary (GHB) nodes assigned to those locations. In general, the match of the model values to the two values interpreted from geophysical data is considered adequate for an area with such sparse hydrogeologic data.

Table 2: Predicted Hydraulic Heads Versus "Measured" Heads from TEM Results

	High-End Parameter Set		Low-End Parameter Set	
Measurement Location	***Predicted Head (feet amsl)***	***Measured Head (feet amsl)***	***Predicted Head (feet amsl)***	***Measured Head (feet amsl)***
TEM-02	1,233	1,232±13	1,235	1,232±13
TEM-09	1,157	1,170±30	1,164	1,170±30

Note: Measured head values were estimated based on TEM survey results from Terra Physics (2010).

Figure 4: Model Grid and Model Domain[1]

[1] Blue nodes represent general-head boundary conditions where groundwater is allowed to flow out of the model domain.

Figure 5: Steady State Calibration, High-End Parameters

Figure 6: Steady State Calibration, Low-End Parameters

4.2 EFFECTS OF PROPOSED GROUNDWATER EXTRACTION - PREDICTIVE SIMULATIONS

4.2.1 Pumping Rates Needed for Construction and Operation

Water needs for construction were revised from earlier estimates and are now estimated to be approximately 192 AFY for two to three years (Soda Mountain Solar 2013). Water needs for operation and maintenance (i.e., for PV panel cleaning, potable water use, and dust control during operation) are estimated to be approximately 33 AFY (Soda Mountain Solar 2013).

Water supply wells were simulated as operating under the conditions expected during construction and operation. Specifically, one and three wells were simulated to be pumping continuously at a combined rate of 192 AFY to accommodate the proposed water use of 200,000 gallons per day, 6 days per week (average continuous withdrawal of 171,000 gallons/day, or 22,913 ft^3/day) for a period of three years, the upper estimate of construction duration. Subsequently, one and three wells were simulated with combined extraction of 33 AFY for an additional 27 years (total simulation time of 30 years, the anticipated life of the project).

4.2.2 Selected Location of Water Supply Wells

Three potential locations for groundwater extraction wells have been selected, based on existing hydrogeologic data from TEM locations and borings and based on proximity to project operational facilities. The three locations are shown on Figure 1 and are named W-1, W-3, and W-4. W-4 was selected as the optimal location for simulation of a single water supply well; however, it is likely that two to three wells will be constructed to provide backup water supply and allow for well maintenance. Simulations were conducted for single well and three-well scenarios to evaluate the feasibility of obtaining sufficient water with acceptable drawdown under these scenarios.

4.2.3 Results of Simulated Groundwater Withdrawals

Three Wells, High-End Parameter Set (10 Percent Recharge)

Figure 7 shows the resulting drawdown and radius of influence predicted around a water supply well after three years of pumping at three wells, with a combined total of 171,000 gallons per day, or 192 AFY (representing the construction phase), for the high-end parameter set (10 percent recharge). The results of the model run (SM237transient) indicate a predicted maximum drawdown of about 28 feet, 20 feet, and 25 feet in the nodes representing Wells 1, 3, and 4 respectively after three years of pumping at 171,000 gallons per day (Table 3). Extraction rates would lower to 33 AFY during operation, and the cones of depression become much less steep but slightly wider in extent (Figure 8). The maximum drawdown would be approximately 1 foot at the closest bedrock interface east of the wells. The model results also indicate groundwater flow through the northeast outlet would be diminished by only one percent (from 424.8 AFY to 420.2 AFY, as shown in Table 4). This reduced flow through the northeast outlet would occur primarily during project operations.

Figure 7: Three Wells, 3 Years, High-end Parameters

Figure 8: Three Wells, 30 Years, High-End Parameters

Table 3: Summary of Results at Each Well Point			
Scenario	**Well 1 Drawdown (ft)**	**Well 3 Drawdown (ft)**	**Well 4 Drawdown (ft)**
3 Wells, 3 Years, High End	28	20	25
3 Wells, 30 Years, High End	5	4	5
3 Wells, 3 Years, Low End	110	68	91
3 Wells, 30 Years, Low End	16	12	15
1 Well, 3 years, High End	N/A	N/A	80
1 Well, 30 Years, High End	N/A	N/A	13
1 Well, 3 Years, Low End	N/A	N/A	Dry
1 Well, 30 Years, Low End	N/A	N/A	Not Modeled

Note: Model predicts declines in hydraulic head and does not account for well loss (head losses due to friction flowing through the well screen). Actual drawdown in the well is expected to be greater due to well loss.

Table 4: Groundwater Discharge at Northeast Outlet of Soda Mountain Valley				
Model Scenario	**Discharge (AFY), After 3 Years**	**Reduction (AFY)**	**Discharge (AFY), After 30 Years**	**Reduction (AFY)**
High Recharge, Existing Conditions	**424.8**	**N/A**	**424.8**	**N/A**
High Recharge, 3 wells	422.2	2.6	420.2	4.6
High Recharge, 1 well	424.8	ND	424.3	0.5
Low Recharge, Current Conditions	**121.2**	**N/A**	**121.2**	**N/A**
Low Recharge, 3 wells	121.2	ND	118.9	2.3

Notes:

ND = Not detectable. No change from existing conditions was measured by the model

Three Wells, Low-End Parameter Set (3 Percent Recharge)

Figure 9 shows the drawdown predicted after three years of pumping at three wells, with a combined withdrawal of 192 AFY for the low-end parameter set (3 percent recharge). With low-end values of K and R, the predicted drawdown is much higher at the well point than with the high-end parameter set. The maximum predicted drawdown is approximately 110 feet, 68 feet, and 91 feet in the nodes for Wells 1, 3, and 4 respectively (Table 3). The model run (SM240transient2) indicates the maximum drawdown at the closest bedrock interface east of the wells would be less than 1 foot after 3 years of construction. The cones of depression would become much less steep and would not spread significantly during operation (Figure 10).

Figure 9: Three Wells, 3 Years, Low-End Parameters

Figure 10: Three Wells, 30 Years, Low-End Parameters

The maximum predicted drawdown is less than 1 foot at the closest bedrock interface to the east of the wells. The model also predicts that there would be an approximately 2 percent reduction in groundwater flow through the northeast outlet during operation (from 121.2 AFY to 118.9 AFY).

One Well, High-End Parameter Set (10 Percent Recharge)

Figure 11 shows the resulting drawdown predicted around a water supply well after three years of pumping at one well (W-4) of 192 AFY with the high-end parameter set (10 percent recharge). The results from the model run (SM250hiR-tr) indicate a predicted maximum drawdown of about 80 feet in the node representing Well 4 after three years of pumping at 171,000 gallons/day during the construction phase (Table 3). The cone of depression would become much less steep but somewhat wider in extent during operation (Figure 12). The results indicate the maximum drawdown at the closest bedrock interface east of the wells would be approximately 2.2 feet. The model also indicates groundwater flow through the northeast outlet would decrease by approximately 0.1 percent from 424.8 AFY to 424.3 AFY. This reduced flow through the northeast outlet would occur primarily during the period of operations.

One Well, Low-End Parameter Set (3 Percent Recharge)

The model results indicate that with the low-end parameter set, the node containing the well would go dry quickly once pumping begins. The results of the model run (SM260) indicate a single well would not be able to sustain the required extraction rate of 192 AFY during the construction phase. The 30-year, one-well scenario was therefore not modeled.

Figure 11: One Well, 3 Years, High-End Parameters

Figure 12: One Well, 30 Years, High-End Parameters

5 DISCUSSION

5.1 RECHARGE

NPS stated that recharge estimates used in the MODFLOW model were too high and could underestimate the potential impacts of groundwater withdrawals associated with the project. NPS suggested using the Maxey-Eakin method for estimating recharge would determine zero recharge and this should be used as the model input for the site.

The rationale for recharge values used in the original model, 0.125 inches per year to 0.5 inches per year, was discussed in detail in Section 3.2 of the Model Report (RMT 2011). Average annual precipitation was estimated to be 4 inches per year or more, based on data from PRISM Climate Group (2012) and Western Regional Climate Center (2013).

NPS's assertion that the Maxey-Eakin method should be used to estimate recharge has been questioned by other researchers. Bredehoeft (2007) notes that, while the Maxey-Eakin method is still useful in Nevada, it has many uncertainties. Davisson and Rose (2013) point out that the Maxey-Eakin method was calibrated to a drier climate in Arizona rather than areas in southern California, similar to the study area, and thus could lead to underestimates of recharge in this area. NPS's assertion that the recharge rate could be zero are unreasonable because a zero recharge rate in a basin this small would result in a dry basin with no groundwater. Geophysical evidence from this valley shows the presence of up to several hundred feet of saturated alluvium in the valley floor, which directly contradicts a recharge rate of zero (TerraPhysics 2010; Wilson 2011).

With relatively coarse-grained sediments overlying much of the valley floor (Wilson 2011; Diaz-Yourman and Associates 2010) and approximately 4 inches of rainfall per year in the valley and mountains (PRISM Climate Group 2012), it is estimated that 7.8 to 8.8 percent of the precipitation in the mountains becomes mountain front recharge (Panorama Environmental 2012). This estimate is comparable to the value of approximately 10 percent of runoff becoming recharge in the Mojave Desert (Izbicki 2002). Recharge rates presented in the project well permit application were estimated to be approximately 641 to 723 acre-feet per year (AFY), with much of it derived from mountain front runoff (Panorama Environmental 2012).

BLM staff suggested recharge rates ranging from 3 percent to 10 percent of precipitation (0.12 to 0.4 inches recharge per year) should be used in the revised model based on their experience elsewhere in arid and semi-arid regions of southern California. These estimates of recharge are slightly lower than the previous estimates of 0.125 to 0.5 inch used in the Model Report (RMT 2011). The low-end (3 percent) and high-end (10 percent) recharge rates used in the model provide a total input of 376 to 1,330 AFY of recharge (corresponding to 0.12 to 0.4 inches of recharge per year).

5.2 MODEL BOUNDARIES CONSIDER OUTFLOW TO EAST

NPS commented that the model incorrectly assumed impermeable boundaries that precluded flow to the east beyond the Soda Mountains.

The model boundaries were defined using geologic data and geophysical information. The Soda Mountain Valley is surrounded by low-permeability granitic and volcanic rock. The model covers the alluvium within the valley. The low permeability rocks define the model boundaries. The cross sections in the Model Report have been updated with geologic information from existing published geologic maps (Figure 3). The geologic cross sections illustrate the nature and extent of bedrock that forms the mountains in the area, and verifies that carbonate rocks, which might have solution openings and be more permeable than the typical bedrock, are not pervasive in the area. The model domain reflects the geologic conditions in the area by assuming no flow through the granitic and volcanic rock to the east and flow through an outlet to the east and an outlet to the south where alluvium is present.

Observed conditions at the site and in the regional groundwater system support the presence of low permeability through fractured bedrock in the Soda Mountain. The water table in the valley is situated approximately 200 to 300 feet above the surface of Soda Lake and substantial fracturing and groundwater discharge through the mountains would have drained the Soda Mountain Valley groundwater basin. As discussed previously, geophysical evidence shows the presence of several hundred feet of saturated alluvium in the valley (Terra Physics 2010).

The existing model incorporated focused discharge through two outlets from the valley, the northeast and the southeast outlets, that allowed groundwater to flow from the model domain to the east. The model simulated groundwater discharge into Soda Lake through these two outlets. The model was therefore not surrounded entirely with impermeable boundaries.

5.3 POTENTIAL FOR IMPACTS TO SODA SPRINGS AT ZZYZX AND MOHAVE TUI CHUB

NPS commented that the model did not adequately address potential impacts to Soda Springs at Zzyzx, habitat for the Mohave tui chub (*Siphateles bicolor* ssp. *Mohavensis*).

The U.S. Fish and Wildlife Service (USFWS) listed the tui chub as endangered in 1970. California Department of Fish and Wildlife (CDFW) lists the species as endangered and a fully protected species. The revised modeling presented in this addendum evaluated groundwater drawdown at two locations to assess potential impacts on Soda Springs at Zzyzx and associated tui chub habitat:

1. NPS's hypothesized preferential flow path (Figure 1)
2. The western edge of the Soda Mountains

5.3.1 Mohave Tui Chub Habitat Requirements

There are specific requirements for suitable Mohave tui chub habitat, including pool configuration, water temperature, water quality, and food sources. Pools should be at least 4 feet deep to resist cattails and to stabilize temperature and dissolved oxygen content. Aquatic plants are needed for attachment of eggs and to prevent anoxic conditions in the water. Vegetation (aquatic and riparian) also provides shade to protect the fish from extreme temperatures Temperature tolerance ranges from 37 to 97 degrees Fahrenheit (3 to 36 degrees Celsius). The tui chub cannot tolerate high salt content; therefore, there must be a flow of fresh water into the pool to counteract high evaporation rates in the desert. Insufficient water supply to existing populations is a threat to the viability of Mohave tui chub populations. Mohave tui chub feed on aquatic invertebrates (USFWS 2009).

5.3.2 Mohave Tui Chub Habitat Locations

The Mohave tui chub historically existed in the Mojave River. Today, there are only four known populations: China Lake, Soda Springs and Lake Tuendae at Zzyzx, CDFW's Camp Cady Wildlife Area, and the Deppe Pond. There is no suitable habitat for Mohave tui chub within the Soda Mountain Valley.

Lake Tuendae

Lake Tuendae is an approximately 1.5-acre man-made lake approximately 800 feet northwest of Soda Springs. Evapotranspiration rates at the Lake were measured by Barthel (2008) based on groundwater withdrawal to support the lake. The pumping rate to support the Lake and adjacent vegetation is 9.27 million gallons per year (28.5 AFY) (Barthel 2008). The Lake is located within an approximately 2 acre watershed and the rate of evapotranspiration was therefore estimated to be 14.25 feet per year over each acre (28.5 AFY/2 acres = 14.25 feet per year) (Barthel 2008). Lake Tuendae supports a population of 1,318 Mohave tui chub (Barthel 2008). This population was introduced to the Lake. The Lake is approximately 3.1 feet deep and the level is managed by the Desert Studies Center to ensure adequate water depth for the tui chub and Saratoga Springs pupfish (also introduced) (Barthel 2008). Lake Tuendae is a managed system and lake levels are maintained by pumping groundwater rather than natural groundwater discharge.

Soda Springs at Zzyzx

Soda Springs at Zzyzx is a natural spring that discharges into an oval shape pond which supports a population of 255 Mohave tui chub. The pond at the spring outlet is approximately 13 feet by 16 feet wide (0.005 acre) and supports vegetation within a 0.4-acre watershed (Barthel 2008). The depth of the spring is approximately 6.5 feet with a total volume of 8,300 gallons. The estimated evapotranspiration from Soda Springs at Zzyzx and the surrounding phreatophytic vegetation is approximately 5.7 AFY (0.4 acre x 14.25 feet per year = 5.7 AFY of evapotranspiration) with approximately 0.07 AFY of evaporation from the pond surface (0.005 acre x 14.25 feet per year = 0.07 AFY).

Observations by Barthel (2008) indicate the water level in the pond has been constant during a year of measurements, apparently unaffected by pumping in the alluvial aquifer production well located near the spring. This finding is consistent with results of the production well testing at up to 200 gallons per minute that indicate the alluvial aquifer is highly permeable and transmissive, at approximately 400,000 gpd/ft^2 (Archbold 1994). This also suggests that there is ample flow of water in the permeable alluvial aquifer to sustain water levels in Soda Springs.

5.3.3 Groundwater Outflows

Groundwater outflows at Lake Tuendae, Soda Springs, and the Desert Studies Center are summarized in Table 5.

Table 5: Groundwater Use at Zzyzx

Location	Use	Amount (acre-feet per year)
Lake Tuendae	Evapotranspiration from approximately 2-acre watershed	28.5
Desert Studies Center	Pumped into pool and reservoir	4.0
Soda Springs at Zzyzx	Evapotranspiration from 0.4-acre watershed	5.7
Total		**38.2**
Note: Evapotranspiration rate is 14.25 feet per year		

Source: Barthel 2008

5.3.4 Source of Soda Springs at Zzyzx

Local Recharge

Research conducted at the Desert Studies Center indicates that Soda Springs at Zzyzx is recharged locally by water flow from alluvial fan deposits. Vargas (2012) showed that water from the spring was similar in stable isotopes and inorganic chemistry to water on the alluvial fan on the east side of the Soda Mountains. The determination was made after analysis of water quality samples from a well located approximately 500 feet west of the spring. The spring water differs substantially from shallow groundwater from the nearby playa of Soda Lake in isotope geochemistry and major ion chemistry. The spring thus does not appear to be recharged from groundwater from the playa area.

The water quality data indicate that the spring is sustained by water that originates locally on the eastern side of the Soda Mountains, infiltrating the alluvial fan sediments and flowing toward the spring under semi-confined conditions (Barthel 2008; Vargas 2012). It is likely that a broad area of alluvial fan sediments on the eastern edge of the Soda Mountains contributes recharge water to the spring flow, based on the age of the water (mostly pre-1950 based on tritium data [Vargas 2012]). The area of local recharge along the eastern face of the South Soda Mountains is approximately 2,600 acres. Assuming that 3 to 10 percent of rainfall becomes recharge, local recharge is in the range of 26 AFY to 86.7 AFY. The combined groundwater withdrawal at the Desert Studies Center, Lake Tuendae, and discharge at Soda Springs is approximately 38.2 AFY (Table 5). Local recharge is therefore sufficient to support all, or the majority of groundwater withdrawal and discharge at Soda Springs and Lake Tuendae.

Soda Mountain Valley Groundwater Outflow

Groundwater outflow through the northeast and southeast outlets of the Soda Mountain Valley is also thought to contribute additional recharge to the alluvial fans east of the Soda Mountains (Hughson 2013). This outflow from the valley may flow towards the Soda Lake Playa and evaporate off the playa, or it may combine with local recharge on the east side of the South Soda Mountains and flow towards Soda Springs. NPS hypothesizes that there is a mountain-front fault on the eastern side of the south Soda Mountains. Discharge from the valley may follow permeable rocks along the fault line as a preferential flow path, shown in Figure 1 (Appendix A). Groundwater outflow from the eastern outlet of the Soda Mountain Valley is estimated in the groundwater flow model for existing (steady-state) conditions to be 121.2 AFY with low-end recharge and 424.8 AFY with high-end recharge. Assuming that this flow contributes to local recharge and flows to the spring, the total combined groundwater flow from the eastern side of the Soda Mountains and Soda Mountain Valley groundwater outflow that is available at the spring is 147.2 AFY to 511.5 AFY.

5.3.5 Potential Impacts to Soda Springs Groundwater Levels

Reduced Flow out of the Soda Mountain Valley

Model results indicate that under any scenario, the discharge of groundwater from the Soda Mountain Valley through the northeast outlet would be diminished only slightly by the Project. The maximum potential reduction in flow is modeled to be 4.6 AFY or less after 30 years of pumping three wells under high recharge, equivalent to about 2 percent or less of the current outflow[1]) as shown in Table 4, with a lower level of reduction of 2.6 AFY (0.6 percent reduction) or less during the three-year construction period for the Project. The groundwater discharge from the Soda Mountain Valley would continue to follow the current flowpath, including potential flow down the alluvial fans along the east side of the Soda Mountains.

A groundwater budget for Soda Springs and Lake Tuendae was prepared to estimate the impact of the reduced outflow from the Soda Mountain Valley on Soda Springs (refer to Table 6). It is assumed in the groundwater budget that the Soda Mountain Valley is a source of groundwater for Soda Springs and Lake Tuendae. The groundwater budget indicates there is more than adequate groundwater flow from local recharge and outflow from the Soda Mountain Valley under project conditions to support existing groundwater use at Soda Springs and Lake Tuendae. There is surplus groundwater flow in excess of 100 AFY that drains to the Soda Lake playa under all scenarios. This analysis is supported by aquifer test results at Zzyzx that indicate there is ample flow of water in the permeable alluvial aquifer to sustain water levels in Soda Springs, as discussed previously. The minor reduction in outflow from the Soda

[1] Discharge was determined as an output of the calibrated model and each model scenario.

Mountain Valley as a result of project groundwater use would therefore have no impact on groundwater flow at Soda Springs or groundwater withdrawal for Lake Tuendae.

Table 6: Groundwater Budget

Element	Low-End Recharge Scenario (AFY)	High-End Recharge Scenario (AFY)
Potential Inflows to Soda Springs and Lake Tuendae		
Local Recharge	26.0	86.7
Soda Mountain Outflow	121.2	424.8
Direct Precipitation on Soda Springs and Lake Tuendae	0.7*	0.7*
Subtotal Inflows	147.9	512.2
Outflows		
Groundwater Use at Zzyzx	38.2*	38.2*
Reduction in Groundwater Flow Due to Project Pumping	2.3	4.6
Subtotal Outflows	40.5	42.8
Surplus Groundwater Flow (Flows to Soda Lake)	**107.4**	**469.4**
*Source: Barthel 2008		

Potential Impacts from Groundwater Table Decline at Western Edge of South Soda Mountains

It is highly unlikely that the volcanic bedrock forming the Soda Mountains and sidewalls of the Soda Mountain Valley are permeable enough to allow for a significant outflow of groundwater from the valley. Groundwater levels in the valley are approximately 1232 feet amsl at TEM-02, and 1170 feet amsl at TEM-09, and thus are over 200 feet higher than groundwater levels near Soda Springs (Barthel 2008; Vargas 2012). If there were substantial discharge through the bedrock, elevated groundwater levels could not be maintained in the valley over 200 feet higher than the water level near Soda Springs adjacent to the Soda Lake playa; the Soda Mountain Valley groundwater basin would drain.

Groundwater modeling results presented here indicate that drawdown of water levels near the edge of the valley adjacent to the west flank of the south Soda Mountains would generally be less than 2 feet at any time during construction or operation. The small drawdown at the edge of the valley would attenuate to negligible levels over the 3 miles of bedrock separating the valley from the Soda Springs area at Zzyzx. In comparison, groundwater levels in monitoring wells near Zzyzx fluctuate naturally by 1 to 2 feet with no effect on the level of Soda Springs (Barthel 2008).

5.3.6 Potential Impacts to Groundwater Quality

The withdrawal of groundwater for the project would not affect groundwater quality in the Soda Mountain Valley or at Zzyzx. Groundwater use would have a minor impact on groundwater levels in the Soda Mountain Valley (as discussed previously) and would not introduce contaminants to the groundwater system or change the chemistry of the groundwater. Construction and operation of the project would involve the use of hazardous materials that could potentially impact water quality (e.g., diesel fuel, solvents, etc.). These hazardous materials would be contained and managed in accordance with State regulations to prevent spills.

6 CONCLUSIONS

6.1 WATER AVAILABILITY AND NUMBER OF WELLS

The groundwater pumping simulations show that that there is adequate groundwater in the Soda Mountain Valley to support construction and operation of the solar project without adversely affecting nearby wells or sensitive resources. The model scenarios included scenarios with use of one well and scenarios with use of three water supply wells; however, current plans are to have two or three extraction wells to provide adequate water supply and a backup well for reliability. The results of the single-well scenario indicate that a single well could support construction water demand with high-end recharge but would be inadequate under a low-end recharge and low-end hydraulic conductivity scenario. The simulations show that three wells would supply an adequate amount of water for construction under all scenarios. It is recommended that an aquifer test be completed after construction of the first well to assess hydraulic properties of the aquifer. If the hydraulic properties are towards the lower end of the modeled range, three wells should be constructed for project water supply. If the hydraulic properties are towards the upper end of the modeled range, only two wells would be needed for the project.

6.2 EFFECTS OF GROUNDWATER PUMPING

The proposed use of water for construction and operation of the project is within the safe yield of the Soda Mountain Valley (Panorama 2013). The low-end recharge rate of 376 AFY would exceed annual project water demand of 192 AFY for the 3 years of construction. The operation pumping of 33 AFY is also within the safe yield with the low-end recharge rate. Groundwater pumping simulations conducted using both the low-end and high-end recharge rates and hydraulic conductivity values indicate a decline in the groundwater table of less than 1 foot to approximately 2 feet at the nearest bedrock interface east of the wells after 3 years of construction and over the operational period of the project.

This groundwater level decline would attenuate over the 3 miles of bedrock between the project wells and Soda Springs and is expected to be negligible at Soda Springs. Moreover, model results indicate the outflow of groundwater from the Soda Mountain Valley northeast outlet would be reduced during construction and operation by 4.6 AFY or less due to groundwater use for the project. Groundwater outflow from the Soda Mountain Valley would return to pre-existing conditions after decommissioning of the project.

6.3 EFFECTS TO SODA SPRINGS AT ZZYZX

There are approximately 3 to 4 miles of bedrock separating the project groundwater wells from Soda Springs. A drawdown of 2.2 feet or less at the nearest bedrock interface is not expected to propagate to a distance of over 3 to 4 miles, particularly through the granitic and volcanic bedrock that comprises the South Soda Mountains. The presence of low permeability bedrock between Soda Springs and the project valley indicate that there would be no change in groundwater levels at Soda Springs as a result of 2.2 feet or less of drawdown at the bedrock interface on the west side of the South Soda Mountains. Modeling results presented in Section 4 indicate the reduction in groundwater flow out of the northeast outlet of the Soda Mountain Valley to a preferential flow path along the east face of the south Soda Mountains would be less than two percent of current outflow (reduction of approximately 4.6 AFY or less) under all model scenarios (Table 4). The analysis of local recharge presented in Section 5.1.3 showed that there is likely sufficient local recharge on the east side of the South Soda Mountains to support discharge at Soda Springs and current groundwater withdrawal at the Desert Studies Center. It is uncertain whether the outflow from the Soda Mountain Valley contributes to groundwater flow at Soda Springs or whether the source of groundwater for Soda Springs is entirely local recharge on the east side of the south Soda Mountains. The outflow from the Soda Mountain Valley may flow east towards the Soda Lake playa rather than south towards Soda Springs at Zzyzx.

Approximately 5.7 AFY of groundwater inflow are needed to balance the evapotranspiration rate in Soda Springs, and 32.5 AFY of groundwater pumping to support Lake Tuendae and groundwater use at the Desert Studies Center Barthel (2008). Assuming that outflow from the Soda Mountain Valley contributes to groundwater flow at Zzyzx, there is a surplus of over 100 AFY of groundwater needed to support current groundwater use at Zzyzx under all model scenarios (Table 6). The potential impact from the project groundwater pumping on Soda Springs would therefore not be measurable or discernible from baseline water level in the Springs.

Pumping of groundwater into Lake Tuendae, located close to Soda Springs, has apparently had no significant effect on spring flow. Barthel (2008) reports that 32.5 AFY of groundwater was pumped from a well in the alluvial aquifer during a 1-year period. During this period, there was no impact to the water level in Soda Springs, which is located approximately 800 feet from the well. This also indicates that the natural flow of groundwater to Soda Springs is robust (Barthel, 2008). The results of the revised groundwater modeling support the conclusion that potential impacts of groundwater extraction for the project on Soda Springs would be negligible.

7 RECOMMENDATIONS

The following measures were developed based on the results of groundwater modeling for the Soda Mountain Solar Project.

Groundwater 1: Soda Mountain Solar will construct a test well within observation wells and a distance observation well within the project ROW prior to project construction. The distance observation well shall be located approximately 1,000 feet from the test well and within the alluvial aquifer underlying the project site. The exact location of the test and observation wells will be determined by a professional hydrogeologist or geologist. A test plan will be submitted to San Bernardino County and BLM a minimum of 14 days prior to performing the aquifer test. The aquifer test shall be conducted upon completion of the test and observation wells for a minimum of 72-hours, or as determined by the professional hydrogeologist or geologist. During the aquifer test, groundwater shall be discharged from the test well at a rate of approximately 200gpm (equivalent to maximum project demand of 300,000 gpd). The necessary permit(s) shall be obtained from the Regional Water Quality Control Board prior to the discharge of groundwater.

Groundwater 2: The aquifer test data shall be analyzed by a professional hydrogeologist or geologist. The professional hydrogeologist or geologist will determine the number of project water supply wells required for the project by calculating the estimated drawdown in two wells using the actual aquifer parameters from the 72-hour aquifer test (see Groundwater 1, above) and the maximum pumping rate of approximately 300,000 gpd for a period of 3 years. If one or more of the wells are expected to run dry at the maximum pumping rate, a third well will be required for the project.

Groundwater 3: A water quality sample will be collected from the test well and analyzed for total dissolved solids (TDS) by a State of California certified laboratory. The results will be evaluated by the project engineer to determine the need for a reverse osmosis facility to treat the water for panel washing.

Groundwater 4: The groundwater model will be recalibrated using the measured aquifer properties resulting from the 72-hour aquifer test (see Groundwater 1, above). If the results of the recalibrated model indicate that reduction in outflow from the valley would be less than 50 AFY under proposed project conditions, then no further action will be taken. If the recalibrated model predicts reduced outflow from the northeast outlet of the Valley in excess of 50 AFY, Groundwater 5 will be implemented.

Groundwater 5: The Applicant will hire a professional hydrogeologist or geologist to develop a groundwater monitoring plan for submittal to and acceptance of BLM and San Bernardino County if the recalibrated model predicts reduced outflow from the northeast outlet of the

Valley in excess of 50 AFY, as described in Groundwater 4. The groundwater monitoring plan would include monitoring and quarterly reporting of groundwater levels within the Soda Mountain Valley, in the alluvial aquifer adjacent to Soda Springs at Zzyzx, and at Soda Springs at Zzyzx during construction of the project. If the project is shown to cause a decline in groundwater levels is 5 feet or more in the alluvial aquifer near Soda Springs or there is a decrease in groundwater discharge at Soda Springs that threatens the tui chub as a result of project groundwater withdrawal, an evaluation would be conducted to determine if the project is causing reduced groundwater discharge at Soda Springs. If it is determined that the project has caused a decrease in the volume of groundwater discharged at Soda Springs then the project shall curtail or, if necessary, cease withdrawal of groundwater and import a corresponding amount of water from outside of the Soda Mountain Valley.

Groundwater level measurements in the monitoring wells located in the Soda Mountain Valley would be compared to the model predictions on an annual basis during construction and every 5 years during project operation. The groundwater model would be recalibrated if the measured drawdown values in the monitoring wells exceed the predicted values by more than 15 percent. Monitoring would cease after 5 years of operational monitoring if two conditions are met:

- The monitoring data support the model predictions.
- The model predicts the reduction in outflow from the northeast outlet will be less than 50 AFY under proposed project conditions, as detailed in Groundwater 4.

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Appendix A

United States Department of the Interior

NATIONAL PARK SERVICE
Mojave National Preserve
2701 Barstow Road
Barstow, California 92311

RECEIVED
BUREAU OF LAND
MAIL ROOM
2012 NOV 27 AM 8:
CALIF. DESERT DISTRICT
MORENO VALLEY, CA

In Reply Refer To:
1.B. Temporary (long-term) (Formerly L3215) (MOJA)

November 21, 2012

Mr. Matthew Slowik
Senior Planner
San Bernardino County
Land Use Services Dept., Planning Division
385 N. Arrowhead Avenue, First Floor
San Bernardino, CA 92415-0182

Mr. Jeffrey Childers
Project Manager
Bureau of Land Management
California Desert District Office
22835 Calle San Juan de Los Lagos
Moreno Valley, CA 92553

Dear Mr. Slowik:

Dear Mr. Childers:

The National Park Service (NPS) appreciates the opportunity to comment on the Notice of Intent/Preparation (NOI/NOP) of the Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Soda Mountain Solar Project (project). NPS supports renewable energy projects on public lands as long as such projects can be constructed and operated in an environmentally responsible manner that serves the public interest, protects natural resources, and protects our treasured landscapes. It is the role of NPS to contribute to the process and the analysis of renewable energy projects to help ensure that they meet the Secretary's goal that such projects on public lands are "Smart from the Start." Our goal is to provide expertise and practical and specific feedback in order to avoid significant adverse impacts to the resources of Mojave National Preserve (Preserve).

NPS has reviewed the project description, location, and potential environmental effects as described in your NOI/NOP dated October 23, 2012, and October 26, 2012. Our comments are as follows:

NPS has significant concerns related to potential project impacts to two federally listed endangered species, one California species of special concern, loss of wildlife connectivity and potential habitat de-fragmentation, viewshed degradation, air quality, storm water management, and hydrogeology and groundwater. The proximity of the proposed Soda Mountain Solar Project to the Preserve is less than one mile. Direct and indirect impacts associated with the project have potential to impact park resources significantly that have been mandated by Congress in the Organic Act of 1916 and the California Desert Protection Act of 1994 (PL 103-433 §2) to be protected by the Preserve.

Hydrogeology and Groundwater

During construction, the project proponent intends to pump approximately 60 acre-feet per year followed by approximately 6 acre-feet per year for operations during the life of the project. The

Hydrogeologic Conditions and Groundwater Modeling Report (RMT Inc. 2011) submitted by the project proponent inadequately addresses potential impacts to the springs at Zzyzx that are habitat for the endangered Mohave tui chub. The report supports the proposal to pump groundwater from the alluvial sediments underlying the project site and lacks subsurface data from boreholes on groundwater levels or geologic formation properties. It assumes an overly high recharge rate for this low-elevation area, incorporates unsupported assumptions in the model, does not account for the possibility of permeable bedrock, and neglects to account for potentially adverse impacts to the springs at Zzyxz that are habitat for the endangered Mohave tui chub.

The groundwater flow model employed a distributed recharge rate ranging between 0.125 and 0.5 inches per year (3.5% - 14% of direct precipitation) and a recharge rate 26 times greater at the boundary nodes on the assumption that mountainous areas act as precipitation collectors and funnel precipitation directly into the subsurface. Based on these assumptions, total recharge was calculated at a range of 343 to 1,373 acre-feet per year (af/y) over an area of 33,000 acres. These assumptions likely substantially overestimate the actual recharge rate for the project area. For example, the Maxey-Eakin method commonly used for estimating recharge in this arid region, would predict about zero recharge at this low an elevation. Recharge efficiency (percent of total precipitation that enters the subsurface as aquifer recharge) for total annual precipitation in the range of 10 cm/year that occurs in the project area is likely less than 3% and probably closer to zero (Dettinger 1989). Other groundwater studies in the eastern Mojave Desert (e.g. Izbicki et al. 1995) show groundwater with carbon-14 dates in the range of 20,000 years before present; this indicates very low to no modern recharge. The model used to estimate impacts from groundwater pumping for this project (RMT Inc. 2011), however, simply assumed a recharge rate and used it to calibrate the parameters of a flow model with no actual measured formation properties for comparison or analyses of recharge using accepted methodologies. The baseline model assumes impermeable, no-flow boundaries in the Soda Mountains and underlying bedrock. The only subsurface data presented in the report, however, comes from an existing well in fractured bedrock, which does not support the assumption of impermeable bedrock. This well near Rasor was drilled to 760 feet and produces up to 1,500 gallons per day (RMT Inc. 2011).

The Soda Springs at Zzyzx lie less than one mile from the Soda Mountain Solar project site and include MC Spring, which is habitat for the source population of the endangered Mohave tui chub (*Siphateles mohavensis bicolor*). The Mohave tui chub is listed as endangered under both the federal Endangered Species Act and the California Endangered Species Act. The no-flow boundary assumptions used in the model preclude analyses of potential effects of groundwater pumping on this spring-fed habitat. For example, one possible source of recharge for Soda Springs is the mountains west of the project site. One possible flow path for this recharge is through the location of the proposed pumping, along the northerly end of the Soda Mountains, and then along the westerly edge of Soda Dry Lake following the permeable beach and colluvial sediments at the playa margin. Pumping at the proposed project location might extract groundwater that would otherwise discharge from the springs. Estimates of groundwater discharge at Zzyzx are in the range of 50 af/y (Barthel 2008), less than the amount proposed to be pumped by the project during the construction phase. The groundwater modeling report does not address this potential flow path, and data used to support the model are limited to surface electrical resistivity surveys. The groundwater modeling and analyses need to be based on actual field data, including recharge estimates obtained by accepted methods (e.g. chloride mass balance) and subsurface data from boreholes on groundwater levels and aquifer formation properties. Project analysis should consider alternatives to the water use described in the project proposal. The proponent should consider alternatives to groundwater pumping, such as use of dust palliatives, panel cleaning by air blowing, dust cloths, or other means.

For each facility site with a drainage system crossing it, the proponent should include a map identifying all surface water resources within the vicinity and include a narrative discussion of the delineation methods used to discern those surface waters in the field and what modifications would occur from project implementation. Specific information regarding the potential impacts to surface waters should be addressed, including both permanent and temporary impacts. Alternatives and mitigation measures to reduce and/or eliminate such impacts should be addressed. If impacts are unavoidable, then impacts need to be minimized, with the project designed such that it would maintain existing hydrologic features and patterns. All unavoidable impacts should be mitigated to ensure no net loss of function and value as the result of project implementation.

Storm water management needs to be considered as a significant component in the project design and implementation. In particular, storm water runoff collects into channels and natural drainage systems. Without adequate design, the consequences of combining these flows will likely be aggradation and head-cutting upstream of the confluence and channel incision, increased sediment transport, and eventual widening downstream of the confluence. The proponent needs to evaluate all potential storm water impacts, describe controls needed during construction, mitigation necessary for potential post-construction hydrologic impacts, and describe specific best-management practices that, when implemented, would reduce those potential impacts to insignificant levels. Where feasible, consideration should be given to design alternatives that maintain the existing hydrology of the site and/or redirect excess flows created by hardscapes and reduced permeability from surface waters to areas where they will dissipate by percolation into the landscape. All potential impacts associated with changes in drainage patterns, changes in water volume, velocity, quantity, quality, soil erosion and sedimentation in streams and water courses on or near the project site need to be modeled and analyzed. Mitigation measures to alleviate such impacts shall be included in the project proposal and environmental documents. The practice of channelizing, straightening, and lining streambeds would change a stream's hydrology by decreasing water storage capacity and increasing water flow velocity, and this, in turn, would lead to increases in the severity of peak discharges. These hydrologic changes can exacerbate flooding, erosion, scouring, and sedimentation, and could lead to loss of natural functions and values.

Biological Resources

The construction site for the proposed project includes desert tortoise habitat modeled by the U.S. Geological Survey to be high quality, in the range of 0.7 to 0.9 on a scale of 0 to 1 (Nussear et al. 2009). Recent population collapses, perhaps due to disease and/or drought (Tracy et al. 2004), make location of cryptic desert tortoises (*Gopherus agassizii*) even more difficult. Thus, absence of live tortoise observations during relatively brief field surveys, as reported by the project proponent, should not be used as justification for destruction of otherwise high-quality habitat as this would preclude the possibility for recovery of tortoise populations in the area and reoccupation of habitat.

The Soda Mountains are habitat for a recently established herd of desert bighorn sheep (*Ovis canadensis nelsoni*). This herd established itself at the Soda Mountains without human intervention with the source population unknown. Even in the absence of an active sheep population, however, the Soda Mountains are a high priority for desert bighorn sheep conservation (John Wehausen, personal communication, 2012) due to the presence of a number of significant bridges under Interstate 15 that serve as rare and important opportunities for gene flow between the northern and north-central bighorn sheep metapopulation segments (Epps et al. 2007). Construction of the proposed solar energy project would preclude desert bighorn sheep gene flow to the north under Interstate 15 as well as to the south with the population in the Cady Mountains. Further fragmentation of the habitat is likely to irreversibly harm the viability of species metapopulations. High mountain habitat is no longer adequate to support permanent populations of sheep (Bleich et al. 2005). All areas used by sheep, including the lower elevation habitat connecting mountain ranges, are essential for the long-term survival of the species.

The Soda Mountain Solar project might also impact other wildlife, including raptors, song birds, and bats. A two-year or longer inventory, depending on environmental conditions, utilizing accepted protocols is needed to identify all potentially impacted species. Modeling techniques should be used to estimate flight patterns and periods of use of birds and bats and to identify potential impacts and potential mitigations. The project should identify significant direct and indirect loss of plant and wildlife habitat from all aspects of the project, including installing towers, constructing, improving, or re-routing roads, burying lines, and constructing ancillary facilities. This analysis needs to identify impacts to all species during each season. Species should include locally unique species, rare natural communities, wetlands, threatened and endangered species, California threatened, endangered, and species of special concern. The inventory needs to list all species present in the project area and include a distribution map with potential migratory and dispersal routes. It should demonstrate how the project will affect wildlife and plant distributions under each alternative. The analysis needs to address the potential loss of wildlife connectivity, include impacts from non-native and invasive plants, and address the association of invasive plants with disturbance, including the cumulative effects of the Rasor Off-Highway Vehicle Area and other disturbed areas.

The project proponent needs to develop a salvage plan for any special-status plants or species associated with habitat loss in the project area. Plant salvage needs to address, at a minimum, location of the mitigation site, plant species, schematic of the mitigation area, schedule, exotic vegetation control, planned monitoring, and plans for long-term conservation of the mitigation site.

Physical Resources

Mojave National Preserve is renowned for its dark night skies. NPS manages the Preserve to protect this valued and increasingly rare resource. The General Management Plan for the Preserve identifies as a resource protection goal "to partner with communities and local government agencies to minimize reflected light and artificial light intrusion on the dark night sky". All exterior lighting should comply with International Dark-Skies standards and should be hooded to prevent light from shining up into the sky and shielded and directed to aim it at the places where it is needed to prevent light from spilling off the site. Low-pressure sodium lamps and fixtures of a non-glare type are required.

Potential impacts to all visual and natural sound need to be evaluated and analyzed. The scenic vistas associated with Mojave National Preserve are considered unique, as described in the California Desert Protection Act of 1994 (PL 103-433 §2). An assessment of visual impacts must include analyses of scenic vistas from specific key observation points, both towards the Preserve and from the Preserve towards the project site. In order to protect the natural soundscapes of Mojave National Preserve, analyses are needed of noises created during both the construction and operation phases of the project, including timing, intensity, duration, frequency spectrum, and impacts to both people and wildlife. Soundscape assessment needs to address the number of vehicle trips per day for delivering personnel, equipment, and supplies to the project during both construction and operational phases of the project. Construction and operation traffic could affect wildlife, soundscapes, and air quality. A traffic study needs to address project impacts to the roads and surrounding environment and to address mitigation measures needed to reduce the impacts. Such analysis should be consistent with the California Department of Transportation's Guide for the Preparation of Traffic Impact Studies.

An analysis of ambient air quality according to the National Ambient Air Quality Standards is needed, including potential air quality impacts of the proposed project (cumulative and indirect impacts). The analysis needs to identify all potential impacts from temporary or cumulative degradation of air quality. It should describe and estimate air emissions from potential construction and maintenance activities and propose avoidance or minimization measures. Emission sources should be identified by pollutant from mobile sources, stationary sources, and ground disturbance. The environmental analyses should include a Construction Emissions Mitigation Plan that addresses degradation of air quality and wilderness values.

A Fugitive Dust Control Plan should be prepared. Dust is the primary source of PM-10 (Particulate Matter 10 microns or smaller) pollution in the Mojave Desert. The environmental analyses needs to model the sources of dust that presently occur from the project area, then show their timing, duration, and transport on- and off-site. Modeling should also identify variations during construction and operational phases of the project for each alternative. Human health and the environment of sensitive receptors should be protected during any construction or demolition activities. If necessary, a health risk assessment should be conducted to determine if there are, have been, or will be, any releases of hazardous materials that might pose a risk to human health or the environment.

Cumulative Impacts

Direct and indirect cumulative impacts need to be analyzed as they apply to both the project site and the greater vicinity. Plans for past, present, and anticipated future projects should all be analyzed relative to their impacts to Mojave National Preserve.

The Soda Mountain Solar project has potential for causing significant impacts to Mojave National Preserve. Potential impacts include decreased spring discharge at Zzyzx as a consequence of groundwater pumping, loss of habitat for the endangered Mohave tui chub, loss of high-quality desert tortoise habitat, increased habitat fragmentation for desert bighorn sheep, and loss of important conservation opportunities. In addition, there are potential impacts from the project to air quality, storm water management, and scenic vistas. We believe that the environmental analysis of these potential impacts has been inadequately addressed in the documents provided by the project proponent.

If you have any questions, feel free to contact Mr. Ted Weasma at (760) 252-6106 or at ted_weasma@nps.gov.

Sincerely,

Stephanie R Dubois

Stephanie R. Dubois
Superintendent

cc:
Greg Miller, BLM, California Desert District
Teri Raml, BLM, California Desert District
Katrina Symons, BLM Barstow Field Office
Sarah Quinn, NPS WASO
Amee R. Howard, NPS PWR
Alan Schmierer, NPS PWR

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APPENDIX H-4
Sensitivity Analysis

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Groundwater Modeling Sensitivity Analysis

Soda Mountain Solar Project

BLM Case No. CACA 49584

August 2014

Groundwater Modeling Sensitivity Analysis

Soda Mountain Solar Project

BLM Case No. CACA 49584

Submitted by:

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1 INTRODUCTION

1.1 OVERVIEW

Soda Mountain Solar, LLC (SMS), proposes to construct, operate, maintain, and decommission the Soda Mountain Solar Project (project), which would be located in the Soda Mountain Valley in San Bernardino County, California, about 6 miles southwest of the Town of Baker (Figure 1.1-1). The proposed project would include withdrawal of approximately 192 acre-feet per year (AFY) of groundwater during a 24- to 30-month construction period and approximately 33 AFY during project operation. A groundwater flow model was developed for the project and presented in *Hydrogeologic Conditions and Groundwater Modeling Report* (RMT 2011) and *Hydrogeologic Conditions and Groundwater Modeling Report Addendum* (TRC 2013).

A groundwater modeling sensitivity analysis has been prepared to address National Park Service (NPS) and U.S. Geological Survey (USGS) comments on the groundwater flow model prepared by SMS. The sensitivity analysis incorporates a broad range of hydraulic conductivity values (0.2 feet/day [ft/day] to 20 ft/day) to reflect the potential for lower or higher recharge in the project area. The sensitivity analysis utilizing an analytical model also expands the model domain by excluding the limitations imposed by the bedrock present in the mountains that bound the valley in which the project would be located. The analysis provides a very conservative assessment of potential impacts to water resources within the Mojave National Preserve, located just east of the project area, and incorporates the range of hydraulic conductivity values that could characterize water-bearing sediments in the Soda Mountain Valley.

1.2 BACKGROUND

NPS and others have expressed concerns about potential impacts from project groundwater withdrawal in the Soda Mountain Valley on MC Spring (also referred to as Zzyzx Spring and Soda Spring) at the Desert Studies Center (DSC), which is located approximately 4 miles east of the eastern project boundary. MC Spring supports a population of Mohave tui chub (*Gila bicolor mohavensis*), which is a federal- and state-listed endangered species. SMS and NPS prepared separate groundwater models to assess the potential for the project to impact MC Spring.

The Department of the Interior requested that USGS conduct an independent evaluation of the SMS-prepared groundwater modeling reports and the NPS groundwater model. Keith Halford of USGS reviewed the groundwater flow models and provided comments in a June 30, 2014, letter to the Bureau of Land Management (BLM) (Halford 2014a). Mr. Halford concluded that the results of both models showed that construction and operational water use for the proposed project will "not measurably affect discharge from the Zzyzx area because a considerable volume of groundwater storage exists between the proposed production wells and the Zzyzx area"(Halford 2014a). USGS suggested that recharge and the associated values of hydraulic conductivity were likely overestimated in the SMS model. On a related note, BLM has directed SMS to conduct an aquifer test to define the aquifer parameters in the valley, including hydraulic conductivity. The aquifer test will be performed by September 2014, and resultant aquifer parameters will be used to test the assumptions used in the SMS model and recalibrate the numerical groundwater flow model, if appropriate.

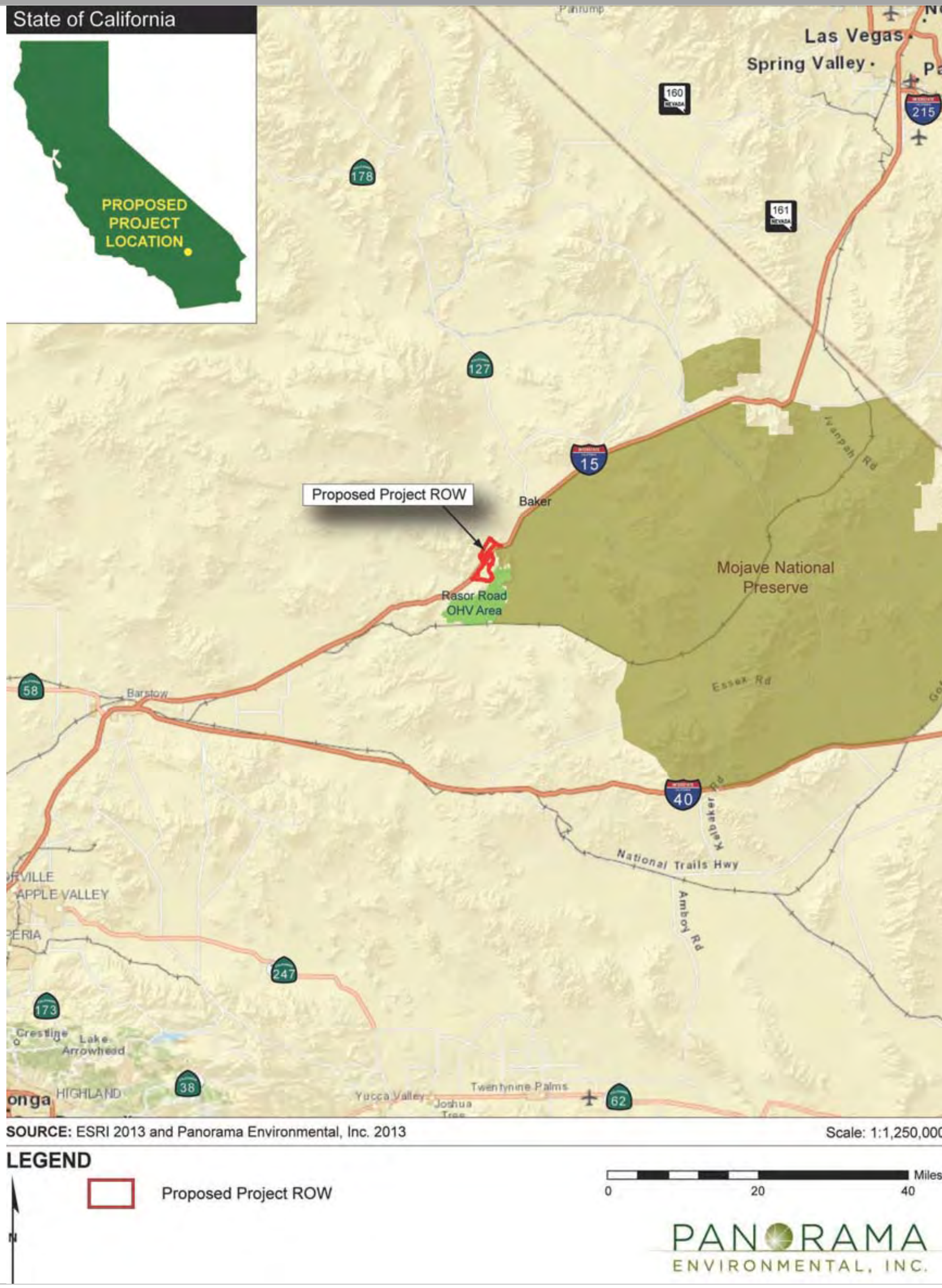
1.3 SENSITIVITY ANALYSIS OBJECTIVES

A sensitivity analysis is commonly performed in mathematical modeling to assess the sensitivity of the model results to individual model parameters. Sensitivity analyses are effective in assessing the robustness of model outcomes in situations where there is uncertainty about the model parameters.

SMS performed a sensitivity analysis using an analytical model to assess the sensitivity of the groundwater model predicted outcome at MC Spring to different values of hydraulic conductivity (and associated recharge). This sensitivity analysis addresses USGS comments regarding the potential overestimation of recharge and hydraulic conductivity by using a wider range including much lower values of recharge and hydraulic conductivity. The objectives of the sensitivity analysis were to:

1. Evaluate the impact of a larger range of values for recharge (R) and hydraulic conductivity (K) on the model outcomes at MC Spring
2. Expand the model domain to include MC Spring
3. Provide a conservative estimate of potential impacts in the Zzyzx area by assuming permeability in the mountain bedrock is equivalent to the permeability of the basin fill sediments

Figure 1.1-1: Project Location



2 GROUNDWATER MODELS

2.1 CONCEPTUAL MODEL

A conceptual model, as used in the analysis presented herein, is a written and/or illustrative (i.e., qualitative) description of an aquifer. The conceptual model for the project describes the physical characteristics of the aquifer that control the flow of groundwater in the Soda Mountain Valley and is based on knowledge of site geology and hydrogeology, as well as established concepts of groundwater flow and geology (e.g., effects of fractures, faulting, and topography on groundwater flow regimes). The conceptual site model is a dynamic model that is adapted and refined as additional data on site aquifer characteristics are collected. The conceptual model supports scientific and technical decisions for the site.

2.1.1 Geology and Hydrogeology

The project area is located within a valley that is mostly separated from the Soda Lake groundwater basin to the east by low-permeability volcanic and granitic bedrock. Inflow to the basin consists of recharge from precipitation. Groundwater inflow from other basins is expected to be minimal due to the presence of low-permeability bedrock surrounding the basin to the north and west. Groundwater flows out of the basin to the Soda Lake groundwater basin at two locations:

1. East of the proposed North Array at the approximate location where I-15 traverses through the mountains
2. East of the southeast corner of the proposed South Array

The conceptual model was developed using geologic mapping, groundwater data from other wells in the region, topographic data, and geophysical data from three locations in the project area (TerraPhysics 2010). Groundwater is present in an unconfined, alluvial aquifer. The alluvium is underlain by bedrock. Geophysical data indicate that groundwater is present approximately 150 to 300 feet below ground surface (bgs) and bedrock is present approximately 350 to 500 feet bgs throughout much of the valley and thins on the valley sides as bedrock elevation rises. Groundwater elevations in the Soda Mountain Valley are approximately 200 to 300 feet higher than groundwater elevations at Soda Lake, indicating the presence of low-permeability bedrock. Flow through the bedrock is expected to be minimal relative to flow through the more permeable basin-fill sediments.

2.1.2 Assumptions and Potential Limitations of Conceptual Model

The conceptual model assumes:

- The only input to groundwater is recharge from rainfall

- There is no permeability or flow through the bedrock into or out of the basin

The Soda Mountain Valley is generally separated from the rest of the Soda Lake groundwater basin by mountains to the south and east. The higher topographic and groundwater elevations in the valley relative to the rest of the basin indicate that there is no groundwater flow from the larger groundwater basin into the Soda Mountain Valley aquifer. The aquifer is, for the most part, physically separated from the Soda Lake groundwater basin by mountains that surround the valley and by higher groundwater elevations. Therefore, the sole input to groundwater recharge is rainfall.

Geologic mapping of the basin shows faulting in the north-south direction east of the proposed North Array. NPS asserts that there may be a preferential flow path along the west margin of the Soda Lake playa. Any flow through fractures in the bedrock is considered to be minimal and was not considered as a source of water to the Soda Mountain Valley nor to MC Spring at Zzyzx in the conceptual model.

2.2 NUMERICAL MODEL

A numerical model is a quantitative representation of the flow regime within an aquifer that is used to simulate and predict aquifer conditions. It provides quantitative predictions of how an aquifer will respond to a specific scenario (e.g., groundwater withdrawal at a given extraction rate). The model predictions are generated using groundwater flow equations based on the physics of groundwater flow. Numerical models are more robust when they use site-specific aquifer parameters as input parameters. The conceptual model is one of the sources used to develop the parameters for the numerical model.

A three-dimensional groundwater flow model was used to simulate groundwater conditions under steady-state and pumping scenarios. The numerical model used a single layer representing an unconfined aquifer. The results of the geophysical survey suggest that the entire thickness of unconsolidated sediments below the water table can be considered a single hydrologic unit, justifying the use of a single-layer model. No significant low-permeability layers such as clays or caliche units were found below the water table, based on geophysical survey results.

2.2.1 Model Inputs

Table 2.2-1 summarizes the selected aquifer parameters used in the numerical groundwater model.

Table 2.2-1: Selected Aquifer Parameters Used in Numerical Groundwater Model

Parameter Set Name	Hydraulic Conductivity (K) (ft/day)	Groundwater Recharge (R) (inches/year)	Storage Coefficient (unitless)
High End	3.2	0.4	0.1
Low End	0.86	0.12	0.1

Note: Values given are for main body of model domain. Nodes at the model boundaries have higher R values. Nodes near the northeast and southeast outlets have higher K values.

2.2.2 Results

The effects of pumping one or three water supply wells at the rate needed for construction and operation were evaluated by conducting transient flow simulations. Transient flow simulations take into account the change in hydraulic heads over time in a dynamic condition of pumping, where the cone of depression spreads downward and outward over time. Simulations were conducted using calibrated high-end and low-end values. The model grid spacing was refined in the vicinity of a simulated well to as small as 1 foot so that a more accurate estimate of drawdown in the well itself could be obtained. Drawdown data generated by the model at three potential well locations (PW-1, PW-2, and PW-3; Figure 2.2-1) are presented in Table 2.2-2.

Table 2.2-2: Summary of Modeling Results at Each Simulated Well[1]

Scenario	Predicted Drawdown Near PW-1 (ft)	Predicted Drawdown Near PW-2 (ft)	Predicted Drawdown Near PW-3 (ft)
3 Wells, 3 Years, High End	28	20	25
3 Wells, 30 Years, High End	5	4	5
3 Wells, 3 Years, Low End	110	68	91
3 Wells, 30 Years, Low End	16	12	15
1 Well, 3 Years, High End	N/A[2]	N/A	80
1 Well, 30 Years, High End	N/A	N/A	13
1 Well, 3 Years, Low End	N/A	N/A	Dry
1 Well, 30 Years, Low End	N/A	N/A	Not Modeled

Notes:

[1] Model predicts declines in hydraulic head and does not account for well loss (head losses due to friction flowing through the well screen). Actual drawdown in the well is expected to be greater due to well loss.

[2] "N/A" indicates the well was not included in the single-well scenario.

The results of the modeling show that it is possible to extract groundwater at the rate needed to supply the project using three wells with low-end conductivity and recharge and using one well with high-end recharge and conductivity.

The model-predicted declines in groundwater were used to extrapolate the predicted reduction in outflow from the valley. The model-predicted decline in water levels at the valley outlets were less than 1 foot in all scenarios. The estimated reduction in outflow out of the northeast outlet is presented in Table 2.2-3.

Figure 2.2-1: Potential Well Locations

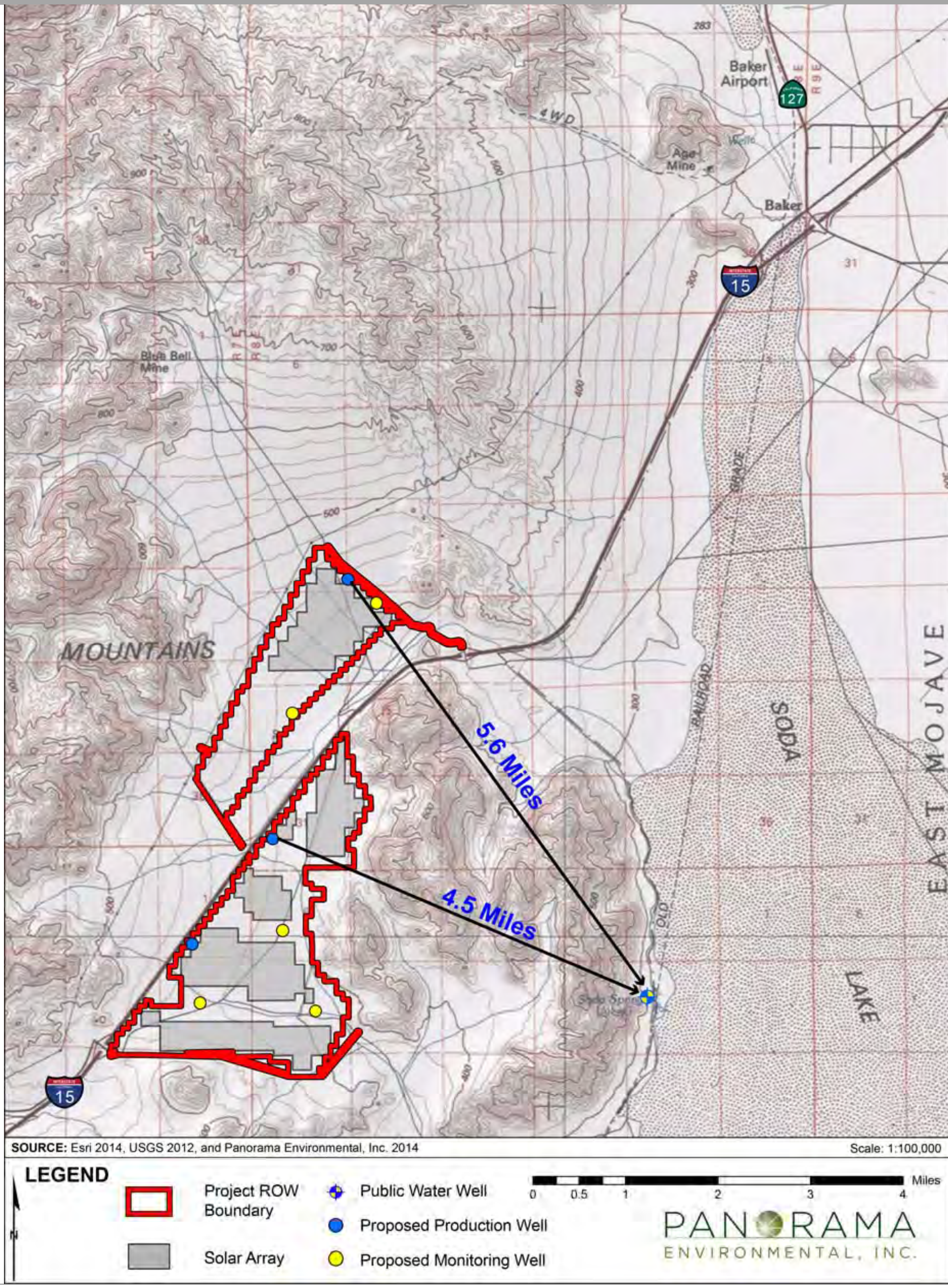


Table 2.2-3: Groundwater Discharge at Northeast Outlet of Soda Mountain Valley

Model Scenario	Discharge (AFY) After 3 Years	Reduction (AFY)	Discharge (AFY) After 30 Years	Reduction (AFY)
High Recharge, Current Conditions	**424.8**	**N/A**	**424.8**	**N/A**
High Recharge, 3 Wells	422.2	2.6	420.2	4.6
High Recharge, 1 Well	424.8	ND	424.3	0.5
Low Recharge, Current Conditions	**121.2**	**N/A**	**121.2**	**N/A**
Low Recharge, 3 Wells	121.2	ND	118.9	2.3

Notes:
N/A= Not Applicable; there is no reduction in outflow for the calibrated model of current conditions
ND = Not detectable; no change from existing conditions was measured by the model

The estimated reduction of outflow of 2.3 to 4.6 AFY is less than 2 percent of current outflow (121 AFY) for the low-recharge scenario and approximately 1 percent of the high-recharge scenario (425 AFY). The potential reduction in outflow from the valley over 30 years of water use is not measurable relative to uncertainty in the model and existing variability.

2.2.3 Assumptions and Potential Limitations of Numerical Model

Model assumptions and a brief discussion of the limitations for each assumption are presented in Table 2.2-4.

Table 2.2-4: Numerical Model Assumptions and Limitations

Model Assumption	Limitation
The model domain includes the Soda Mountain Valley and does not extend to Soda Lake	Impacts to MC Spring at Zzyzx cannot be directly measured because MC Spring is not included in the model domain. Instead the model evaluates if drawdown is significant at the edges of the valley.
A no-flow boundary was assigned to the Soda Mountains east of the project area	The model does not include any flow through the Soda Mountains. Geologic maps indicate the mountains are composed of crystalline bedrock; no major faults are known to exist there, and hydraulic conductivity is likely to be extremely low.
Recharge is assumed to be 3 to 10 percent of rainfall	The recharge and hydraulic conductivity in the valley may not be reflected in the model range.
The storage coefficient is 0.1 in all scenarios	The model may not reflect the actual volume of water in storage. However the storage coefficient used is at the conservative (low) end of the range of typical values.
The aquifer is assumed to be unconfined and homogeneous	Variability in the hydraulic conductivity is not reflected in the model. However, a large range of values thought to encompass a reasonable range of values (based on borehole and geophysical data) was used.

The numerical model was constructed using geophysical data collected in the valley. No groundwater wells have been constructed within the Soda Mountain Valley and therefore model values for hydraulic conductivity, storage coefficient, depth to groundwater, and thickness of saturated alluvium have not yet been confirmed by direct field measurement. A range of conductivity values was used in the model to account for the expected range of recharge in the valley aquifer. USGS commented that the low-end recharge and conductivity values are too high for the Soda Mountain area based on recharge rates from the Death Valley regional flow system (Hevesi et al. 2003).

3 ANALYTICAL MODEL SENSITIVITY ANALYSIS

3.1 METHODOLOGY

A sensitivity analysis was conducted using the Theis method (Theis 1935) to test the sensitivity of the predicted outcome at MC Spring to variations in hydraulic conductivity. The Theis equation is a two-dimensional model of groundwater flow to a point source in an infinite, homogeneous aquifer. It is used in hydrogeology to predict groundwater level (unconfined aquifer) or hydraulic head (confined aquifer) declines at distances from a pumping well.

The Theis equation was not adjusted for the presence of lower-permeability bedrock in the mountains east of the Soda Mountain Valley. The model therefore provides a conservative estimate of groundwater declines on the east side of the Soda Mountains by assuming that the geologic unit within the Soda Mountains is as permeable as the basin fill in the Soda Mountain Valley, and that groundwater declines will radiate outward at the same rate within the mountain bedrock as within the basin fill.[1] This is an extremely conservative assumption because the Soda Mountains are composed of granitic rocks that are impermeable except for limited fractures.

Hydraulic conductivity and recharge values used in the sensitivity analysis are presented in Table 3.1-1. The low-end value represents a recharge rate of 0.6 percent of rainfall and the high-end value represents a recharge rate of 50 percent of rainfall. The low-end value of 0.6 percent is identical to the low-end value for recharge that was suggested by USGS and is based on a value for the hydrologically similar Valjean Valley. The high-end value is about two orders of magnitude (83 times) higher than the low-end value. This wide range of values allows for an assessment of whether the model outcome is affected by vastly different values of hydraulic conductivity.

The proposed wells would be located in a valley that is underlain by an alluvial aquifer. Alluvium covers an area of approximately 12,632 acres within the valley. The storage coefficient is assumed to be 0.1, identical to that used for the numerical model, and a reasonable and

[1] The Theis method also provides a conservative assessment of drawdown in the Town of Baker. Baker is farther from the project area than MC Spring and impacts are predicted to be even less at a farther distance from the wells.

Table 3.1-1: Recharge and Conductivity Values Used in Sensitivity Analysis

Parameter Value Set	Hydraulic Conductivity (feet/day)	Groundwater Recharge (inches/year)
Original Low-End	0.86	0.12
New Low-End	0.17	0.024
Original High-End	3.2	0.4
New High-End	16	2

conservative value to use for unconfined aquifers, which typically have storage coefficients between 0.1 and 0.3 (Lohman 1972).

Total water demand used in the model over the maximum 3-year construction period was estimated to be approximately 576 acre-feet (AF) (192 AFY over 3 years). Total water demand over the 30-year operational period was estimated to be approximately 990 AF (33 AFY over 30 years).

3.2 RESULTS

The results of the sensitivity analysis are presented in Table 3.2-1. Detailed calculations are presented in Appendix A. The maximum estimated drawdown at MC Spring is 0.061 feet under the high-end scenario. The maximum estimated drawdown at MC Spring is 0.0015 feet under the low-end scenario, and would be at the limit of detection. The impact at MC Spring decreases in proportion to the reduction in recharge and conductivity. If recharge and conductivity in the Soda Mountains were less than the low-end values used in this sensitivity analysis, the potential for impact at MC Spring would be even less.

Table 3.2-1: Sensitivity Analysis Results

Hydraulic Conductivity Value (ft/day)		Predicted Drawdown at MC Spring (ft) after 3 Years of Construction	Predicted Drawdown at MC-Spring (ft) after 30 Years of Operation	Total Predicted Drawdown at MC Spring (ft)
Original Low End	0.86	<0.00025	<0.000044	<0.00029
New Low End	0.17	<<0.0013	<<0.00022	<<0.0015
Original High End	3.2	<0.000068	0.0037	0.0037
New High End	16	<0.000043	0.061	0.061
	Range	**<0.000043 to <<0.0013**	**<<0.00022 to 0.061**	**<<0.0015 to 0.061**

Notes:

The well function (W(u)) for the Theis equation was approximated using published tables for values of *u* (dimensionless time parameter). Where there was no exact value of *u*, < indicates that the value is lower than the value *u* and << indicates that the value is much lower than the nearest value of *u* available. See Appendix A for details.

3.3 SUMMARY

The results of the sensitivity analysis indicate that the potential impacts at MC Spring are not sensitive to variations in hydraulic conductivity and recharge. The project is not likely to affect MC Spring given any range of values of hydraulic conductivity and recharge because (1) there is approximately 4.5 miles between the nearest proposed project well and MC Spring, (2) the duration of construction, during which water use will be high, is only 3 years (maximum), and (3) the proposed volume of water to be used during the 30-year operational period (33 AFY) is small relative to the volume of water in storage and the distance to MC Spring.

The model results are very conservative because the model approach assumed that the bedrock separating the Soda Mountain Valley from MC Spring was as permeable as the basin fill. The predicted reduction in groundwater flow and groundwater levels at MC Spring were minimal under all modeled scenarios and demonstrate that the project will not affect the Mohave tui chub because the small potential reduction in water surface elevation (conservatively predicted at a maximum of 0.061 feet, which is less than 1/10 of 1 foot) will not adversely impact Mohave tui chub habitat suitability.

The sensitivity analysis results demonstrate that the proposed groundwater well test results will not change the analysis of impacts at MC Spring. The information provided in this report and in previous modeling reports provide evidence of the limited potential for impact at MC Spring.

SMS has also developed a Groundwater Monitoring and Mitigation Plan that includes the following measures to ensure impacts to MC Spring would not occur as a result of project groundwater withdrawal:

- **Groundwater monitoring within Soda Mountain Valley:** SMS will implement a groundwater monitoring program within the Soda Mountain Valley that will serve as an early warning system. If drawdown at the monitoring wells exceeds predicted values by 20 percent or more, the groundwater model will need to be recalibrated. If the recalibrated model predicts that outflow from the valley would decrease by more than 20 percent from existing conditions, SMS will need to curtail pumping to a safe extraction rate.
- **Groundwater monitoring at MC Spring:** Implementation of a groundwater monitoring program at MC Spring would allow for identification of drawdown effects at the spring. The monitoring program would involve collection of background water level data at the spring to provide information on static, non-pumping conditions. Background data would also provide information on the magnitude of water level variations that occur in the spring under normal conditions. After pumping is initiated the spring would continue to be monitored for changes in water levels. Water level data would be regularly analyzed by a qualified professional hydrologist or hydrogeologist to identify if project groundwater pumping is adversely affecting the spring.
- **Groundwater extraction activities assessment and revision:** The groundwater extraction activities being performed at the project site would be evaluated and possibly revised to minimize effects to the spring if the action thresholds at monitoring wells in

the valley and at the spring are triggered. This may involve discontinuation of or reduced use of wells that may have an effect on spring water levels (i.e., those closer to the eastern project boundary).

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Appendix A: Drawdown Calculations

Objective: Calculate potential drawdown at the Desert Studies Center due to pumping for the proposed Soda Mountain Solar project, assuming there are no hydraulic barriers from the Soda Mountains that form the eastern flank of Soda Mountain Valley.

Approach: Use Theis solution (Theis 1935) to calculate drawdown over time and distance, with assumption of uniform hydraulic conductivity and infinite aquifer (no hydraulic boundaries).

Drawdown ($h_o - h$) can be calculated using the Theis Equation:

$$h_o - h = \frac{Q}{4\pi T} W(u)$$

where h_o is the head at time t=0, h is the head at time t, Q is the pumping rate, and T is the transmissivity. The transmissivity is calculated using the following approximation that assumes uniform aquifer thickness and uniform horizontal conductivity:

$$T = Kb$$

where K is the hydraulic conductivity and b is the aquifer saturated thickness. The well function $W(u)$ can be approximated using published tables of values for values of u, which are calculated according to the following equation:

$$u = \frac{r^2 S}{4Tt}$$

where r is the distance to the closest well and S is the storage coefficient.

S = 0.1 (TRC 2013; typical value)

r = 4.5 miles (closest distance from production well to Desert Studies Center)

b = 100 ft (approximate at well location, based on geophysical measurements)

Q_1 = 192 AFY for t = 3 yrs

Q_2 = 33 AFY for t = 30 yrs

Calculations were performed using two different transmissivities, reflecting the upper and lower estimates for the hydraulic conductivity:

K_1 = 3.2 ft/d

K_2 = 0.86 ft/d

High-end K Case: Let K_1 = 3.2 ft/d

$$T_1 = K_1 b = (3.2\,\text{ft/d})(100\,\text{ft}) = 320\,\text{ft}^2/\text{d}$$

Q_1 = 192 AFY = 22,914 ft^3/d for t_1 = 3 yrs

$$u = \frac{r^2 S}{4T_1 t_1} = \frac{[(4.5\text{miles})(5280\text{ft/mile})]^2 * 0.10}{(4)(320\,\text{ft}^2/\text{d})(3\text{yrs})(365\text{d/yr})} = 40.3$$

$W(u) < 0.000012$ (Table 8.1, Freeze & Cherry, 1979, p318)

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{22{,}914\,\text{ft}^3/\text{d}}{(4)(\pi)(320\,\text{ft}^2/\text{d})} * (< 0.000012)$$

$$h_o - h < 0.000068\,\text{ft}$$

Q_2 = 33 AFY = 3,938 ft^3/d for t_2 = 30 yrs

$$u = \frac{r^2 S}{4T_2 t_2} = \frac{[(4.5\text{miles})(5280\text{ft/mile})]^2 * 0.10}{(4)(320\,\text{ft}^2/\text{d})(30\text{yrs})(365\text{d/yr})} = 4.03$$

$W(u) = 0.0038$ (Table 8.1, Freeze & Cherry, 1979, p318)

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{3{,}938\,\text{ft}^3/\text{d}}{(4)(\pi)(320\,\text{ft}^2/\text{d})} * (0.0038)$$

$$h_o - h = 0.0037\,\text{ft}$$

Total drawdown = drawdown after t_1 = 3 yrs + drawdown after t_2 = 30 years

= <0.000068 ft + 0.0037 ft

Total possible drawdown = 0.0037 ft

Low-end K Case: Let K_2 = 0.86 ft/d

$$T_2 = K_2 b = (0.86\,\mathrm{ft/d})(100\ \mathrm{ft}) = 86\,\mathrm{ft}^2/\mathrm{d}$$

Q_1 = 192 AFY = 22,914 ft^3/d for t_1 = 3 yrs

$$u = \frac{r^2 S}{4T_2 t_1} = \frac{[(4.5\mathrm{miles})(5280\mathrm{ft/mile})]^2 * 0.10}{(4)(86\,\mathrm{ft}^2/\mathrm{d})(3\mathrm{yrs})(365\mathrm{d/yr})} = 150$$

$W(u) < 0.000012$ (Table 8.1, Freeze & Cherry, 1979, p 318)

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{22{,}914\,\mathrm{ft}^3/\mathrm{d}}{(4)(\pi)(86\,\mathrm{ft}^2/\mathrm{d})} * (< 0.000012)$$

$$h_o - h < 0.00025\ \mathrm{ft}$$

Q_2 = 33 AFY = 3,938 ft^3/d for t_2 = 30 yrs

$$u = \frac{r^2 S}{4T_2 t_2} = \frac{[(4.5\mathrm{miles})(5280\mathrm{ft/mile})]^2 * 0.10}{(4)(86\,\mathrm{ft}^2/\mathrm{d})(30\mathrm{yrs})(365\mathrm{d/yr})} = 14.98$$

$W(u) < 0.000012$ (Table 8.1, Freeze & Cherry, 1979, p318)

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{3{,}938\,\mathrm{ft}^3/\mathrm{d}}{(4)(\pi)(86\,\mathrm{ft}^2/\mathrm{d})} * (0.0038)$$

$$h_o - h < 0.000044\ \mathrm{ft}$$

Total drawdown = drawdown after t_1 = 3 yrs + drawdown after t_2 = 30 years

= <0.00025 ft + <0.000044 ft

Total possible drawdown < 0.00029 ft

Sensitivity Testing - Extreme Ends of K Range Analysis

Assume for the Highest-end Case K = 5 times the High-end Case K, and for the Lowest-end Case, K = 1/5 of the Low-end K value.

Highest-end K: Let K = 5 x 3.2 ft/d = 16 ft/d

$$T_2 \;=\; K_2 b \;= (16\ \text{ft/d})(100\ \text{ft}) = 1600\ \text{ft}^2/\text{d}$$

Q_1 = 192 AFY = 22,914 ft^3/d for t_1 = 3 yrs

$$u = \frac{r^2 S}{4T_2 t_1} = \frac{[(4.5\text{miles})(5280\text{ft/mile})]^2 * 0.10}{(4)(1600\ \text{ft}^2/\text{d})(3\text{yrs})(365\text{d/yr})} = 8.05$$

$$W(u) = 0.000038 \text{ (Table 8.1, Freeze \& Cherry, 1979, p 318)}$$

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{22{,}914\ \text{ft}^3/\text{d}}{(4)(\pi)(1600\ \text{ft}^2/\text{d})} * (0.000038)$$

$$h_o - h = 0.000043\ \text{ft}$$

Q_2 = 33 AFY = 3,938 ft^3/d for t_2 = 30 yrs

$$u = \frac{r^2 S}{4T_2 t_2} = \frac{[(4.5\text{miles})(5280\text{ft/mile})]^2 * 0.10}{(4)(1600\ \text{ft}^2/\text{d})(30\text{yrs})(365\text{d/yr})} = 0.81$$

$$W(u) < 0.31 \text{ (Table 8.1, Freeze \& Cherry, 1979, p318)}$$

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{3{,}938\ \text{ft}^3/\text{d}}{(4)(\pi)(1600\ \text{ft}^2/\text{d})} * (0.31)$$

$$h_o - h = 0.061\ \text{ft}$$

Total drawdown = drawdown after t_1 = 3 yrs + drawdown after t_2 = 30 years

= <0.000043 ft + <0.061 ft

Total possible drawdown < 0.061 ft

Lowest-end K Case: Let K_4 = 0.17 ft/d

$$T_2 = K_2 b = (0.17\ \text{ft/d})(100\ \text{ft}) = 17\ \text{ft}^2/\text{d}$$

Q_1 = 192 AFY = 22,914 ft^3/d for t_1 = 3 yrs

$$u = \frac{r^2 S}{4T_2 t_1} = \frac{[(4.5\text{miles})(5280\text{ft/mile})]^2 * 0.10}{(4)(17\ \text{ft}^2/\text{d})(3\text{yrs})(365\text{d/yr})} = 758$$

$W(u) \ll 0.000012$ (Table 8.1, Freeze & Cherry, 1979, p 318)

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{22{,}914\ \text{ft}^3/\text{d}}{(4)(\pi)(17\ \text{ft}^2/\text{d})} * (\ll 0.000012)$$

$$h_o - h \ll 0.0013\ \text{ft}$$

Q_2 = 33 AFY = 3,938 ft^3/d for t_2 = 30 yrs

$$u = \frac{r^2 S}{4T_2 t_2} = \frac{[(4.5\text{miles})(5280\text{ft/mile})]^2 * 0.10}{(4)(17\ \text{ft}^2/\text{d})(30\text{yrs})(365\text{d/yr})} = 75.8$$

$W(u) \ll 0.000012$ (Table 8.1, Freeze & Cherry, 1979, p318)

$$h_o - h = \frac{Q}{4\pi T} W(u) = \frac{3{,}938\ \text{ft}^3/\text{d}}{(4)(\pi)(17\ \text{ft}^2/\text{d})} * (\ll 0.000012)$$

$$h_o - h \ll 0.00022\ \text{ft}$$

Total drawdown = drawdown after t_1 = 3 yrs + drawdown after t_2 = 30 years

= <<0.0013 ft + <<0.00022 ft

Total possible drawdown << 0.0015 ft

Discussion

The conceptual model for the site is that the Soda Mountains, which form a crystalline intrusive bedrock mass at the eastern wall of the Soda Mountain Valley, serve as a hydraulic barrier to flow of groundwater. Some have proposed that the mountains may be fractured such that pumping effects could be transmitted outside the valley and affect water levels at the DSC. While this contention seems highly unlikely given the low permeability nature of crystalline bedrock compared to that of the sand aquifer in the Soda Mountain Valley, it can be tested readily by assuming the mountains had the same permeability as the sand and gravel aquifer, as if the sand aquifer extended all the way to the DSC and beyond.

The Theis equation can be applied to evaluate the drawdown in a uniform aquifer of infinite extent. It was applied here using projected pumping rates during the life of the project, and drawdown over time and distance was calculated.

At the reasonable upper end of hydraulic conductivity estimates for the aquifer, 3.2 ft/d, the drawdown, calculated based on the assumption of an infinite aquifer with uniform properties, would be approximately 0.004 ft at the distance of 4.5 miles to the DSC after 33 years of pumping. At the lower end of the *K* estimate (0.86 ft/d), the drawdown at the DSC after 33 years of pumping would be less than 0.0003 ft.

Sensitivity testing was conducted by extending the range of *K* values tested, with five times lower and five times higher estimates of *K*. The sensitivity testing showed that even for *K* values that were five times higher and five times lower than what has been selected as a reasonable range, the resulting drawdown calculations indicate that the drawdown at the DSC would be 0.06 feet or less for all *K* values, over the life of the project.

Conclusion:

The results indicate that even if the mountains that form the eastern wall of the valley did not exist, and the aquifer extended without any hydraulic barriers directly to the DSC, the drawdown that would result from pumping over the life of the project would not be reliably measurable (0.06 feet or less) at the DSC.

APPENDIX H-5
Alternative Water Source Memo

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PANORAMA
ENVIRONMENTAL, INC.

MEMORANDUM

To: Adriane Wodey, Bechtel

From: Susanne Heim, Panorama Environmental

Date: September 10, 2014

Subject: Alternative Water Supply for Soda Mountain Solar Project

INTRODUCTION

Panorama has conducted an investigation of potential alternative water supply sources for the Soda Mountain Solar Project (project). This memorandum provides a summary of potential alternative water supplies and the potential impacts associated with importation of water from each location.

BACKGROUND

Soda Mountain Solar, LLC proposes to construct and operate a 350 MW photovoltaic solar project in San Bernardino County, California 6 miles south of Baker along Highway I-15. Water is required for project construction (compaction and dust control), operation (panel washing and dust control), and maintenance. The estimated construction water demand is 192 acre-feet per year for up to 3 years. The estimated operation and maintenance water demand is up to 33 acre-feet per year for the operational life of the project.

The project includes construction of up to three water supply wells for groundwater production. The Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and Draft Groundwater Monitoring and Mitigation Plan (GMMP) for the project include measures for potential curtailment of water use if the project groundwater use triggers specific action criteria designed to be protective of the endangered Mohave tui chub spring water habitat approximately 4 miles east of the project area.

Groundwater modeling indicates pumping in the Soda Mountain Valley would have no adverse effects on the spring and water source for the Mohave tui chub habitat. A sensitivity analysis has shown that there would be no measureable effects at the springs after groundwater pumping for 30 years.

The U.S. Bureau of Land Management (BLM) requested that SMS identify the location of an alternate water source that could be used if the project were required to curtail or cease local production of groundwater.

Figure 1: Alternate Water Source Locations

SOURCE: ESRI 2014, BLM 2008, and Panorama Environmental, Inc. 2014

Scale: 1:500,000

LEGEND

Proposed Project ROW

Desert Wildlife Management Area

Potential Water Source

PANORAMA ENVIRONMENTAL, INC.

Table 1: Potential Well Locations				
Well	**Latitude, Longitude**	**Distance to Project by Truck**	**Maximum Supply in gallons per minute (gpm)**	**Percent of Project Water Supply**
BLM Well	35.161454, -116.349906	12 miles	12 to 20[1]	Up to10% of construction needs 60% of operation and maintenance
Rasor Road Well	35.090299, -116.120728	7 miles	200	100%
Union Pacific Well	35.035727, -116.378791	16 miles	Unknown	Unknown
Amboy/Essex Agricultural Well	34.561487, -115.750098	90 to 110 miles[2]	200	100%

Notes:

[1]The groundwater well is currently able to produce approximately 12 gpm and may be able to supply up to 20 gpm if a larger pump were used.

[2]The well is 90 miles to the site via Kelbaker Road and 110 miles to the site via I-40 and I-15.

SMS has initiated drilling a water well at the project site. Preliminary indications are that there is sufficient water supply available in the Soda Mountain Valley. The properties of the aquifer will be defined in the coming months as data become available.

ALTERNATE WATER SOURCES

Locations

Panorama has identified four potential alternative water sources for the project. The locations of the water sources are shown on Figure 1. Information about each water source is summarized in Table 1. Access to the potential alternative water sources is via BLM Open Routes, existing County roadways, and/or paved highways. No new roads would be required to access the wells.

Approach to Alternate Water Source Definition and Use

Four potential alternative water supply wells are proposed. Two of the four well owners indicated that the wells could produce and supply the entire construction and operational water demand for the project. While a single well could potentially be used as an alternative to the project, we have defined a number of wells that could be used individually or in combination with alternative wells and the Soda Mountain Solar wells should project water production be curtailed.

DRAFT EIS/EIR CONSISTENCY ANALYSIS

Air Quality

Draft EIS/EIR Air Quality Impact Analysis

The Draft EIS/EIR included an analysis of air quality impacts associated with importing water for the project. The analysis was presented for Alternative F: CEQA No Project (no groundwater pumping).

The analysis for Alternative F assumed that all water for the project would be imported in up to 30 truck trips (60 one-way trips) per day with a travel distance of 10 miles per trip for a total travel distance of 600 miles per day. The analysis in the Draft EIS/EIR is based on the assumption that all water for the project would be imported and reflected a maximum rate of 300,000 gallons per day. The average water use per day is estimated at 200,000 gallons per day; 300,000 gallons per day is a construction peak and maximum water use.

In the unlikely event that the project groundwater wells are unable to provide adequate supply for the project or the project triggers an action criterion requiring curtailment of water use, a portion of the total project water use would be supplied by imported water.

Consistency with Draft EIS/EIR

The Rasor Road alternative water supply well is located within the 10 mile travel distance included in the model assumption in the EIS/EIR. The BLM Well and Union Pacific Well are located 12 and 16 miles from the project site, respectively and just beyond the modeled distance of 10 miles. The Amboy/Essex well is located approximately 90 to 110 miles from the project site. SMS would use one or a number of alternate wells to supply water for the project should BLM require curtailment of groundwater pumping. SMS would determine the location of the water supply wells and number of wells required to supply water for the project based on the need at the time of potential curtailment. SMS would define a water supply scenario that limits the total trucking distance to 600 miles per day. For example, if half the water is imported from the Rasor Road well and half from the Union Pacific well when demand is 200,000 gallons per day, the total vehicle miles would be 460 and below the threshold of 600 miles per day.

Conclusion

The air quality impacts from importing water from any of the proposed alternative water sources or a combination of the groundwater would be consistent with the emissions presented in the EIS/EIR.

Biology

Draft EIS/EIR Impact Analysis

The Draft EIS/EIR states that importing water to the Project site would not affect vegetation resources and would have no impact on wildlife species.

Consistency with Draft EIS/EIR

The potential water sources identified in this memo are existing public wells and private wells. Access to these wells is via BLM Open Routes, County roads, and/or existing highways. The importation of water would not affect vegetation or wildlife resources consistent with the analysis presented in the EIS/EIR.

Groundwater

BLM Well

Description

The BLM Well is an existing groundwater well that supplies water for grazing. The well currently has a pump and currently produces water. SMS may choose to install a larger pump to increase the production rate from the well.

Consistency with Draft EIS/EIR

The impacts to groundwater from use of the BLM Well would be negligible because extraction for the project would be similar to current groundwater extraction rates. No other groundwater wells or sensitive resources would be affected by the proposed extraction because there are no wells or sensitive groundwater resources located in close proximity to the existing well.

Rasor Road Well

Description

The Rasor Road well is owned by Mr. Terry Young. The well has been damaged and is no longer usable. Mr. Young could reconstruct or rehabilitate the well. A reconstructed or rehabilitated well at Rasor Road could potentially supply water for the project.

Consistency with Draft EIS/EIR

The existing Rasor Road well is located in the Mojave Wash, approximately 7 miles from the South Array project area (via Rasor Road) and is 3.7 miles south of MC Spring at Zzyzx. The potential impact to MC Spring from use of this well would be within the range that was modeled in the Groundwater Model Sensitivity Analysis for the project (BMCD and Panorama 2014) due to similar proximity between the Rasor Road well and MC Spring. The well is located in the Mojave Wash, which drains a larger area and has more groundwater flow than the Soda Mountain Valley. The average annual streamflow of the Mojave River is estimated to 7,700 acre-feet (Enzel 1990 in Enzel et al. 2003). The amount of water that would be extracted from this location would therefore represent a smaller fraction of groundwater flow (approximately 3 percent of the perennial yield during construction and .0.5 percent during operation) than the fraction extracted from Soda Mountain Valley. The larger amount of groundwater flow at the well location would result in a smaller cone of depression at the Rasor Road well than at the

Soda Mountain Valley well, and a lower potential to reduce water levels at MC Spring, which the Groundwater Model Sensitivity Analysis has already shown to be highly unlikely (BMCD and Panorama 2014).

Union Pacific Well

Description

The Union Pacific Well is an existing well that is used by the Union Pacific Railroad. The maximum flow rate from this well has not been determined. This well is currently producing water for use by the Railroad. SMS would need to enter into an agreement with Union Pacific Railroad to extract water from the well.

Consistency with Draft EIS/EIR

The groundwater extraction rate at the well would not change substantially from the current level of extraction if the well is used to supply water for the project. There are no known sensitive resources that would be affected by the groundwater use. Other wells in the area are not currently in use.

Amboy/Essex Well

Description

The Amboy/Essex well is an existing well that is currently producing water at between 3,000 and 5,000 acre-feet per year for agricultural purposes. The well is located between Amboy, CA and Essex, CA on Route 66. SMS would need to enter into a contract to purchase water from this well for the proposed project.

Consistency with Draft EIS/EIR

The use of less than 200 acre-feet per year of water from this well would not change the current use rate. The effects of the water production would be less than the existing production from the well. The water purchase would be a small percentage of the existing water rights.

REFERENCES

BMCD and Panorama 2014. Groundwater Modeling Sensitivity Analysis: Soda Mountain Solar Project, BLM Cas No. CACA 49584. Prepared for Soda Mountain Solar, LLC. August 2014.

Enzel, Y, Wells, S. G. and Lancaster, N. 2003. “Late Pleistocene lakes along the Mojave River, southeast California,” *in* Paleoenvironments and paleohydrology of the Mojave and southern Great Basin Deserts: Boulder, Colorado, Geological Society of America Special Paper 368, p. 61-77.

APPENDIX I
General Plan Consistency Evaluation

I.1 Overview

Pursuant to California Environmental Quality Act (CEQA) Guidelines Section 15125(d), this Appendix I describes the San Bernardino General Plan policies that apply to the Soda Mountain Solar Project, and then discusses the Project's consistency with these policies. Each environmental resource section in Chapter 3 (Environmental Analysis) of this PA/EIS/EIR identifies the applicable policies that pertain to individual resources, where applicable.

Goals, objectives, and policies not considered relevant to the Project are not discussed here, as CEQA Guidelines Section 15125(d) only requires discussion of applicable aspects of general plans. For example, policies requiring the County to implement actions not related to the Project, such as review of specific plans, or policies related to land use designations that are not present within the Project boundary, are not addressed.

The San Bernardino County 2007 General Plan addresses eight policy "elements" that guide the physical development of the County. These are: Land Use, Circulation and Infrastructure, Housing, Open Space, Conservation, Safety, Noise, and Economic Development.

Of these eight elements, all are applicable to the Project except the Land Use, Housing, and Economic Development elements. The Land Use Element is intended to guide decision makers and the public in determining the pattern of land use development for the County. The Project would be located entirely on federally-administered public lands. Therefore, this element does not apply to the Project. The Housing Element provides the County's goals, policies and programs relative to the development, improvement, and maintenance of housing within the unincorporated areas of the County, during the planning period of 2008-2014. The Project does not involve the construction or removal of housing and would not hinder development, improvement, or maintenance of any housing, and is therefore not subject to the policies of the Housing Element. The Economic Development Element is intended to guide the County in expanding the local economy and consists of policies applicable to County actions, but not specifically to review of permit applications such as the Applicant's groundwater well permit application. The Project would create jobs within the County and would not interfere with the County's goal to expand the local economy.

The Project area is located in the Desert Planning Region of the County. Therefore, goals and policies relating specifically to the Valley Planning Region and Mountain Planning Region are not applicable to the Project and are not discussed further.

The San Bernardino County General Plan does not govern the use of federal lands located within the County, and so determinations of consistency with the General Plan will not affect the BLM's decision regarding the ROW application or CDCA Plan Amendment. The provisions of the General Plan are enforceable only with respect to those portions of the Project under County jurisdiction, i.e., the groundwater well permits. The General Plan was written with recognition of the limitations of County land use jurisdiction due to the fact that federal and state agencies own and control most of the land within the County.

I.2 Approach to Analysis

Because the policy language found in a general plan is susceptible to varying interpretations, it is often difficult to determine whether a proposed project is consistent or inconsistent with such policies. Furthermore, because plans often contain numerous policies emphasizing differing legislative goals, a project may be consistent with a general plan, taken as a whole, even though it may appear to be inconsistent with specific policies within the plan. The board or commission that enacted the plan or policy generally determines the meaning of such policies; these interpretations prevail if they are "reasonable," even though other reasonable interpretations may also exist. In light of these considerations, the consistency evaluation in this PA/EIS/EIR reflects the County's determination that, as a whole, that the Project is consistent with applicable plans and policies.[1] The consistency of the Project (and alternatives) with applicable San Bernardino County plans and policies is discussed below.

I.3 Consistency with the San Bernardino County General Plan Circulation and Infrastructure Element

The purpose of the Circulation and Infrastructure Element is to promote and support the development of a coordinated, multi-modal transportation system and infrastructure capacity to meet the needs of all people living, working, or visiting the County. The Project would not conflict with the objectives and policies of this element. As described in Section 3.16, *Transportation and Travel Management*, the Project would be accessed by I-15. The traffic generated by the Project would not affect levels of service on I-15 nor create adverse queuing effects on the I-15 off-ramps, and would remain at levels less than the carrying capacity of local roads including Zzyzx Road, Rasor Road, Blue Bell Mine Road, and Arrowhead Trail Highway. Although the Project would not be located near mass transit services, it would not impede the future development of the types of circulation systems envisioned by the General Plan because it would not occupy land that would be needed to create transportation corridors or result in any other long-term changes that would adversely affect transportation in the County. For example,

1 Direct and indirect physical impacts resulting from Project implementation are not addressed in this section, but in the appropriate technical sections of this EIR (See Chapter 3, *Environmental Analysis*). Any conflict between the Project and General Plan policies that relates to physical environmental issues are discussed in Chapter 3. The compatibility of the Project with San Bernardino County General Plan policies that do not relate to physical environmental issues will be considered by decision-makers as part of their decision on the Project. Any potential conflicts identified as part of the process would not alter the physical environmental effects of the Project.

the Project would not adversely affect the development of the approved XpressWest High Speed Rail Project, which is proposed to be constructed parallel to I-15 through the Project area.

The Project's consistency with specific policies identified as relevant in Sections 3.2 through 3.21 is described in Table I-1.

TABLE I-1
CIRCULATION AND INFRASTRUCTURE ELEMENT

Policy	Evaluation
Policy CI 11.2. Support the safe management of hazardous materials to avoid the pollution of both surface and groundwaters. Prohibit hazardous waste disposal facilities within any area known to be or suspected of supplying principal recharge to a regional aquifer.	As described in Sections 3.8 and 3.19, the Project would be consistent with this policy because it would adequately contain and dispose of hazardous materials to avoid the pollution of surface and groundwater.
Policy CI 13.2. Promote the implementation of low impact design principles to help control the quantity and improve the quality of urban runoff. These principles include: a. Minimize changes in hydrology and pollutant loading; ensure that post development runoff rates and velocities from a site do not adversely impact downstream erosion, and stream habitat; minimize the quantity of stormwater directed to impermeable surfaces; and maximize percolation of stormwater into the ground where appropriate. b. Limit disturbance of natural water bodies and drainage systems; conserve natural areas; protect slopes and channels; c. Preserve wetlands, riparian corridors, and buffer zones; establish reasonable limits on the clearing of vegetation from the project site; d. Establish development guidelines for areas particularly susceptible to erosion and sediment loss; e. Require incorporation of structural and non-structural BMPs to mitigate projected increases in pollutant loads and flows.	The Project would be consistent with this policy. As described in Section 3.19, the Project would involve limited changes in on-site hydrology, resulting in less-than-significant effects related to erosion on-site and downstream. The Project would add a small area of new impervious surface and would not interfere with groundwater recharge. The Applicant would implement a SWPPP or stormwater BMP plan to reduce the potential impacts of changes in storm flows and sediments.
Policy D/CI 2.1. Retain the natural channel bottom for all storm water drainage facilities and flood control channels when such facilities are required for a specific development. This protects wildlife corridors and prevents loss of critical habitat in the region.	The Project would retain the natural channel bottom for all stormwater drainage channels on the site, and would therefore be consistent with this policy.
Policy D/CI 3.9. The County shall encourage the use of pervious paving materials on all commercial, industrial and institutional parking areas, where feasible. Large parking areas should consider using landscape as depressions to receive and percolate runoff as an alternative.	The Project does not involve the addition of substantial areas of impervious surfaces within the solar array area and would therefore not substantially change the runoff conditions. Long-term parking areas (less than 1 acre) would be graded but unpaved. The Project would be consistent with this policy.
Policy D/CI 3.10. Encourage the retention of natural drainage areas unless such areas cannot carry flood flows without damage to structures or other facilities.	The Project would retain natural drainage areas with the exception of berms to direct occasional side channel flows away from structures, buildings, and brine ponds to minimize the potential for damage or accidental releases, and would be consistent with this policy.
Policy D/CI 3.12. Require commercial or industrial operations with discharges other than standard domestic waste to submit a report for County and Regional Board review. This report shall identify non-domestic or industrial wastes contained in wastewater and shall quantitatively evaluate the potential for water quality impacts from the discharge.	The Applicant would prepare and submit a Report of Waste Discharge. The Project would therefore be consistent with this policy.

I.4 Consistency with the San Bernardino County General Plan Conservation Element

The Conservation Element is intended to provide direction for the conservation, development, and use of the County's natural resources and to prevent the wasteful exploitation, destruction, and neglect of these resources. The Project would be located within the Desert Region, a recognized important biological area that contains numerous sensitive plant and animal species, as described in Sections 3.3, *Biological Resources – Vegetation*, and 3.4, *Biological Resources – Wildlife*.

The physical environmental impacts of the Project are described throughout the PA/EIS/EIR; generally speaking, it would not contribute substantially to the degradation of natural resources after the implementation of mitigation measures. It would provide a source of renewable energy for use within California, increasing the productive capacity of the land while avoiding the types of pollution traditionally associated with fossil fuel energy sources; and through mitigation, it would preserve and enhance off-site lands with greater resources for vegetation and wildlife. The Project's consistency with specific policies identified as relevant in Sections 3.2 through 3.21 is described in Table I-2.

TABLE I-2
CONSERVATION ELEMENT

Policy	Evaluation
Policy CO 2.1. The County will coordinate with state and federal agencies and departments to ensure that their programs to preserve rare and endangered species and protect areas of special habitat value, as well as conserve populations and habitats of commonly occurring species, are reflected in reviews and approvals of development programs.	The Project would be consistent with this policy. The County's coordination with applicable state and federal agencies is documented in this PA/EIS/EIR, in particular in Sections 3.3 and 3.4.
Policy CO 2.4. All discretionary approvals requiring mitigation measures for impacts to biological resources will include the condition that the mitigation measures be monitored and modified, if necessary, unless a finding is made that such monitoring is not feasible.	As described in Sections 3.3 and 3.4, mitigation measures for impacts to biological resources would include conditions for monitoring and modification where necessary,
Policy CO 3.1. Identify and protect important archaeological and historic cultural resources in areas of the County that have been determined to have known cultural resource sensitivity.	The Project would be consistent with this policy because it would implement measures described in Section 3.6, Cultural Resources to identify and protect important archaeological and historic cultural resources.
Policy CO 3.2. Identify and protect important archaeological and historic cultural resources in all lands that involves disturbance of previously undisturbed ground.	The Project would be consistent with this policy because, as described in Section 3.6, *Cultural Resources*, a cultural resources inventory was conducted for the Project to identify known cultural resources within the Area of Potential Effect. As part of this study, a records search was conducted at the San Bernardino Archaeological Information Center (SBAIC) in Redlands. The records search area included the Project site and a 1-mile buffer zone. USGS topographic quadrangle base maps on file at the SBAIC were reviewed to identify previously documented cultural resources and cultural resources investigations completed within the records search study area. Additionally, mitigation measures described in that section would require the identification of previously unknown resources as part of the construction monitoring process.

**TABLE I-2 (Continued)
CONSERVATION ELEMENT**

Policy	Evaluation
Policy CO 3.5. Ensure that important cultural resources are avoided or minimized to protect Native American beliefs and traditions.	The Project would be consistent with this policy because, as described in Section 3.6, *Cultural Resources*, with implementation of mitigation measures, the Project would have less than significant impacts on cultural resources. Additionally, consultation with Native American tribes and groups for the Project is described in Chapter 4, Consultation and Coordination.
Policy CO 4.1. Because developments can add to the wind hazard (due to increased dust, the removal of wind breaks, and other factors), the County will require either as mitigation measures in the appropriate environmental analysis required by the County for the development proposal or as conditions of approval if no environmental document is required, that developments in areas identified as susceptible to wind hazards to address site-specific analysis of: a. Grading restrictions and/or controls on the basis of soil types, topography or season. b. Landscaping methods, plant varieties, and scheduling to maximize successful revegetation. c. Dust-control measures during grading, heavy truck travel, and other dust generating activities.	The Project would be consistent with this policy as described in Section 3.2, *Air Resources*, because it would limit grading to up to 1,155 acres (less than half the total area of disturbance), and would implement Applicant Proposed Measures 1 through 8, which specify dust control measures. As described in Chapter 2, the array blocks and other infrastructure would undergo only partial removal of scrub vegetation, leaving the root structure and about 6 inches of stem in place. Additionally, as described in Applicant Proposed Measure 34, the site would be revegetated after decommissioning according to the Final Closure Plan prepared in conformance with BLM requirements at the time of decommissioning.
Policy CO 7.1. In areas containing valuable mineral resources, establish and implement conditions, criteria, and standards that are designed to protect the access to, and economic use of, these resources, provided that the mineral extraction does not result in significant adverse environmental effects and that open space uses have been considered for the area once mining operations cease.	The Project would be consistent with this policy. Because none exist on the site, the Project would not affect valuable mineral resources. Additionally, as described in Section 3.10, the Project would not affect access to existing valuable resources.
Policy CO 7.5. Protect existing mining access routes by giving them priority over proposed alterations to the land, or by accommodating the mining operations with as good or better alternate access, provided the alternate access does not adversely impact proposed open space areas or trail alignment.	The Project would be consistent with this policy. As described in Section 3.10, the Caltrans access road to the Opah Ditch site runs adjacent to the Project site boundary northwest of I-15, and may be used periodically for construction of the collection line to the substation or Project site access. However, no Project facilities are planned in the vicinity of the Caltrans access road and the Proposed Action would not affect development of or access to the Opah Ditch site.
Policy CO 8.1. Maximize the beneficial effects and minimize the adverse effects associated with the siting of major energy facilities. The County will site energy facilities equitably in order to minimize net energy use and consumption of natural resources, and avoid inappropriately burdening certain communities. Energy planning should conserve energy and reduce peak load demands, reduce natural resource consumption, minimize environmental impacts, and treat local communities fairly in providing energy efficiency programs and locating energy facilities.	The Project would be consistent with this policy. Its environmental effects are described throughout this PA/EIS/EIR. As described in Section 3.14, *Socioeconomics and Environmental Justice*, the Project would not inappropriately or inequitably burden any community.
Policy CO 9.2. The County will work with utilities and generators to maximize the benefits and minimize the impacts associated with siting major energy facilities. It will be the goal of the County to site generation facilities in proximity to end-users in order to minimize net energy use and natural resource consumption, and avoid inappropriately burdening certain communities.	This PA/EIS/EIR describes the potential impacts and mitigation measures associated with the Project. As described in Chapter 2, other sites were considered for the Project, but not carried forward for analysis based on environmental, land use, and/or feasibility constraints. Also as described in Chapter 2, the Project would be sited within close proximity to an existing transmission line, minimizing the need for a generation-transmission tie-in line that would result in further land disturbance. As described in Section 3.14, *Socioeconomics and Environmental Justice*, the Project would not disproportionately burden any particular community of concern with respect to income or race.

TABLE I-2 (Continued)
CONSERVATION ELEMENT

Policy	Evaluation
Policy CO 10.2. The location of electric facilities should be consistent with the County's General Plan, and the General Plan should recognize and reflect the need for new and upgraded electric facilities.	As described throughout this section and in Chapter 4 of the EIS/EIR, the location of the Project is consistent with the applicable policies contained in the General Plan.
Policy D/CO 1.1. Encourage the greater retention of existing native vegetation for new development projects to help conserve water, retain soil in place and reduce air pollutants.	The Project would be consistent with this policy as described in Section 3.2, *Air Resources*, because it would limit grading to up to 1,155 acres (less than half the total area of disturbance), and would implement Applicant Proposed Measures 1 through 8, which specify dust control measures. As described in Chapter 2, the array blocks and other infrastructure would undergo only partial removal of scrub vegetation, leaving the root structure and about 6 inches of stem in place. Additionally, as described in Applicant Proposed Measure 34, the site would be revegetated after decommissioning according to the Final Closure Plan prepared in conformance with BLM requirements at the time of decommissioning.
Policy D/CO 1.2. Require future land development practices to be compatible with the existing topography and scenic vistas, and protect the natural vegetation.	The Project would be consistent with this policy because it would generally maintain the existing topography with the exception of limited grading, would have less than significant impacts from scenic vistas after the implementation of mitigation measures described in Section 3.18, *Visual Resources*, and would maintain to the extent practicable and mitigate for disturbance of natural vegetation on the Project site as described in Section 3.3, *Biological Resources – Vegetation*.
Policy D/CO 1.3. Require retention of existing native vegetation for new development projects, particularly Joshua trees, Mojave yuccas and creosote rings, and other species protected by the Development Code and other regulations. This can be accomplished by: a. Requiring a landscape plan, approved as part of the location and development plan review and approval process for all new development projects. b. Requiring the Building Official to make a finding that no other reasonable siting alternatives exist for development of the land prior to removal of a protected plant. c. Encourage on-site relocation of Joshua trees and Mojave yuccas. However, if on-site relocation is not feasible require developers to consult a list that will be established and maintained in the County Building and Safety Office of residents willing to adopt and care for relocated trees. d. The developer/home builder shall bear the cost of tree or yucca relocation. e. Retention and transplantation standards will follow best nursery practices.	The Project is not subject to San Bernardino County Development Code Chapter 88.01, Plant Protection and Management, because it is not located within the County's land use jurisdiction. No Joshua tree or Mojave yucca is present on the Project site. The Project would be consistent with the applicable portions of this policy because it would implement measures to retain, protect, and /or mitigate for the removal of native plants protected by applicable state and federal regulations as described in Section 3.3, *Biological Resources – Vegetation*.
Policy D/CO 1.4. Reduce disturbances to fragile desert soils as much as practicable in order to reduce fugitive dust. The County shall consider the following in the development of provisions to limit clearing. a. Parcels of one acre or larger shall not be disturbed or cleared of natural vegetation unless for the installation of building pads, driveways, landscaping, agriculture or other reasonable uses associated with the primary use of the land, including fire clearance areas. b. Fire abatement or local clean-up efforts shall be accomplished by mowing or means other than land	The Project would be consistent with this policy because it would limit grading and soil disturbance to necessary portions of the Project site associated with the construction, operation, and maintenance of a solar plant, including the well pads.

TABLE I-2 (Continued)
CONSERVATION ELEMENT

Policy	Evaluation
scraping whenever possible to minimize fugitive dust and windblown sand. When de-brushing or blading is considered the most feasible alternative, additional methods shall be required for erosion control. c. The County Office of Building and Safety may issue permits for further grading or clearance of vegetation subject to proper review.	
Policy D/CO 1.5. Mechanical removal of vegetation shall be minimized and limited to the building pad, driveway and areas prepared for permitted accessory uses.	The Project would be consistent with this policy because mechanical removal would occur only within areas permitted under the terms of the BLM ROW grant and groundwater well permits.
Policy D/CO 1.6. In the landscaping of individual sites, native and other drought tolerant plants shall be encouraged.	As described under Applicant Proposed Measure 36, the Vegetation Resources Management Plan would include restoration plans discussing the methods that would be used to restore any of the four native plant community types (creosote bush-white bursage scrub, cheesebush scrub, creosote bush scrub, and smoke tree woodland) present within the Project right-of-way that may be temporarily disturbed by construction activities. The Applicant would obtain BLM approval for any seed mix used for restoration. Therefore, the Project would be consistent with this policy.
Policy D/CO 1.8. Require future development to utilize water conservation techniques.	The Project would be consistent with this policy. The primary uses of water on the Project site would be dust suppression and panel washing. These water demands would be minimized through a vegetation management approach that would leave most root systems intact to minimize erosion and fugitive dust.
Policy D/CO 2.1. Through the development process [*of renewable energy resources*] encourage building orientations conducive to utilizing available solar energy.	The Project would be consistent with this policy because it has been sited and its tracker assemblies would be oriented to maximize solar energy output.
Policy D/CO 3.1: Protect the night sky by providing information about and enforcing existing ordinances: a. Provide information about the Night Sky Ordinance and lighting restrictions with each land use or building permit application. b. Review exterior lighting as part of the design review process.	The Project would be consistent with the applicable portion of this policy because the County would review the Project's exterior lighting plans as part of the review process for the groundwater well permit application.
Policy D/CO 3.2. All outdoor lighting, including street lighting, shall be provided in accordance with the Night Sky Protection Ordinance and shall only be provided as necessary to meet safety standards.	As described in Section 3.18, exterior lighting would be limited to that necessary to meet safety standards, and would be designed in such a way to minimize night sky effects. The Project would therefore be consistent with this policy.
Policy D/CO 6.1. Identify and protect significant cultural resources from damage or destruction.	As described in Section 3.6, *Cultural Resources*, the Applicant would implement mitigation measures to identify and protect any significant cultural resources that may be discovered during ground disturbance activities, and the Project would therefore be consistent with this policy.
Policy D/CO 6.2. Inventory Cultural Resources, encouraging inputs from the local historical society and committees.	As described in Section 3.6, *Cultural Resources*, cultural resource inventories were performed for the Project's Area of Potential effects, and a record search was performed to identify any known resources. Through both Native American tribal consultation and public comment opportunities, the Project has and will continue to encourage input in this process. Therefore, it would be consistent with this policy.

I.5 Consistency with the San Bernardino County General Plan Open Space Element

The Open Space Element is intended to guide the protection and preservation of open space, recreation, and scenic areas, while accommodating future growth within the County. This element acknowledges that the BLM administers approximately 47 percent of the County's land area, including all of the lands within the Project site. The County's review of the Project for consistency with its applicable goals and policies with respect to recreation is reflected in Section 3.13; however, the County does not have land use jurisdiction in this area, and so its recreation-related general plan policies are not applicable.

The Project's consistency with specific policies identified as relevant in Sections 3.2 through 3.21 is described in Table I-3.

TABLE I-3
OPEN SPACE ELEMENT

Policy	Evaluation
Policy OS 5.1: Features meeting the following criteria will be considered for designation as scenic resources: a. A roadway, vista point, or area that provides a vista of undisturbed natural areas. b. Includes a unique or unusual feature that comprises an important or dominant portion of the viewshed (the area within the field of view of the observer). c. Offers a distant vista that provides relief from less attractive views of nearby features (such as views of mountain backdrops from urban areas).	The Project's potential impacts to scenic resources are described in Section 3.18; as analyzed therein, the Project would have less-than-significant impacts on scenic resources after the implementation of mitigation measures. The Project would be consistent with this policy.
Policy OS 5.2: Define the scenic corridor on either side of the designated route, measured from the outside edge of the right-of-way, trail, or path. Development along scenic corridors will be required to demonstrate through visual analysis that proposed improvements are compatible with the scenic qualities present.	The compatibility of the Project with scenic qualities in the Project area is described in Section 3.18. The County's decision to approve or deny the groundwater well permit(s) will depend in part on this analysis. Therefore, the Project would be consistent with this policy.
Policy OS 5.3: The County desires to retain the scenic character of visually important roadways throughout the County. A "scenic route" is a roadway that has scenic vistas and other scenic and aesthetic qualities that over time have been found to add beauty to the County.	The Project would be consistent with this policy. Impacts to views from I-15, a County-designated scenic route within the Project area, are analyzed throughout Section 3.18. Project-level impacts would be less than significant with mitigation incorporated. However, the Project would contribute to a synergistic significant cumulative effect on views from I-15 when viewed in combination with other large-scale renewable energy facilities. Implementation of mitigation measures would reduce the Project's contribution to this impact to the extent feasible.

I.6 Consistency with the Noise Element

The Noise Element contains policies that address the issues of noise producers and their effects on noise-sensitive land uses. As described in Section 3.11, *Noise*, the Project with mitigation measures incorporated would comply with all applicable noise standards and would have less-than-significant effects on noise-sensitive land uses (e.g., residences). The Project would be consistent with the intent of this element.

The Project's consistency with specific policies identified as relevant in Sections 3.2 through 3.21 is described in Table I-4.

TABLE I-4
NOISE ELEMENT

Policy	Evaluation
Policy N 1.3. When industrial, commercial, or other land uses, including locally regulated noise sources, are proposed for areas containing noise-sensitive land uses, noise levels generated by the proposed use will not exceed the performance standards of Table N-2 within outdoor activity areas. If outdoor activity areas have not yet been determined, noise levels shall not exceed the performance standards listed in Chapter 83.01 of the Development Code at the boundary of areas planned or zoned for residential or other noise-sensitive land uses.	As described in Section 3.11, *Noise*, with implementation of Mitigation Measure 3.11-1, Project-generated noise levels would be reduced below standards listed in Chapter 83.01 of the Development Code at the nearest residences. Therefore, the Project would be consistent with this policy.
Policy N 1.6. Enforce the hourly noise-level performance standards for stationary and other locally regulated sources such as industrial, recreational, and construction activities as well as mechanical and electrical equipment.	As described in Section 3.11, *Noise*, with implementation of Mitigation Measure 3.11-1, the Project's construction-generated noise levels would be reduced below the County's noise-level performance standards. Therefore, the Project would be consistent with this policy.
Policy N 2.2. The County will continue to work aggressively with federal agencies, including the branches of the military, the U.S. Forest Service, BLM, and other agencies to identify and work cooperatively to reduce potential conflicts arising from noise generated on federal lands and facilities affecting nearby land uses in unincorporated County areas.	As evidenced by the analysis in this PA/EIS/EIR, the County has cooperated with the BLM to reduce potential conflicts due to noise generated on federal lands (i.e., the Project site). The Project is consistent with this policy.

I.7 Consistency with the Safety Element

The Safety Element seeks to reduce the impacts of future natural disasters and man-made hazards in the County. The Project's impacts with respect to safety are primarily addressed in Sections 3.7, *Geology and Soil Resources*, and 3.8, *Hazards and Hazardous Materials*. The design of the Project, as well as mitigation measures proposed in this PA/EIS/EIR, consider the potential seismic, soil instability, flood, fire, waste, and other hazards that are present in the Project area or that could result as a consequence of Project implementation. Although the Project would not avoid all hazards, even with mitigation incorporated, design and operational considerations such as providing secondary emergency site access and implementing a Hazardous Materials Business Plan and Health and Safety Plan demonstrate the Project's consistency with the objectives of the Safety Element.

The Project's consistency with specific policies identified as relevant in Sections 3.2 through 3.21 is described in Table I-5.

TABLE I-5
SAFETY ELEMENT

Policy	Evaluation
Policy S 2.1. Because reducing the amount of waste generated in this County is an effective mechanism for reducing the potential impact of these wastes on the public health and safety and the environment, and because legislation encourages the reduction, to the extent feasible, of hazardous waste, this jurisdiction will encourage and promote practices that will, in order of priority: (1) reduce the use of hazardous materials and the generation of hazardous wastes at their source; (2) recycle the remaining hazardous wastes for reuse; and (3) treat those wastes that cannot be reduced at the source or recycled. Only residuals from waste recycling and treatment will be land disposed.	As described in Section 3.8, limited amounts of hazardous materials and wastes would be used, stored, and/or generated at the Project site. All hazardous wastes would be disposed of in accordance with all applicable regulations.
Policy S 2.5 Minimize the risk of exposure to hazardous substances by residential and other sensitive receptors through the application of program review and permitting procedures.	The Project would be consistent with this policy; Section 3.8 of this PA/EIS/EIR documents the County's CEQA review of the Project; other review requirements would be met before issuance of a groundwater well permit(s).
Policy S 7.1. Strive to mitigate the risks from geologic hazards through a combination of engineering, construction, land use, and development standards.	As described in Section 3.7, the Applicant would be required to implement mitigation measures that would reduce the risks from geologic hazards to less than significant. The Project would be consistent with this policy.
Policy S 7.3. Coordinate with local, regional, state, federal, and other private agencies to provide adequate protection against seismic hazards to County residents.	The Project would be consistent with this policy. The County's coordination with applicable state and federal agencies regarding seismic hazards is documented in this PA/EIS/EIR, particularly in Section 3.7, which describes the Project's less-than-significant impacts related to seismic hazards with implementation of mitigation measures.
Policy S 7.5. Minimize damage cause by liquefaction, which can cause devastating structural damage and a high potential for saturation exists when the groundwater level is within the upper 50 feet of alluvial material.	As described in Section 3.7, the Applicant would be required to implement mitigation measures that would reduce the risks from geologic hazards to less than significant. Permanent groundwater depth at the Project site is much greater than 50 feet, making the potential for liquefaction very low. The Project would be consistent with this policy.
Policy S 7.6. Protect life and property from risks resulting from landslide, especially in San Bernardino and San Gabriel Mountains that have high landslide potential.	The Project would be consistent with this policy. The predominantly flat, alluvial nature of the Project site generally precludes any risk of or susceptibility to landslides, and no landslide hazards are identified for the Project site on the County geologic hazards map. As required by mitigation measures described in Section 3.7, sampling and testing of materials and performance of slope stability analyses would be required to ensure proper foundation design and incorporation of necessary protective measures for potentially vulnerable Project components.
Policy S 8.1. Ensure the safety of airport operations and surrounding land uses.	As described in Section 3.8, the Project site is not located within any FAR Part 77 imaginary surface area, nor within any of the designated hazard zones of the Baker Airport. The Proposed Action also would not affect operations at the Desert Studies Center private airstrip. Therefore, there would be no impacts associated with the Proposed Action on navigable airspace in the vicinity of the Project site.
Policy S 9.1. Maintain projected emergency access needs in the periodic review of the County's Hazard Mitigation Plan.	The Project would be consistent with this policy because it would not hinder emergency access or adversely affect access routes.
Policy S 9.2. Ensure that future developments have no less than two points of access for emergency evacuation and for emergency vehicles, in the event of wildland fires and other natural disasters.	As shown in Figure 2-2, the Project site would be accessible by both Blue Bell Mine Road and Rasor Road, and would be consistent with this policy.
Policy D/S 1.1. Designate the following roads and highways as evacuation routes in the in the Desert Region: Interstates 15 and 40, U.S. 95 and 395 and State Highways 18, 58, 62, 127, 138, 178 and 247.	As described in Sections 3.8 and 3.16, the Project would not interfere with emergency evacuation routes or alter levels of service on I-15. It would be consistent with this policy.