Biological Resources Technical Report

Soda Mountain Solar
San Bernardino County, CA

BLM Case Number CACA 49584

March 2013

PANORAMA ENVIRONMENTAL, INC.

One Embarcadero Center, Suite 740 San Francisco, CA 94111 650-373-1200
www.panoramaenv.com

PANORAMA
ENVIRONMENTAL, INC.

Biological Resources Technical Report

Soda Mountain Solar Project
San Bernardino, California

BLM Case Number CACA 49584

Submitted by:

Soda Mountain Solar, LLC
5275 Westview Drive
Frederick, MD 21703
301-228-8110
Adriane Wodey

Prepared by:

Panorama Environmental, Inc.
1 Embarcadero Center, Suite 740
San Francisco, CA 94111
650-373-1200

TABLE OF CONTENTS

List of Tables

List of Figures

Appendices

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)

[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

SOURCE: ESRI 2013, BLM 2013, BLM 2012, BLM 2008, National Atlas of the United States 2005, and Panorama Environmental, Inc. 2013

1.3 PROJECT OVERVIEW

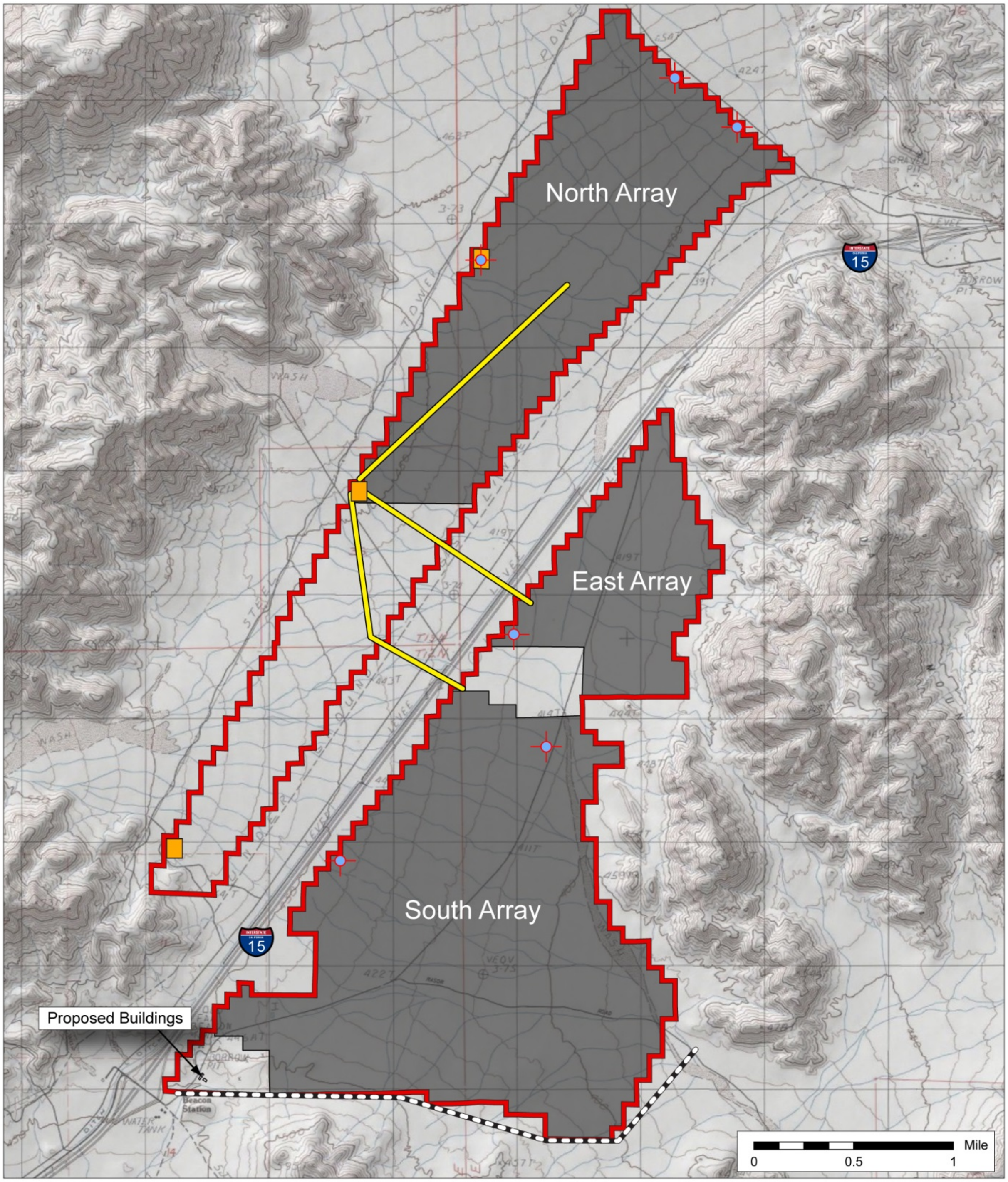
The proposed project includes construction and operation of a 350-MW PV solar electric power generating facility (project). The major components of the project include:

- 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

PANORAMA ENVIRONMENTAL, INC.

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:

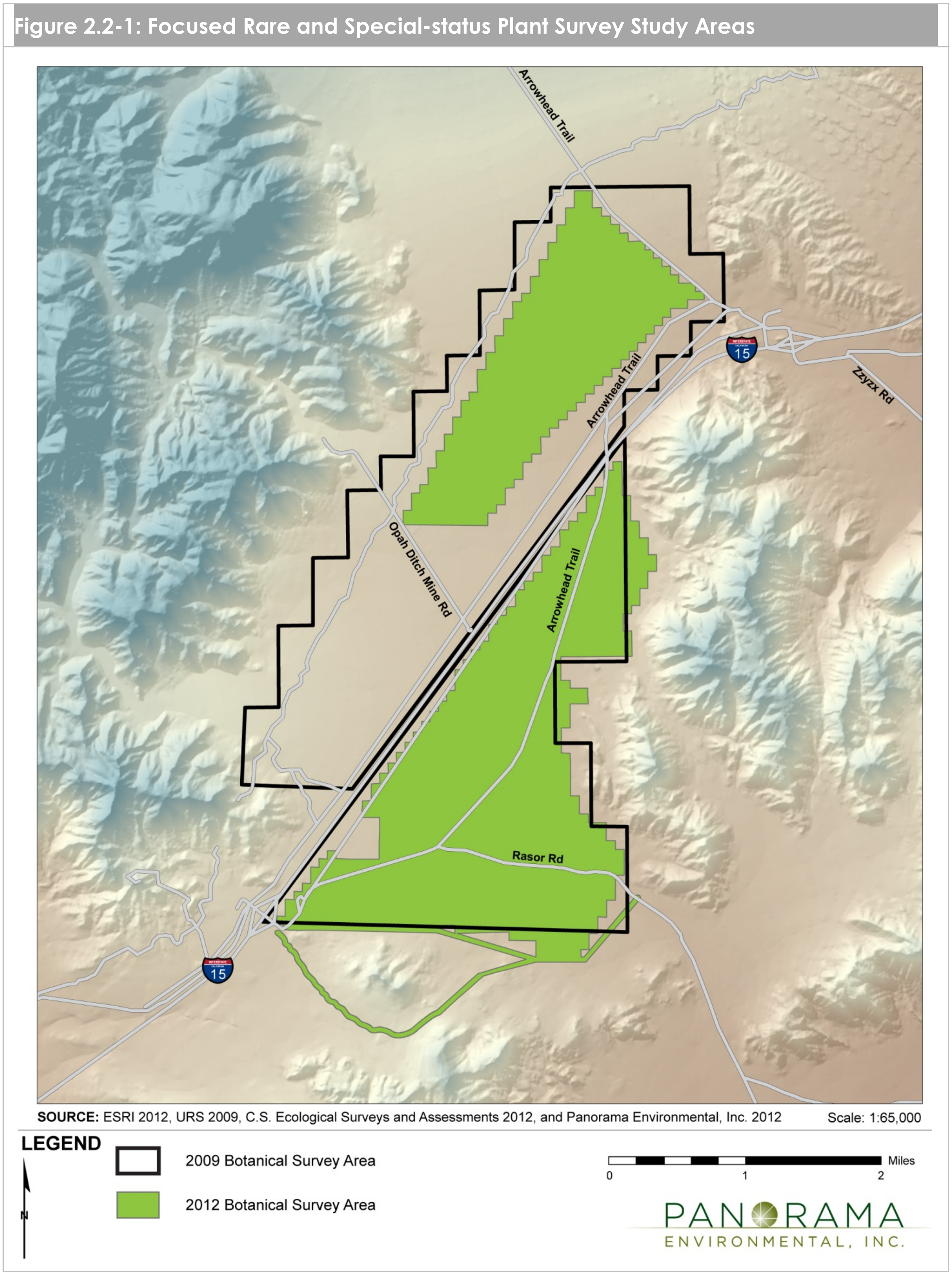
- 1B Rare, threatened, or endangered in California and elsewhere.
- 2 Rare, threatened, or endangered in California, but more common elsewhere.
- 3 More information is needed – a review list.
- 4 Limited distribution – a watch list.

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



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.

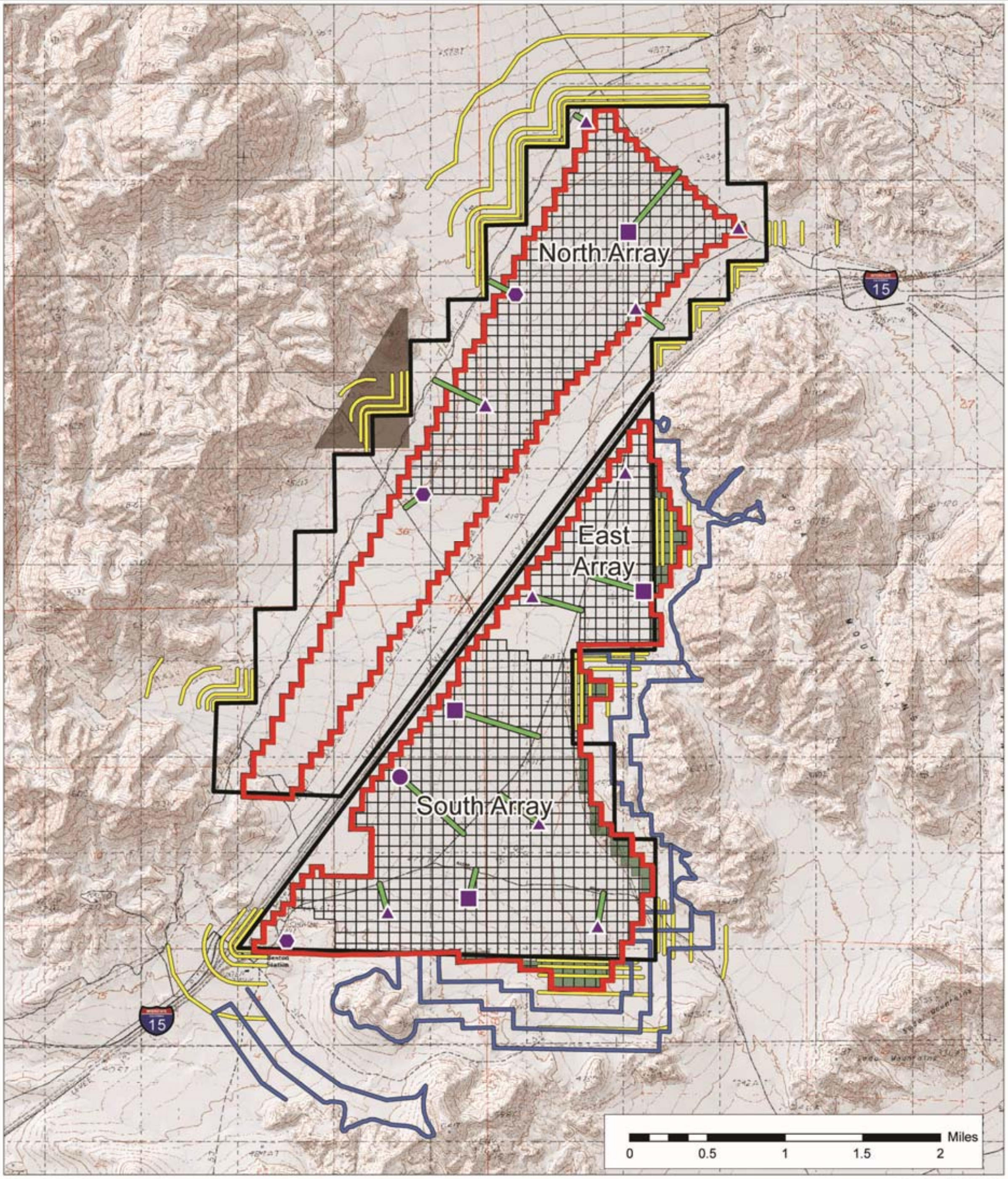
Invasive Species
Both the spring 2009 and fall 2012 rare and special-status plant surveys included documentation of all plants observed in the survey area, including invasive species (URS 2009c; CSESA 2012). The locations of the invasive species located during the surveys were not mapped, although general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

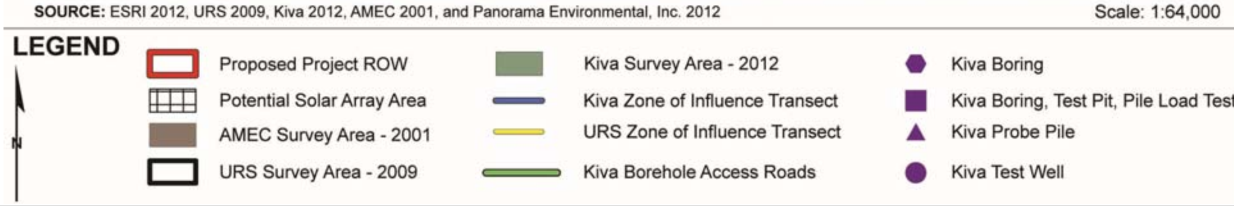
The 2009 field surveys consisted of 100 percent coverage transects spaced at 33-foot (10-meter) intervals within the 6,700-acre study area (URS 2009a). Surveyors also walked zone of influence transects outside of the survey area. Zone of influence transect locations were developed and approved in consultation 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

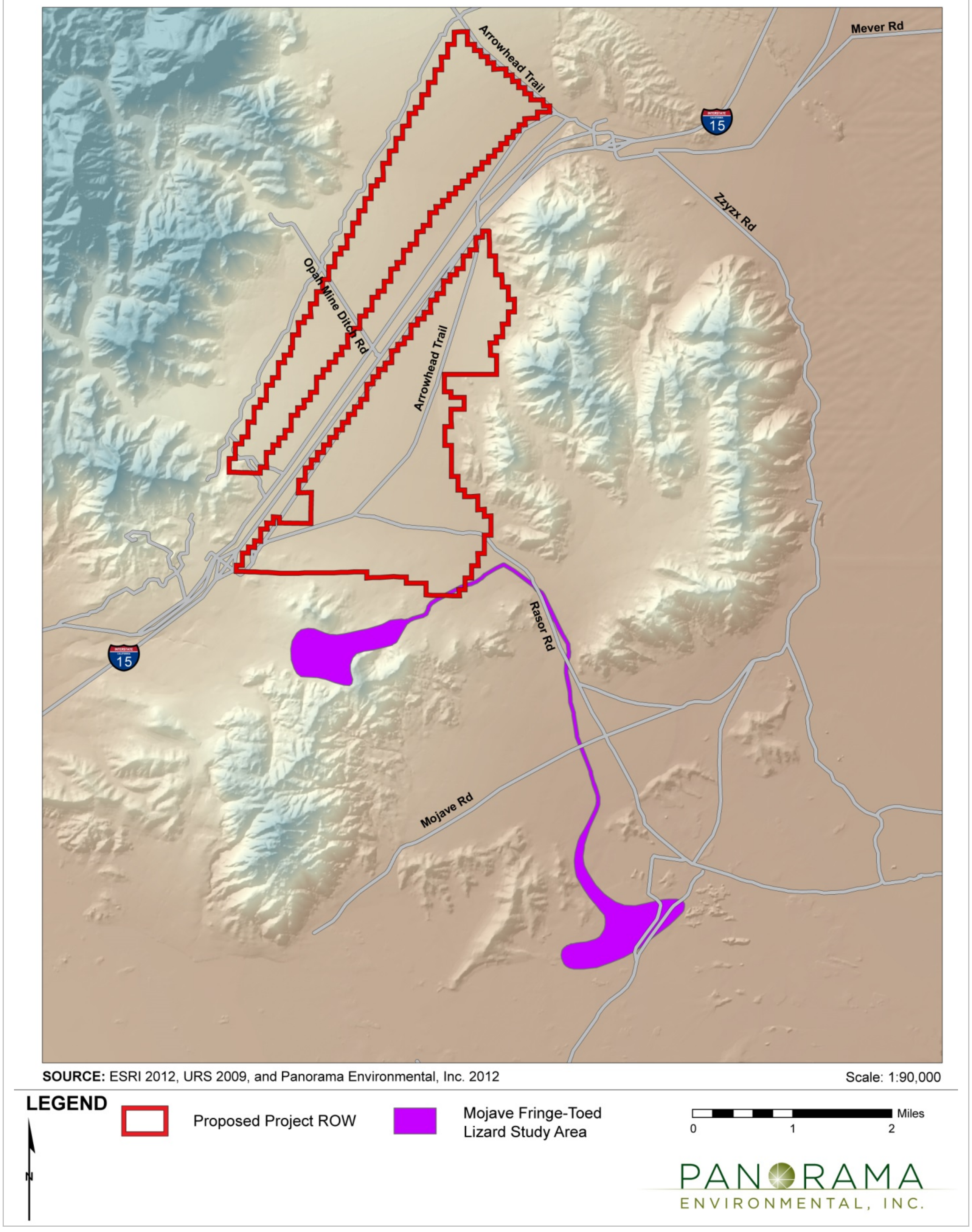
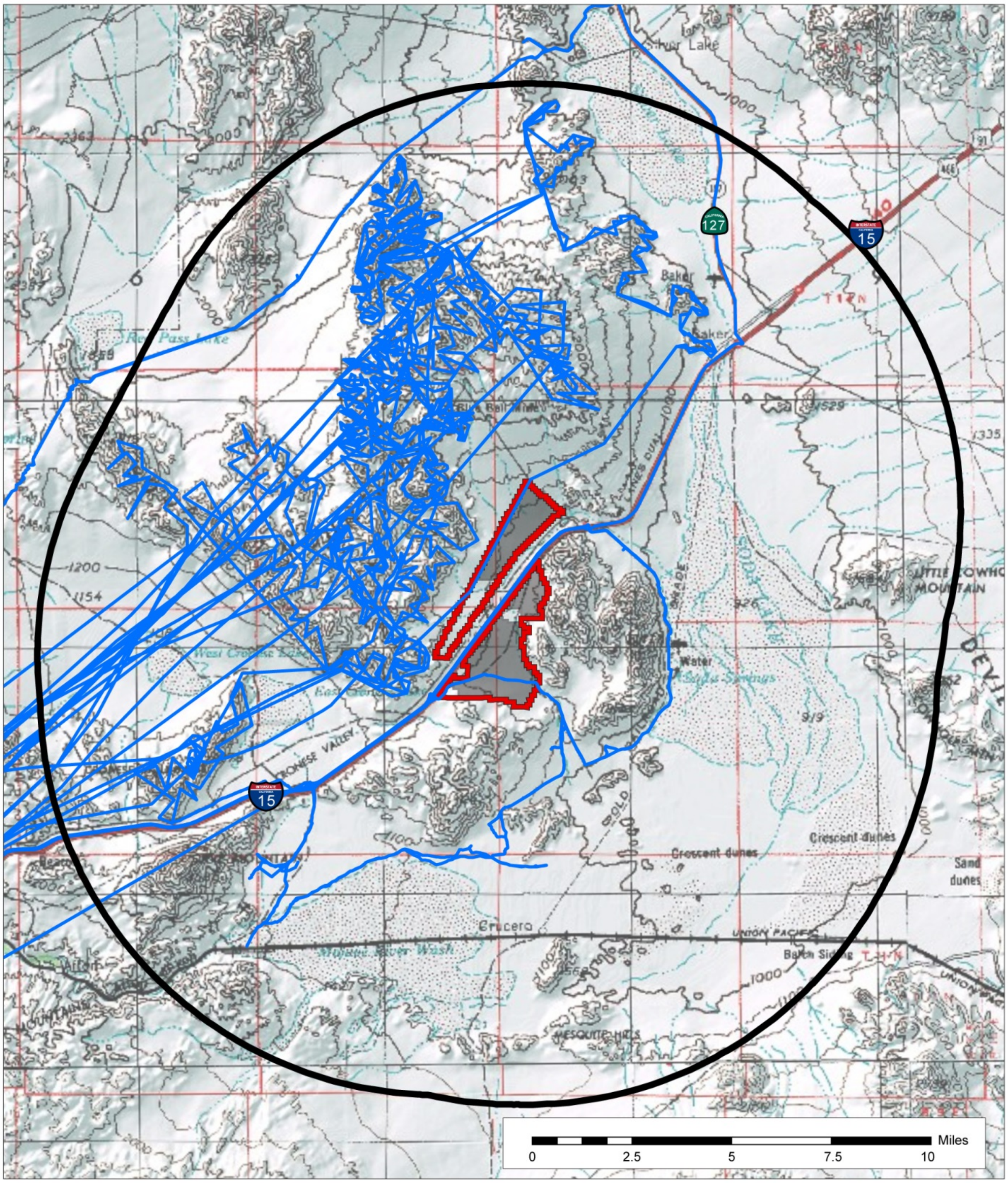


Figure 2.2-4: 2011 Bighorn Sheep and Golden Eagle Survey Locations



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

Scale: 1:250,000

LEGEND

- Proposed Project ROW
- Potential Solar Array Area
- BRC Survey Routes
- 10 Mile Buffer

N

PANORAMA ENVIRONMENTAL, INC.

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

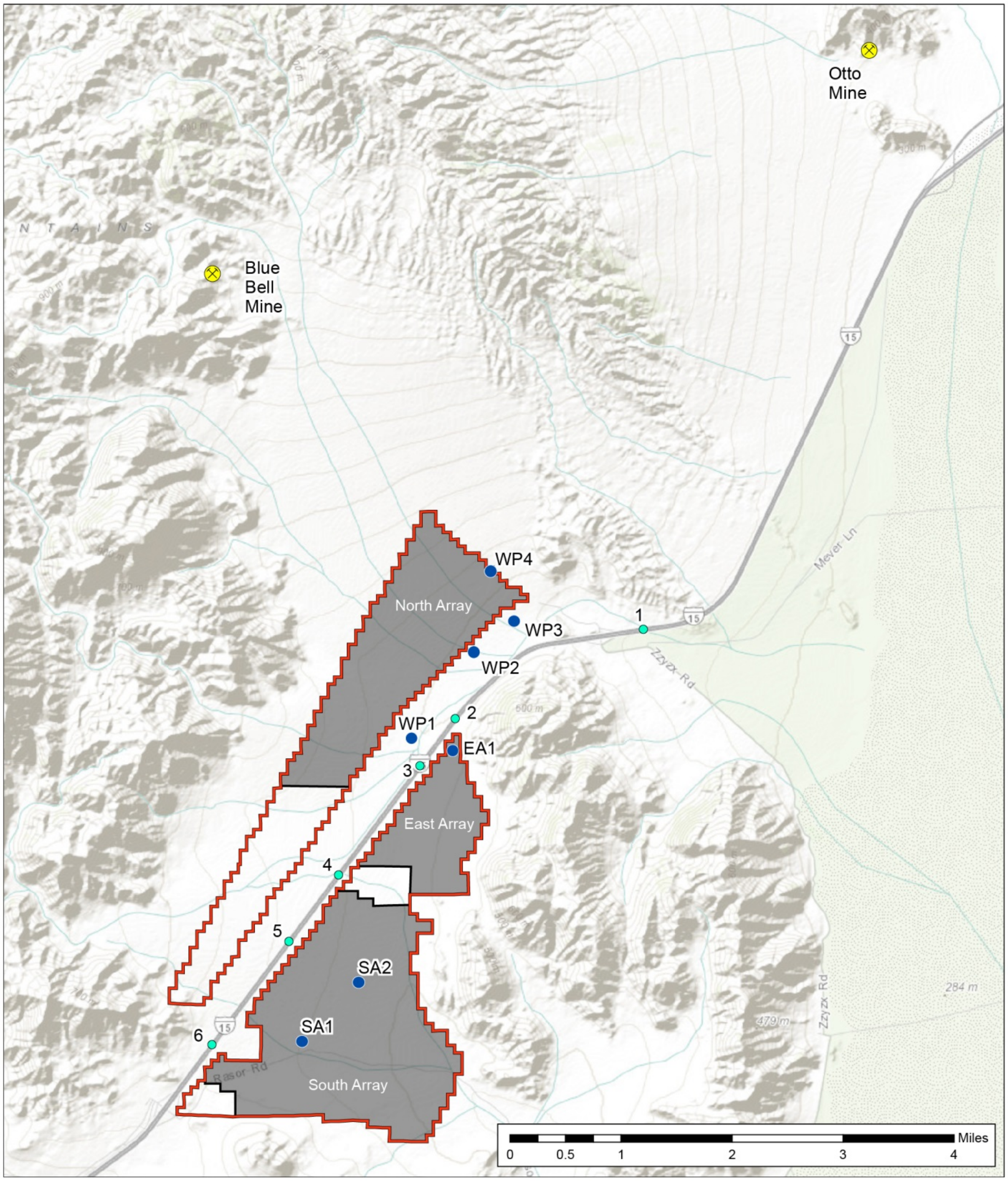
Bat surveys were conducted using acoustic monitoring and roost surveys (Brown-Berry Biological Consulting 2012). Survey methods and biologist qualifications were submitted to and approved by BLM and CDFW prior to conducting surveys. Acoustic monitoring was conducted to identify bat species using the 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

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

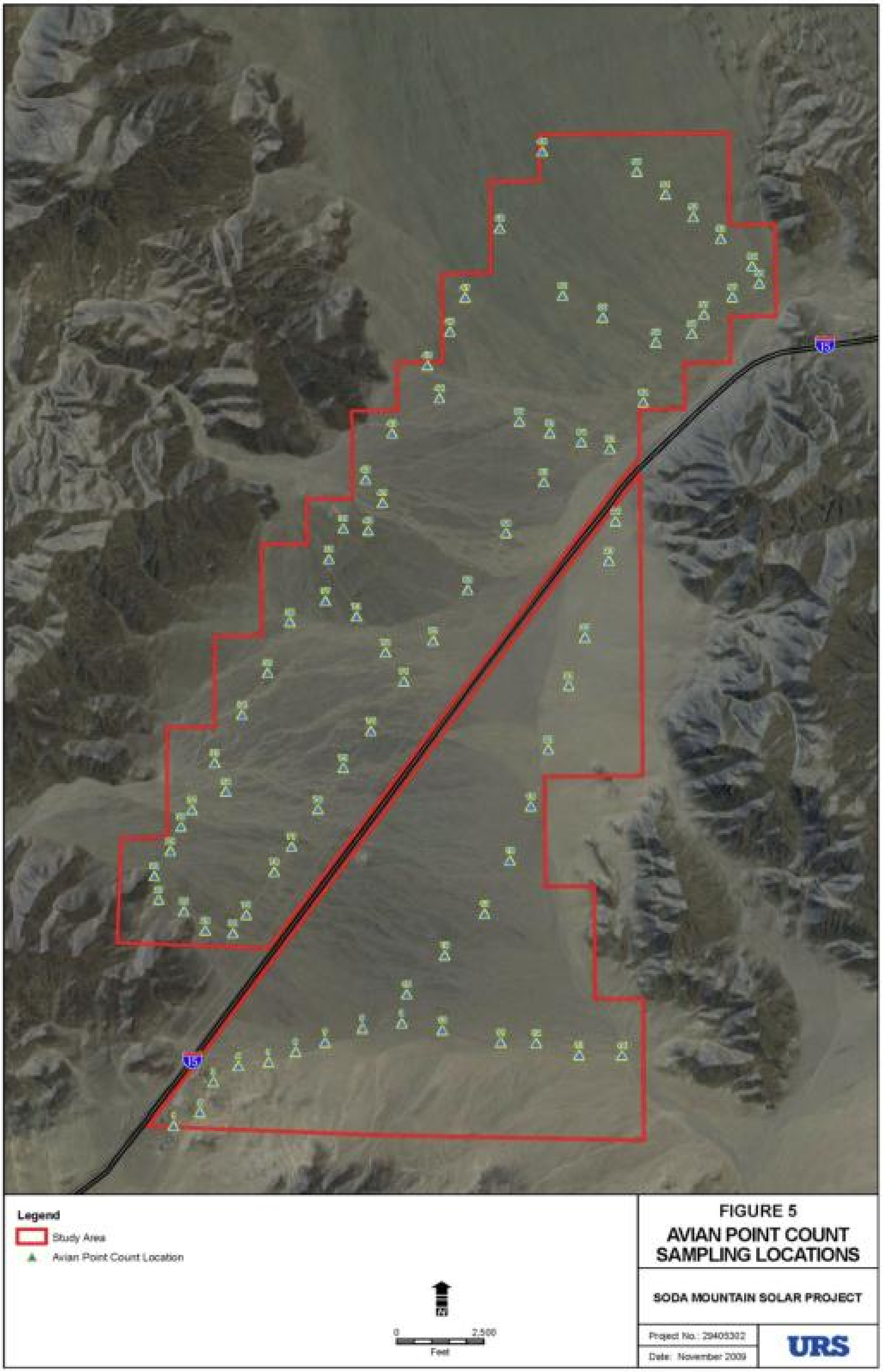
2009 Delineation

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

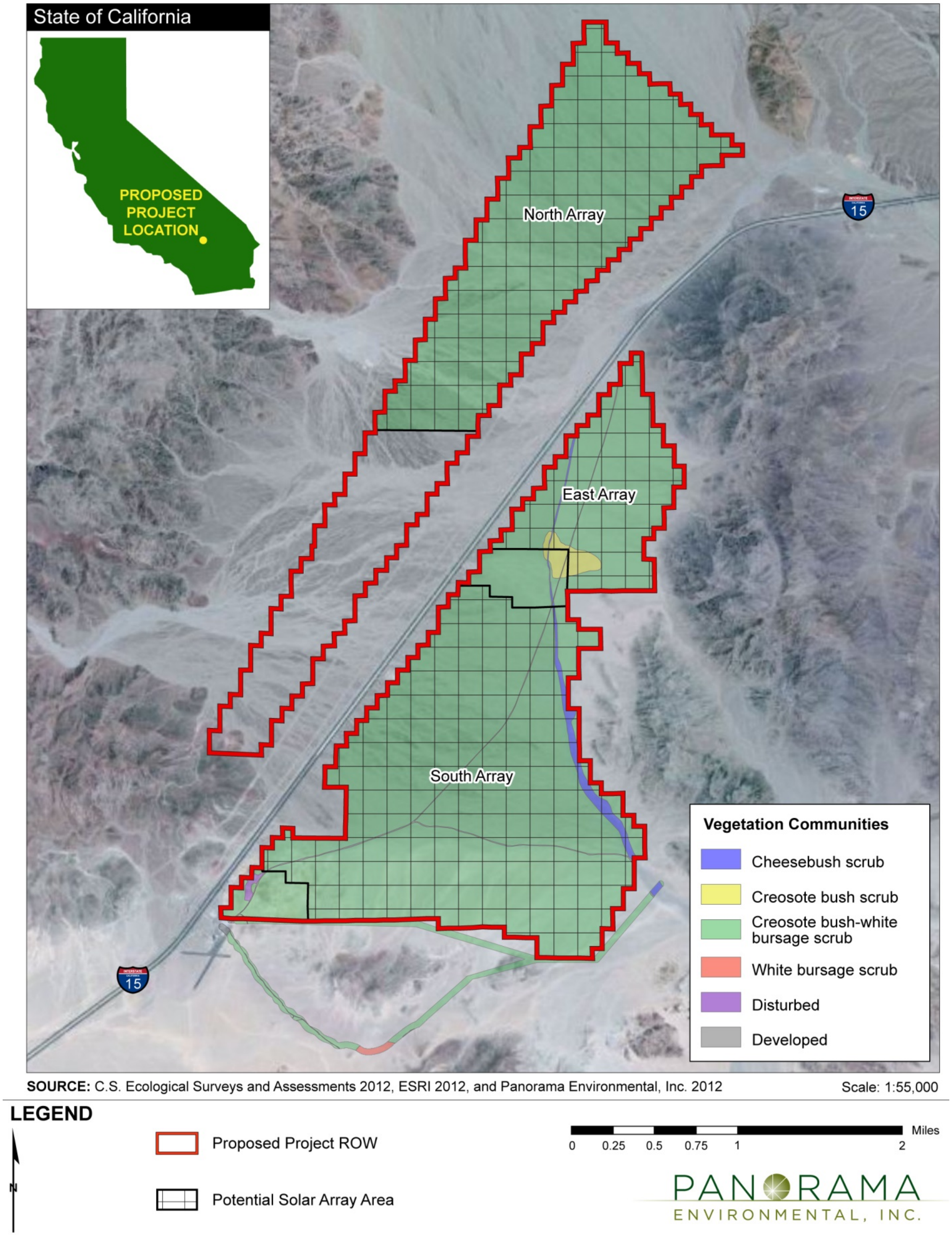
The creosote bush-white bursage scrub vegetation community is common throughout the lower elevations of the Mojave Desert and covers about 97 percent of the 2012 survey area. There was little understory cover present in this community during the surveys. Devil's spineflower (*Chorizanthe rigida*) was 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

PANORAMA ENVIRONMENTAL, INC.

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

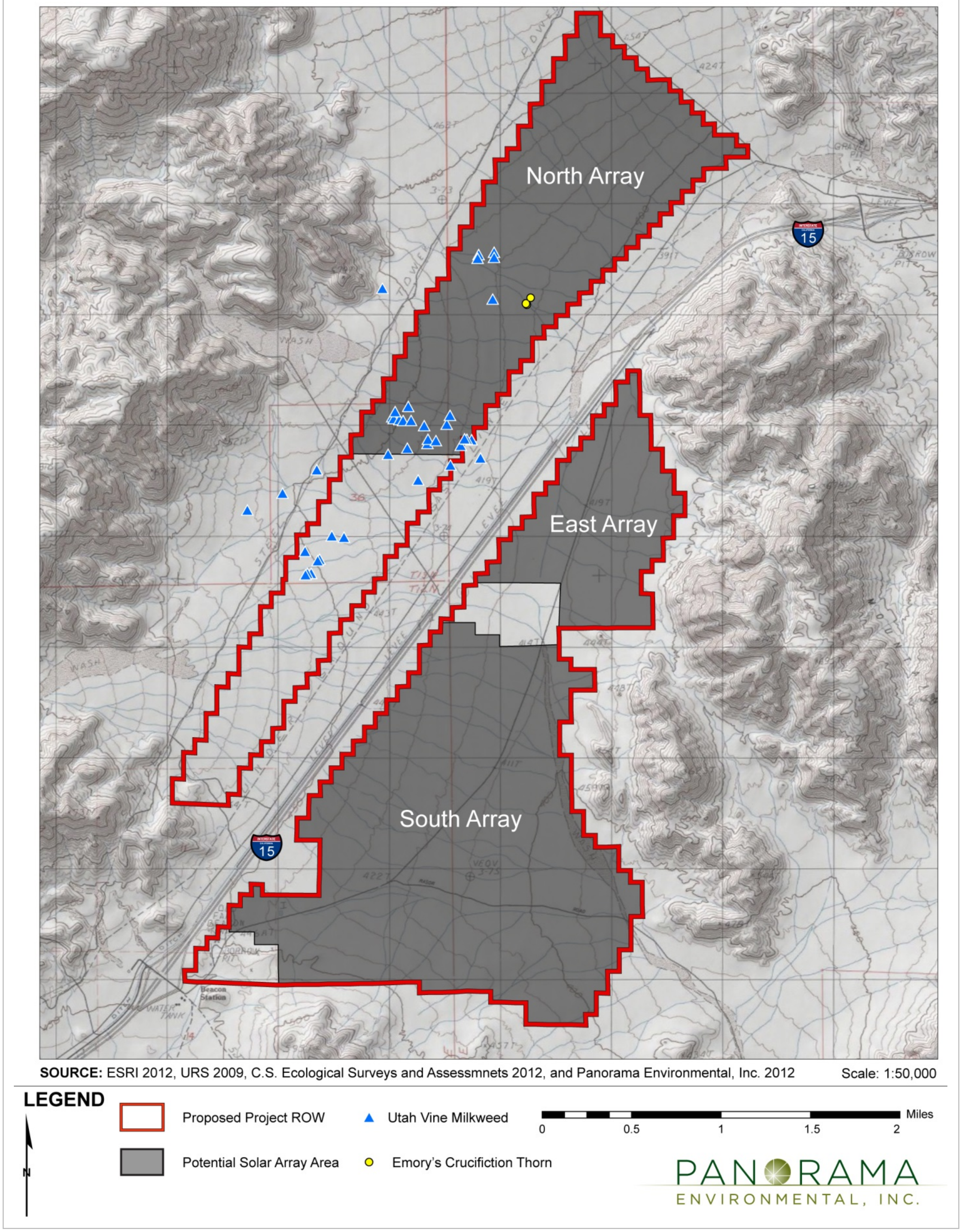
Table 3.2-4 (*Continued*): Special-status Plants and Potential to Occur in the Project Area

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:		*California Rare Plant Rank threat categories:*	
1B	Rare, threatened, or endangered in California and elsewhere.	.1	Seriously endangered in California.
2	Rare, threatened, or endangered in California, but more common elsewhere.	.2	Fairly endangered in California.
3	More information is needed – a review list.	.3	Not very endangered in California.
4	Limited distribution – a watch list.		

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

Figure 3.2-2: Special-status Plant Locations



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.

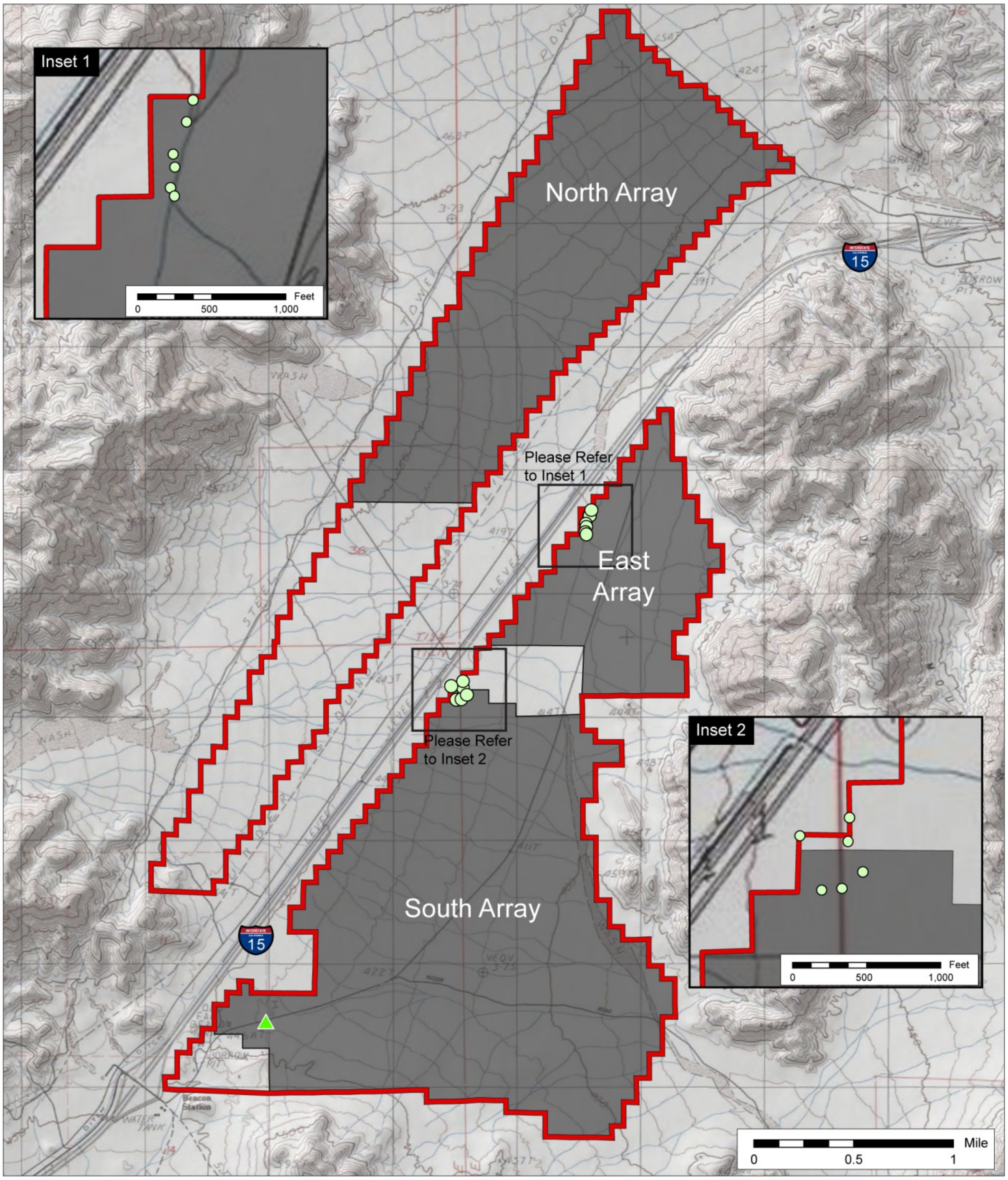
Locations and densities of cactus including beavertail cactus (*Opuntia basilaris* ssp. *basilaris*), California barrel cactus, cotton top, fish hook cactus, golden cholla, buckhorn cholla (*C. acanthicarpa* var. *coloradensis*), and pencil cholla were identified during the 2009 spring floristic surveys. 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

PANORAMA ENVIRONMENTAL, INC.

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)

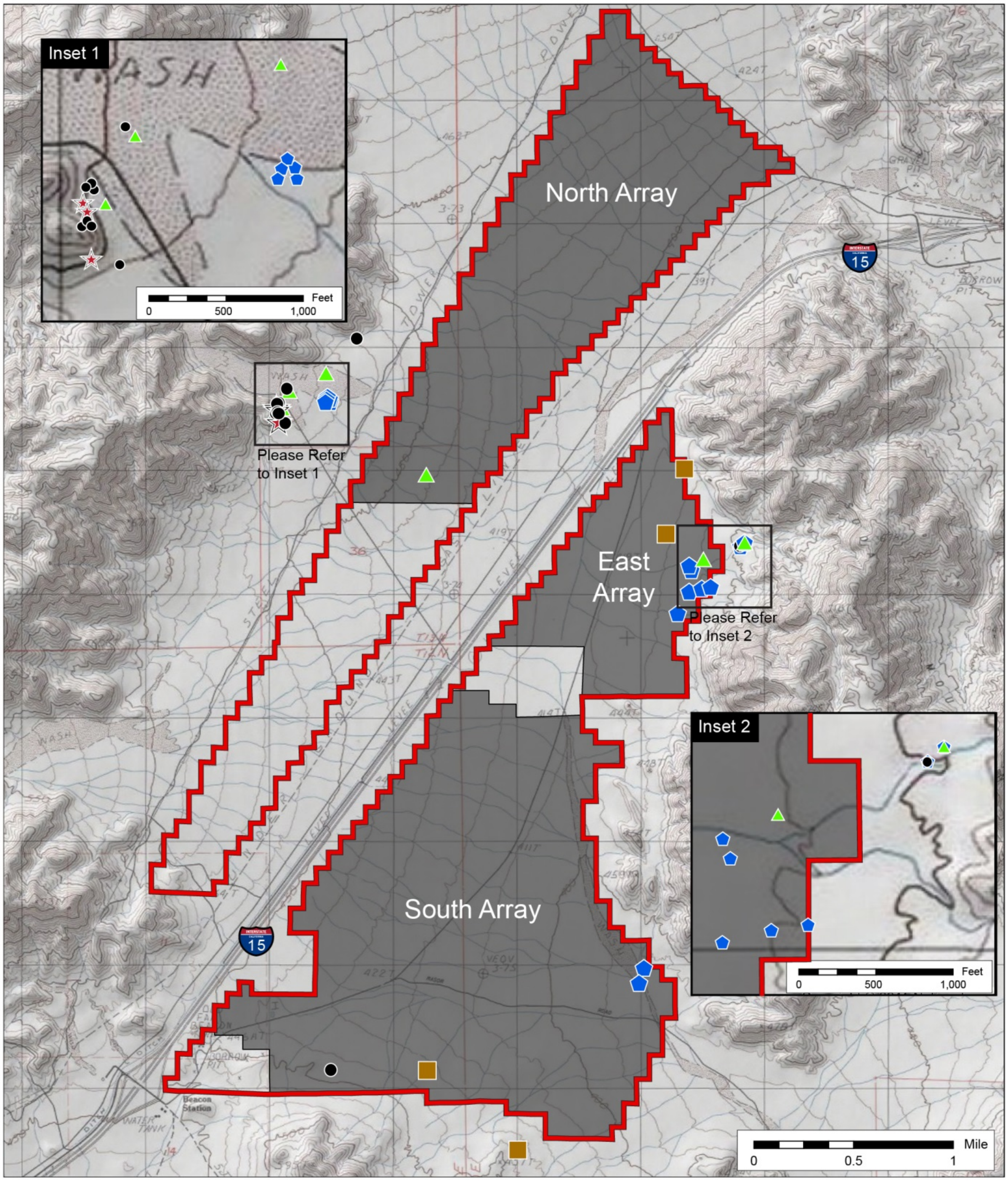
Survey results are summarized on Figure 3.3-1 and in Table 3.3-2. Sign were found outside of the project area in 2001 and 2009. Sign were found in the eastern and southern portion of the project area in 2012 during supplemental desert tortoise surveys and rare plant surveys. A desert tortoise was seen 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

N

PANORAMA ENVIRONMENTAL, INC.

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).

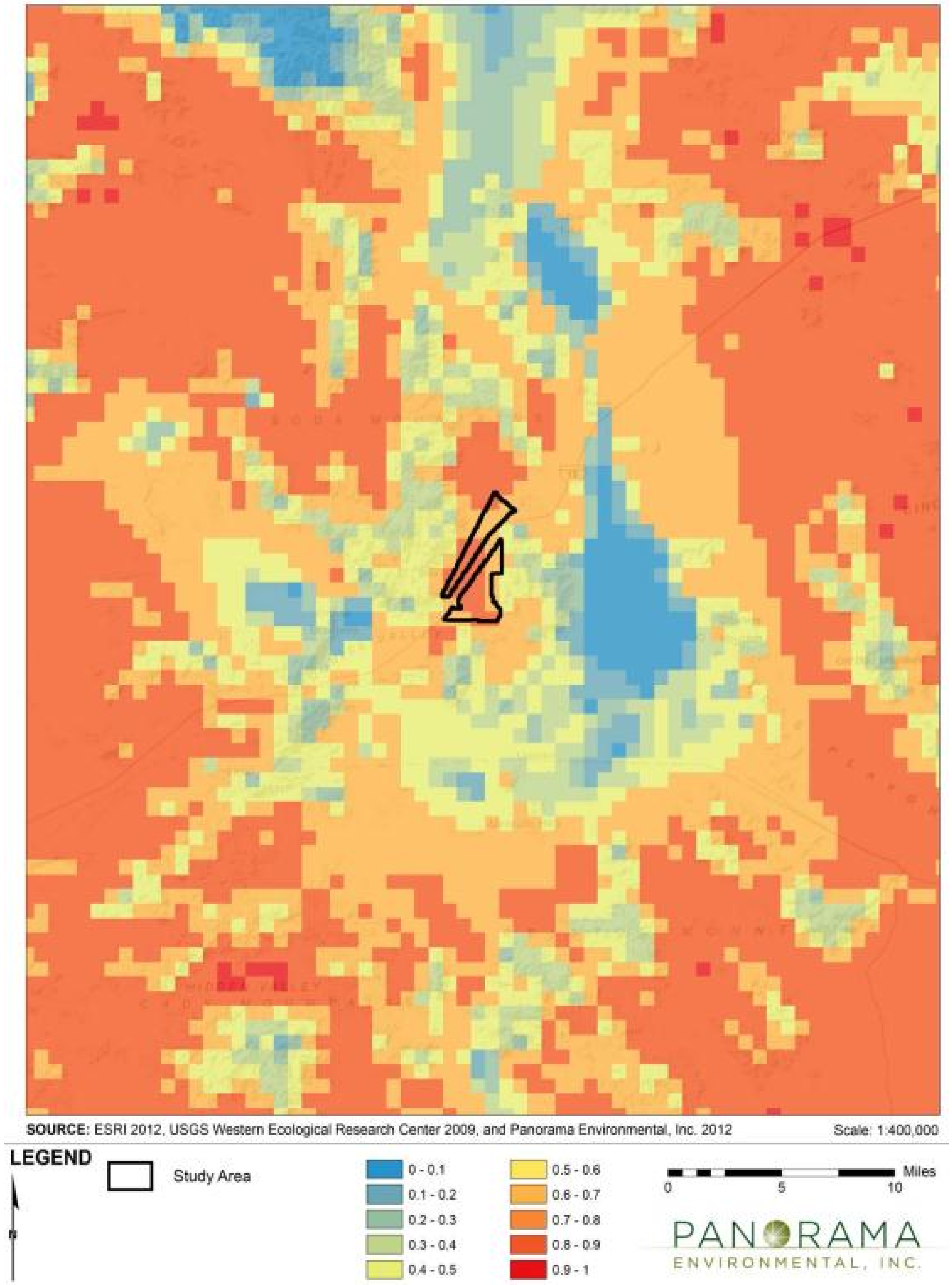
The Desert Connectivity Project is a regional-scale mapping effort that identified connectivity corridors for desert tortoise in the Mojave Desert. The results of the Desert Connectivity Project are presented in *A Linkage Network for the California Deserts* (Penrod et al. 2012). The Desert Connectivity 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

---

[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)

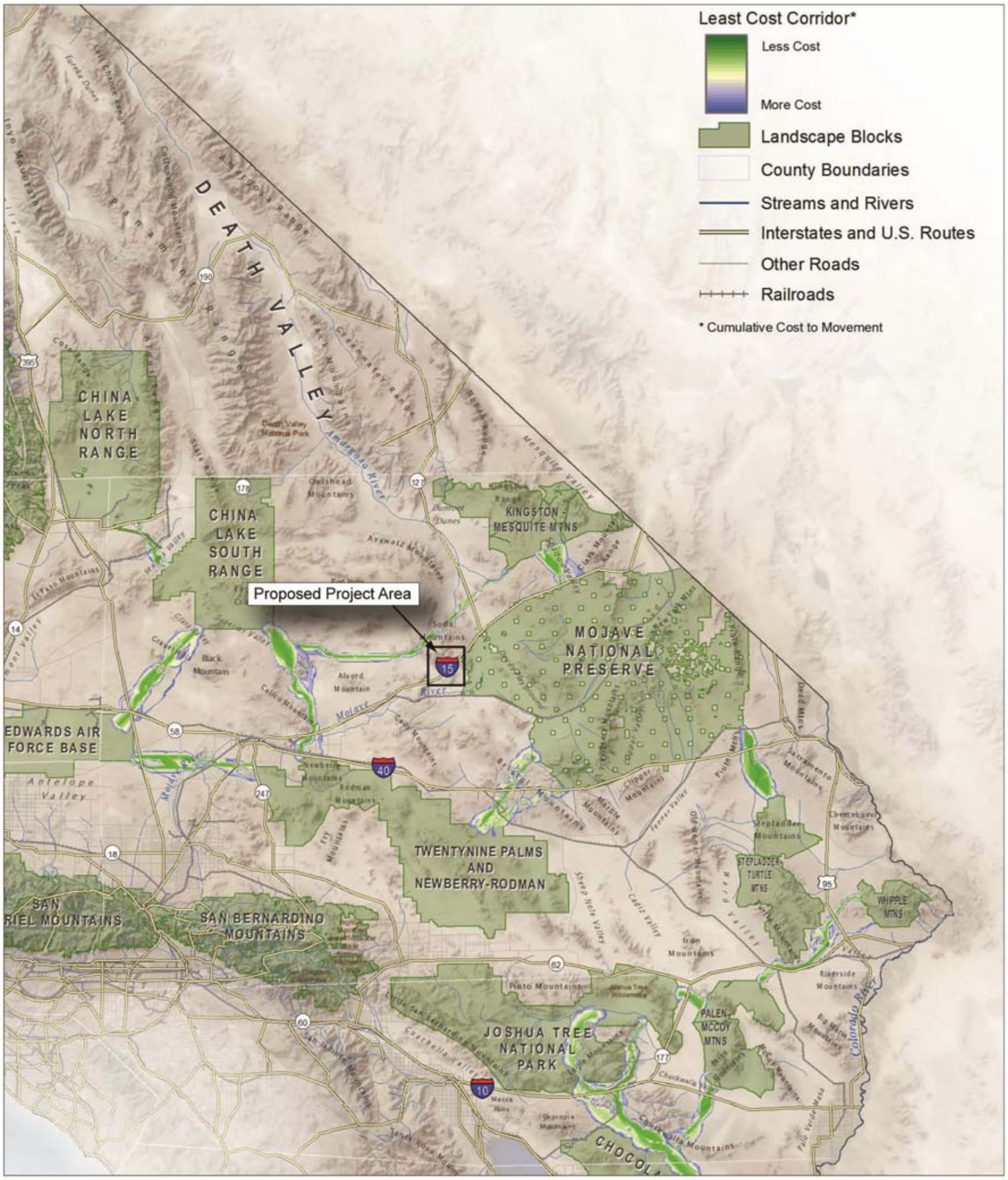


Kingston-Mesquite Mountains to the China Lake South Range. The Mojave National Preserve is linked to Twentynine Palms through the Bristol Mountains approximately 20 miles south of the project area. The project area was not included within a desert tortoise linkage corridor (Figure 3.3-3) in *A Linkage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

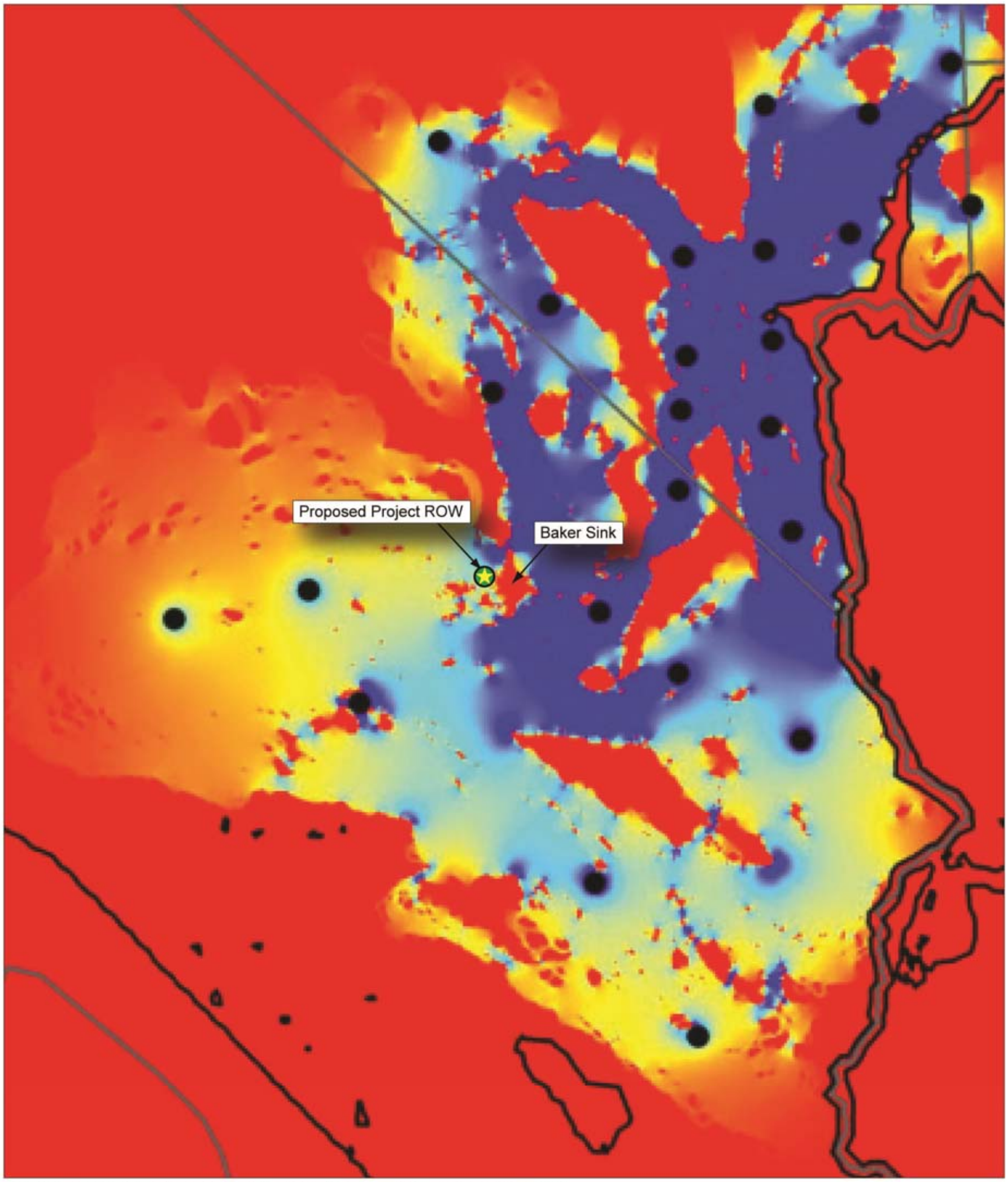


SOURCE: ESRI 2012, Penrod, K. et al. 2012, and Panorama Environmental, Inc. 2012

N

PANORAMA
ENVIRONMENTAL, INC.

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

PANORAMA ENVIRONMENTAL, INC.

Figure 3.3-5: DRECP Modeled Desert Tortoise Connectivity Corridor

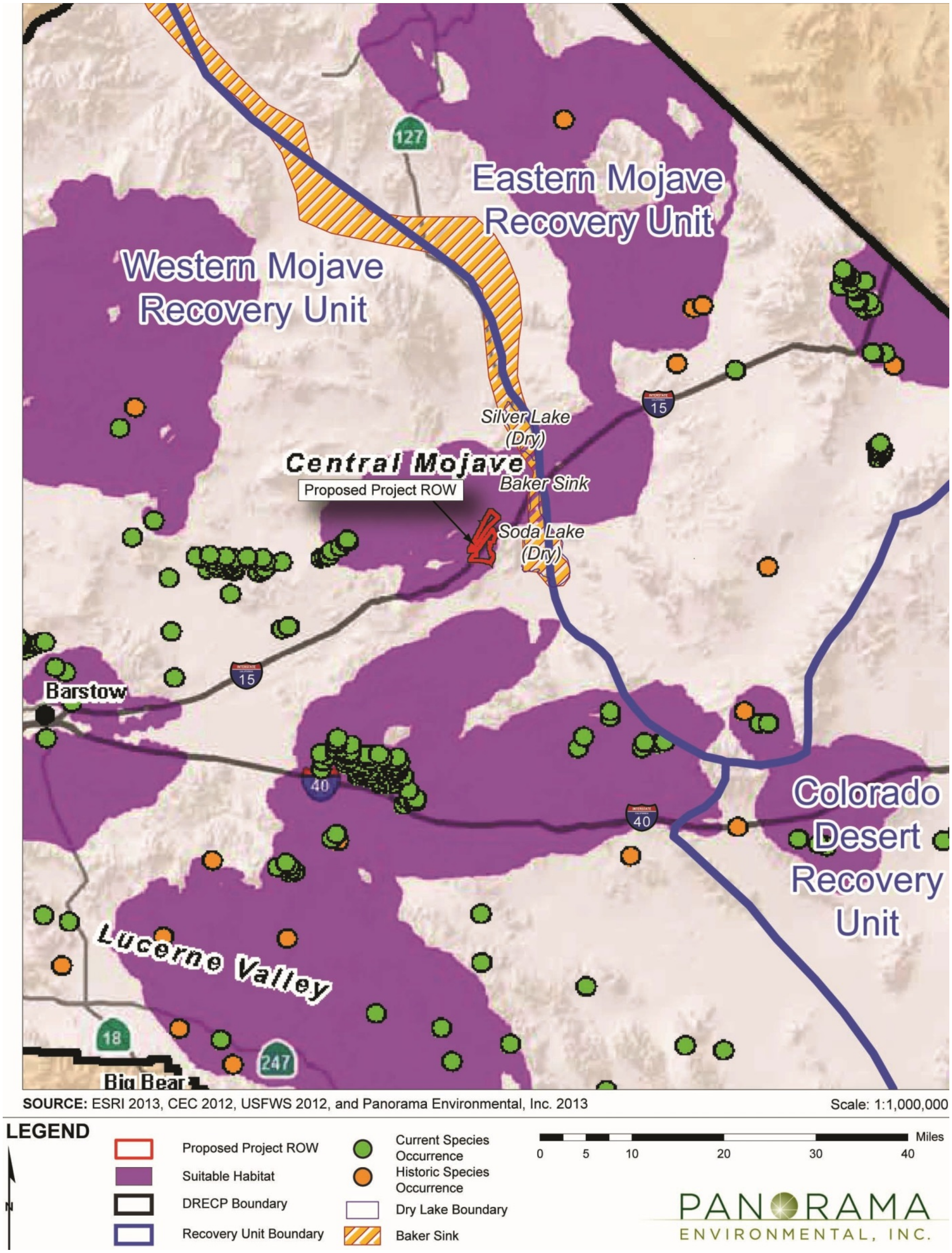
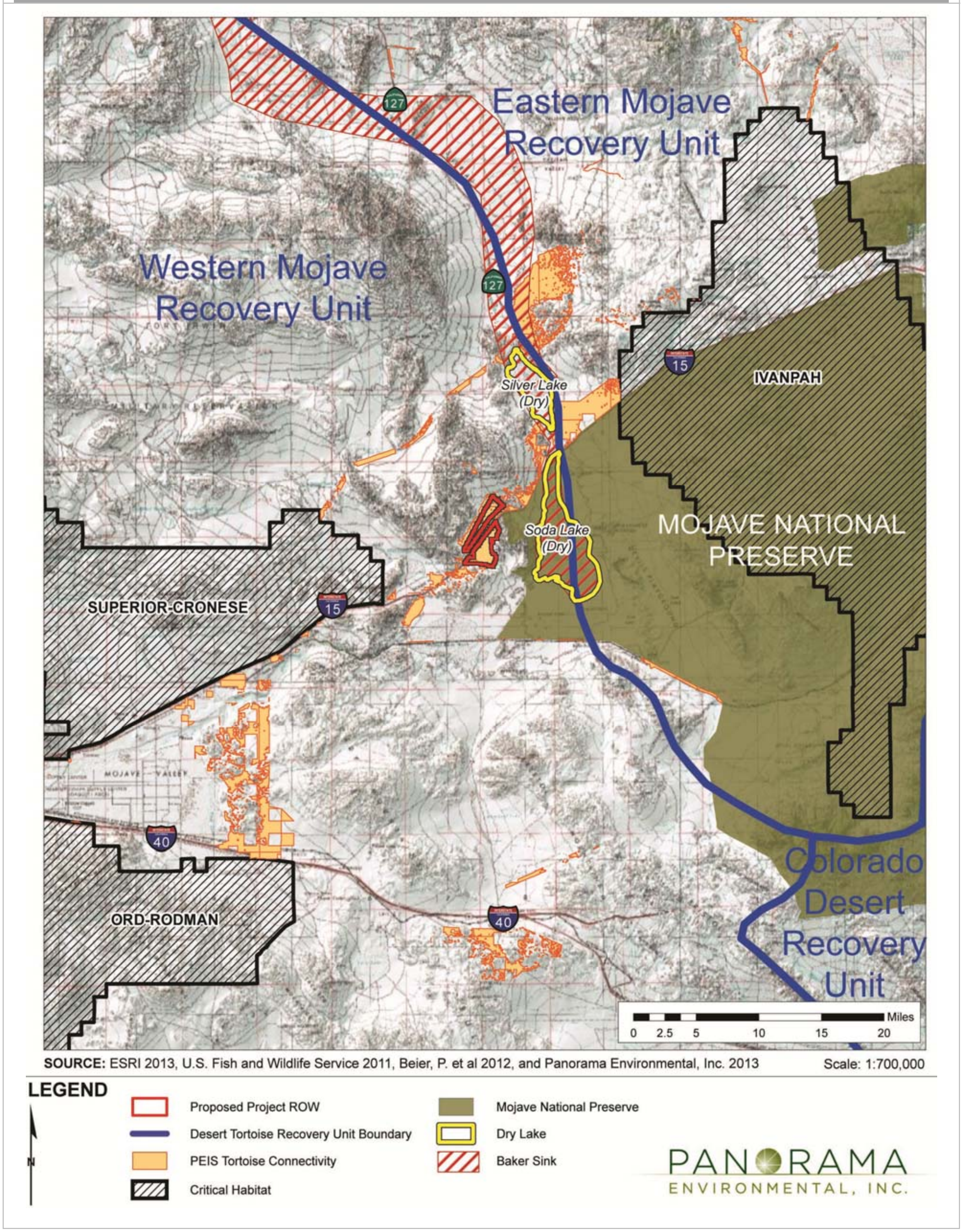


Figure 3.3-6: Solar PEIS Priority 1 Connectivity Corridor with Recovery Units



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.

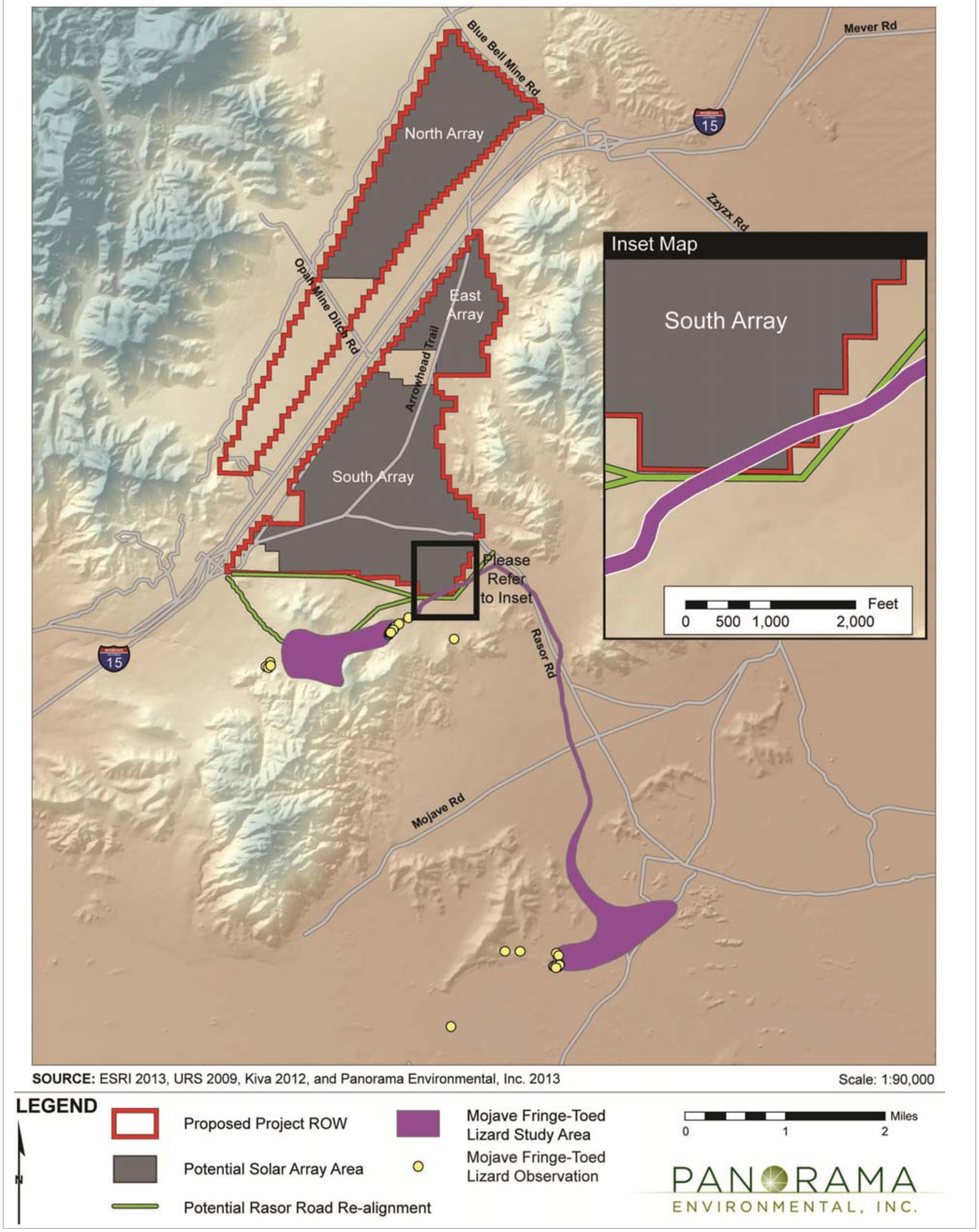
Mojave Fringe-toed Lizard. The Mojave fringe-toed lizard is listed as a BLM sensitive species and a California species of special concern. Mojave fringe-toed lizard habitat is characterized as fine, aeolian sand dunes and ramps on the margins of lakebeds and washes. Some populations are restricted to 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



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

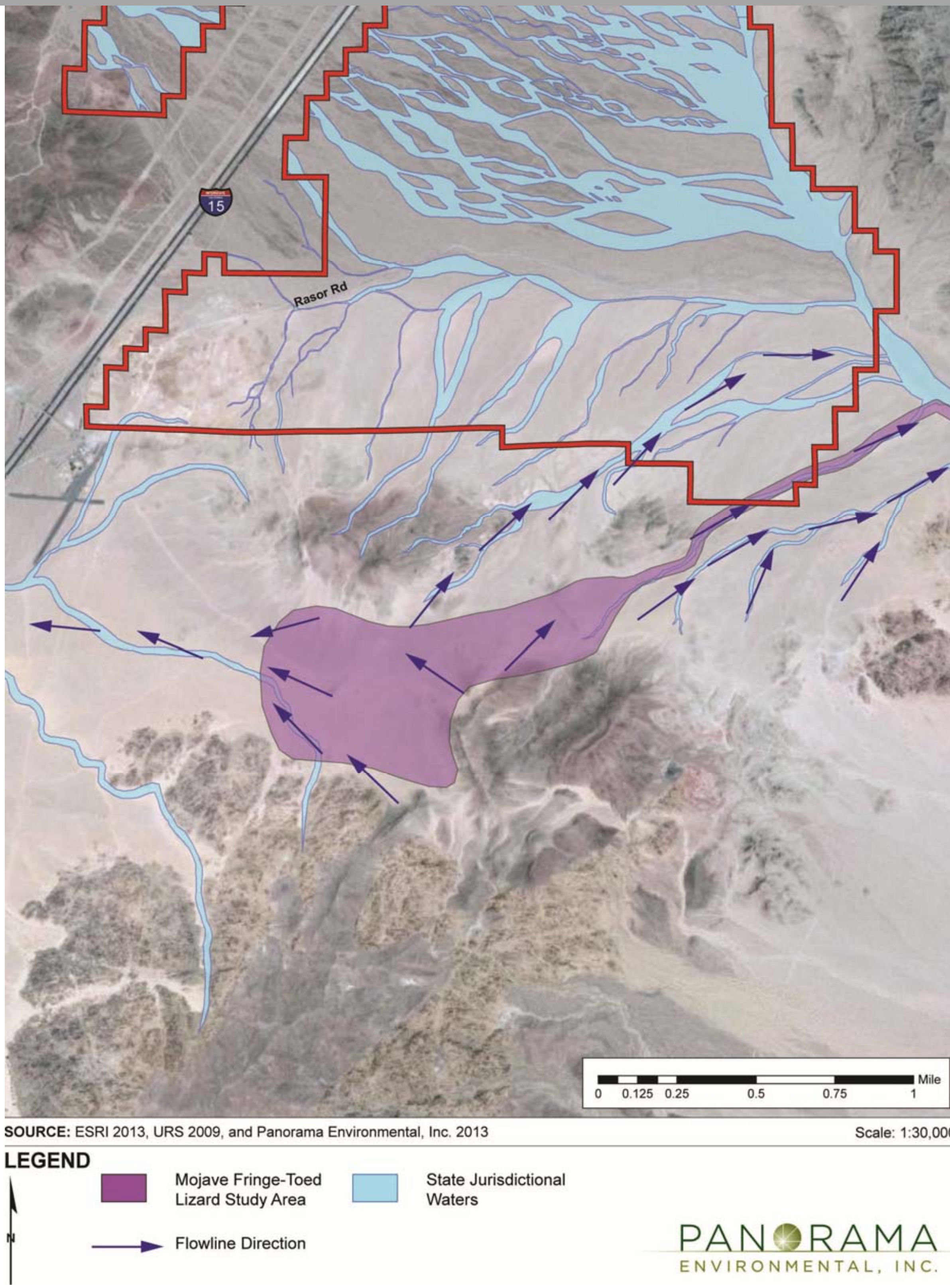
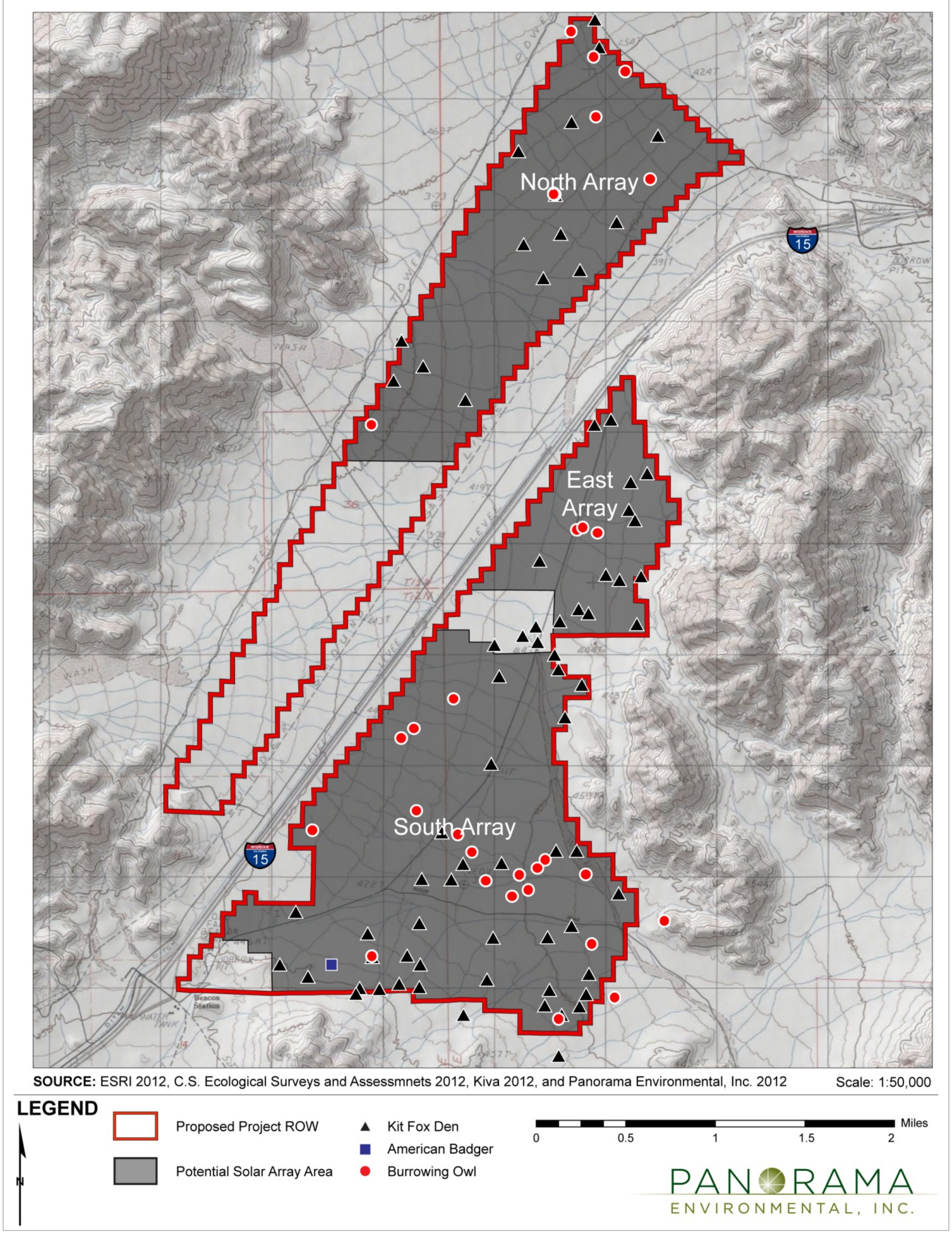


Figure 3.3-9: Burrowing Owl, Kit Fox, and American Badger Locations in Survey Area



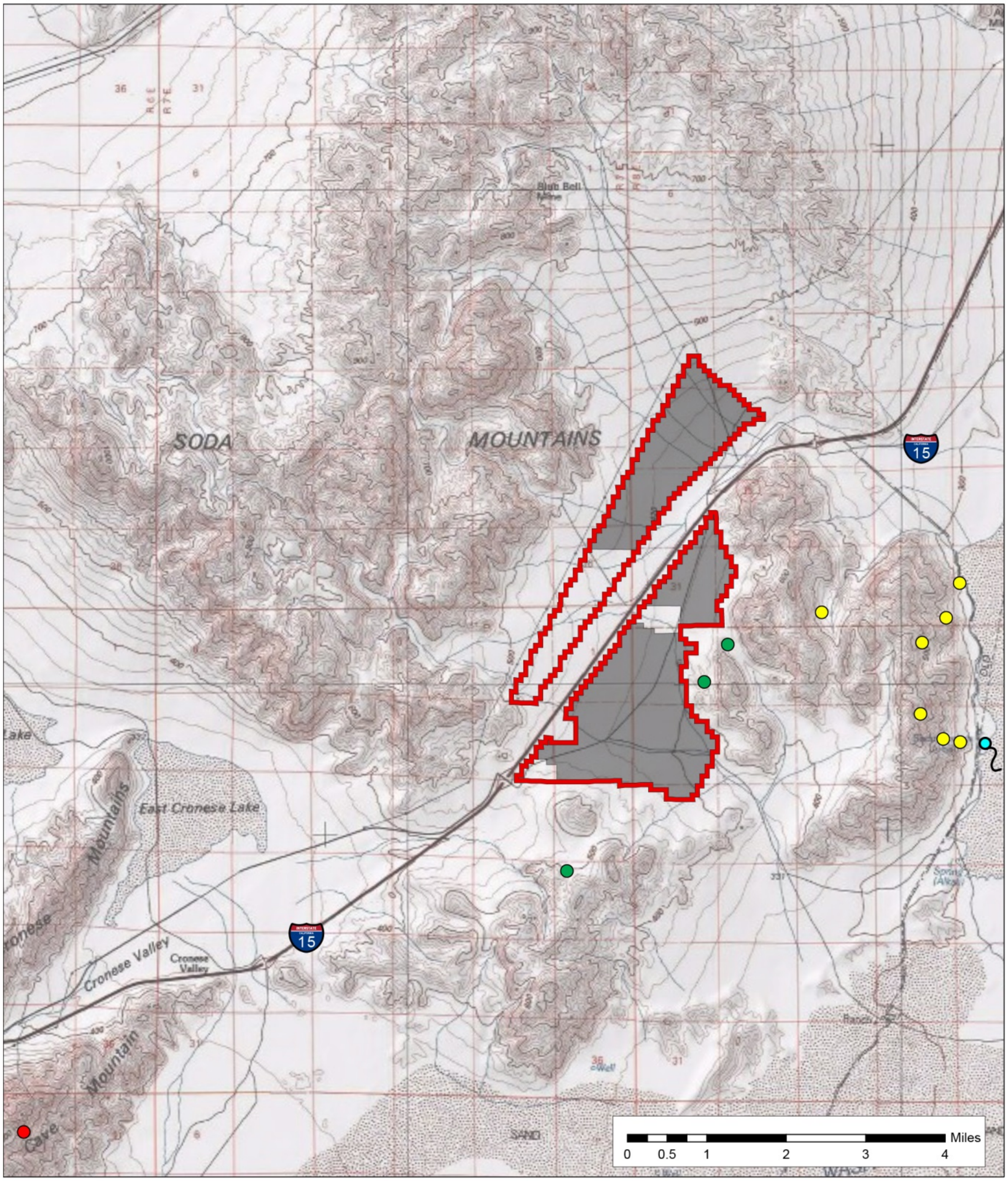
The project is located within an open valley and there is no suitable nesting habitat for golden eagles within the project area. The project area provides suitable foraging habitat and could be used by golden eagles nesting outside of the project area, as the home range of the species in southern California 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

PANORAMA ENVIRONMENTAL, INC.

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)

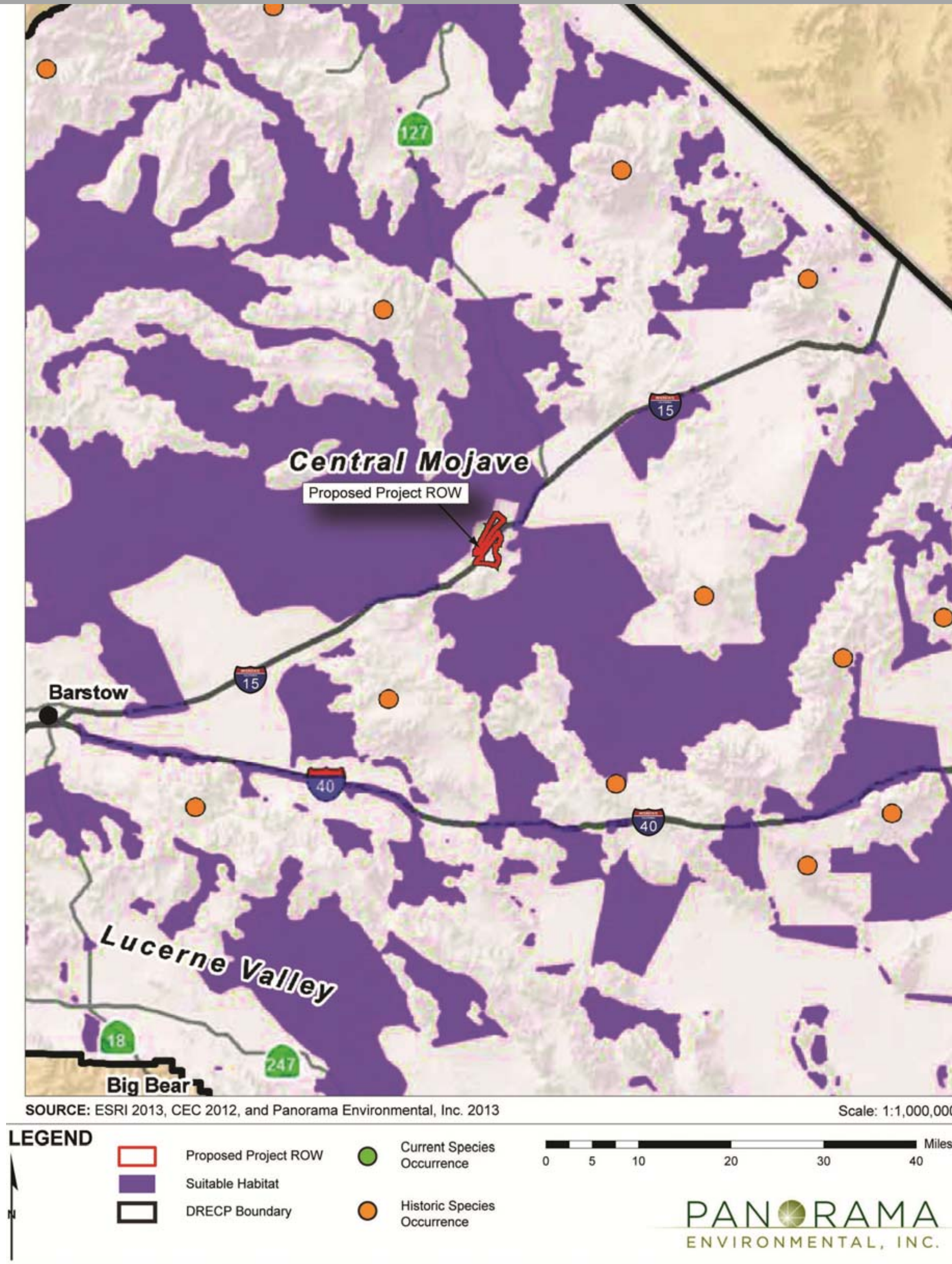


Figure 3.3-12: Bighorn Sheep Mountain Habitat (CEC 2012b)

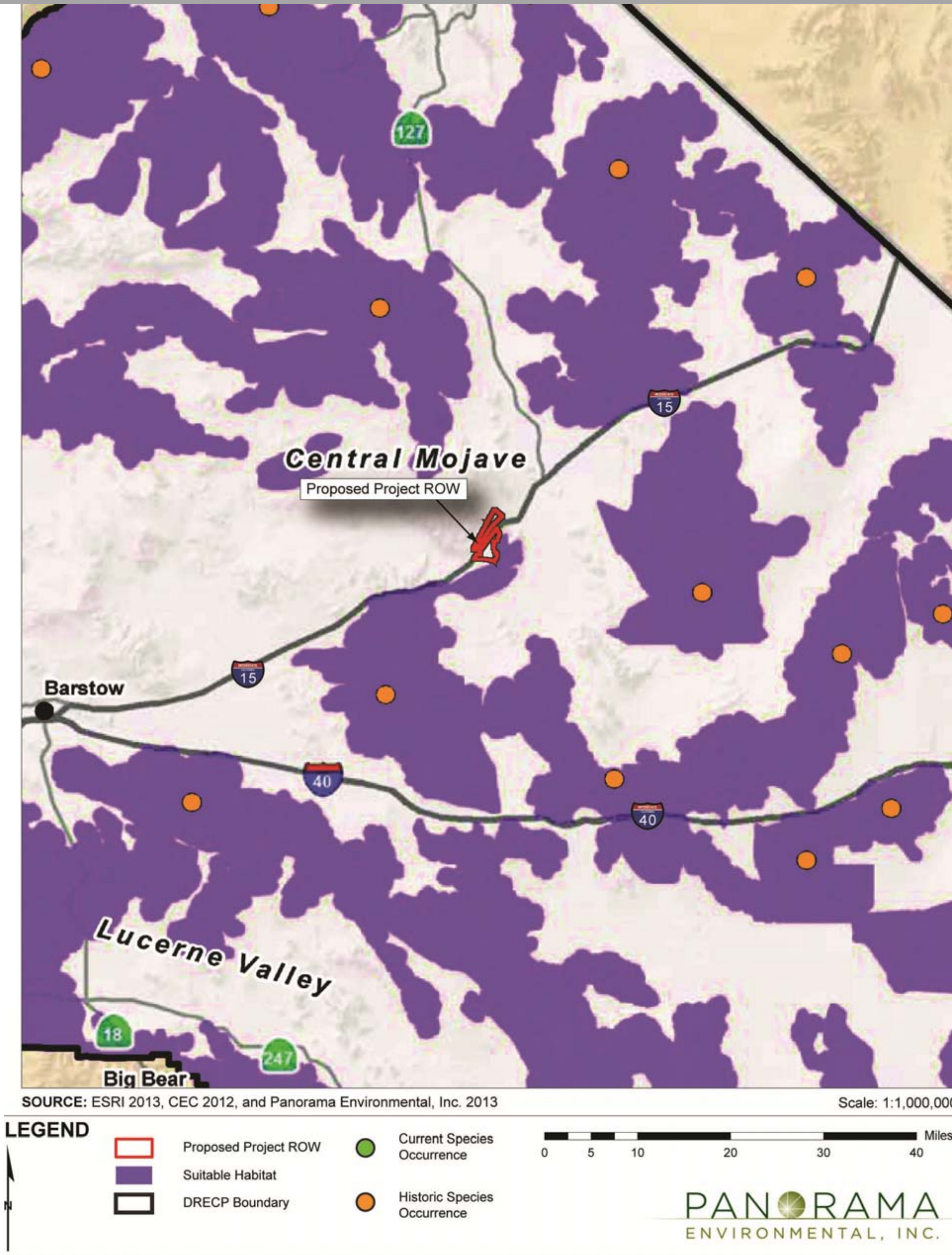
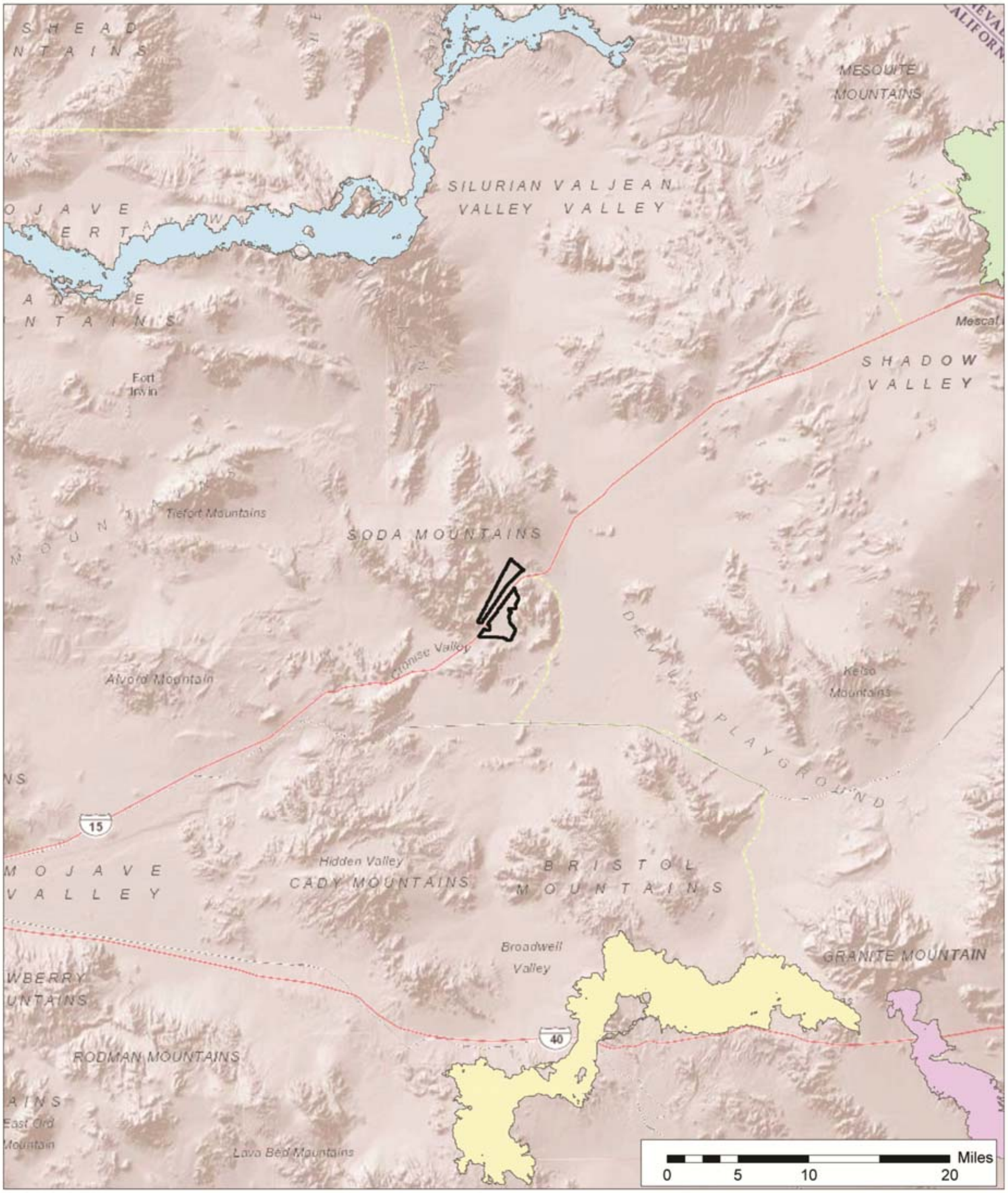


Figure 3.3-13: Bighorn Sheep Connectivity (Penrod et al. 2012)



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

LEGEND

- 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).

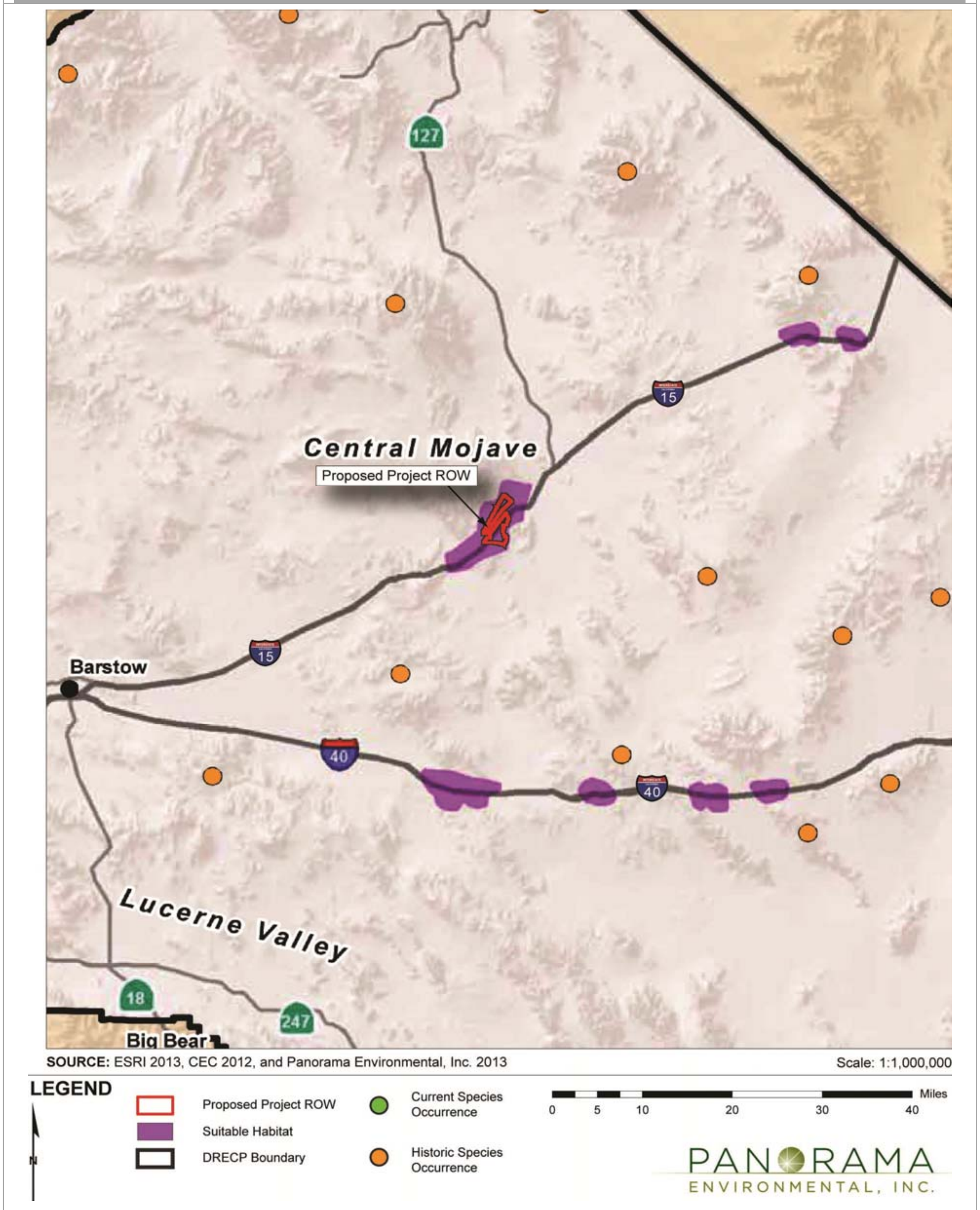
Bighorn sheep are not expected to use the project area (which is neither mountain nor intermountain habitat) for migration between populations because the sheep are more likely to cross the highway at areas where the mountains are close on both sides of the highway, as is the case at both Rasor Road 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).

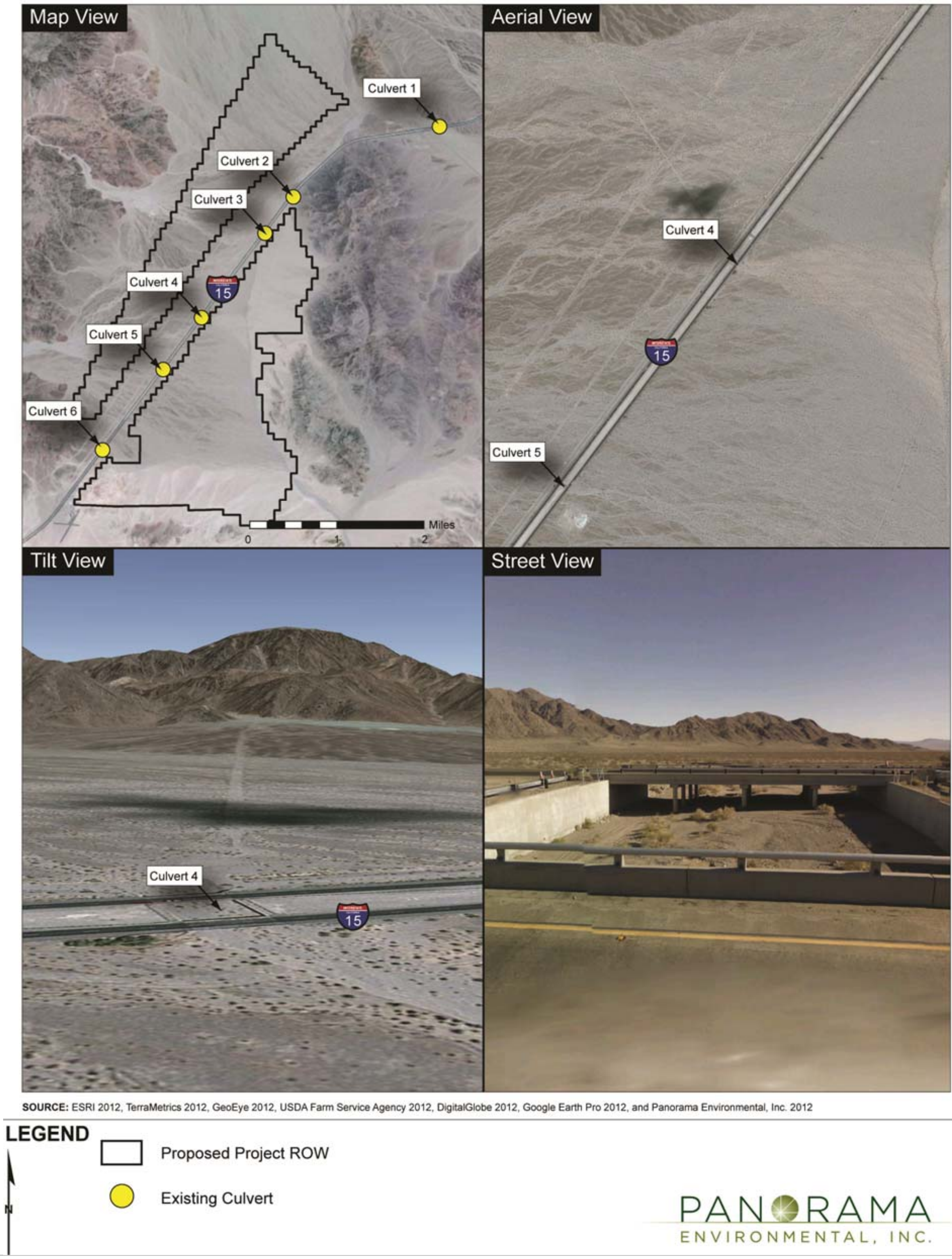
Figure 3.3-15: Box Culverts 2, 3, 5, and 6

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

PANORAMA ENVIRONMENTAL, INC.

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

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

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

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

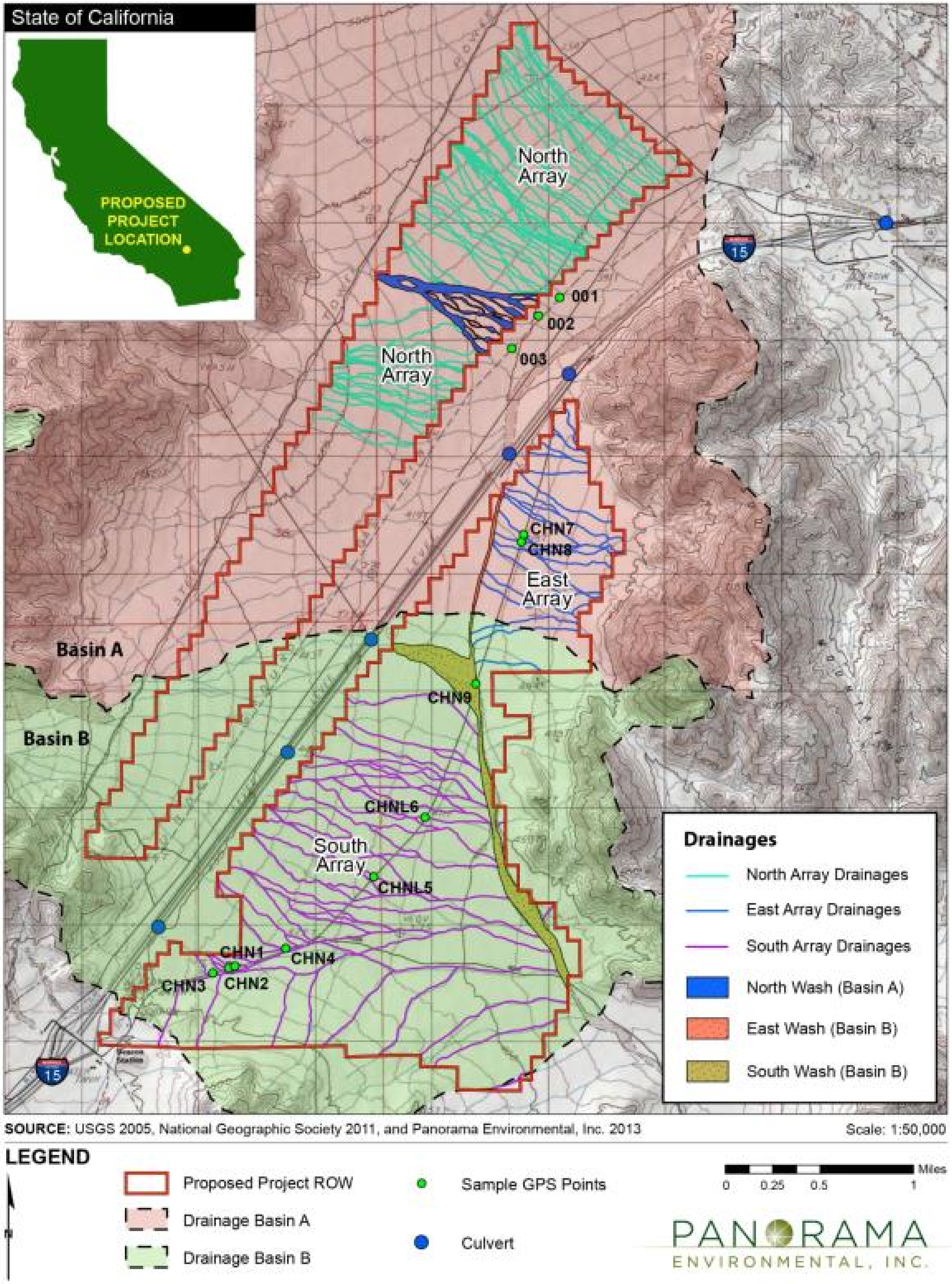


Table 3.4-1: Acreage of Ephemeral Drainages/Washes

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)

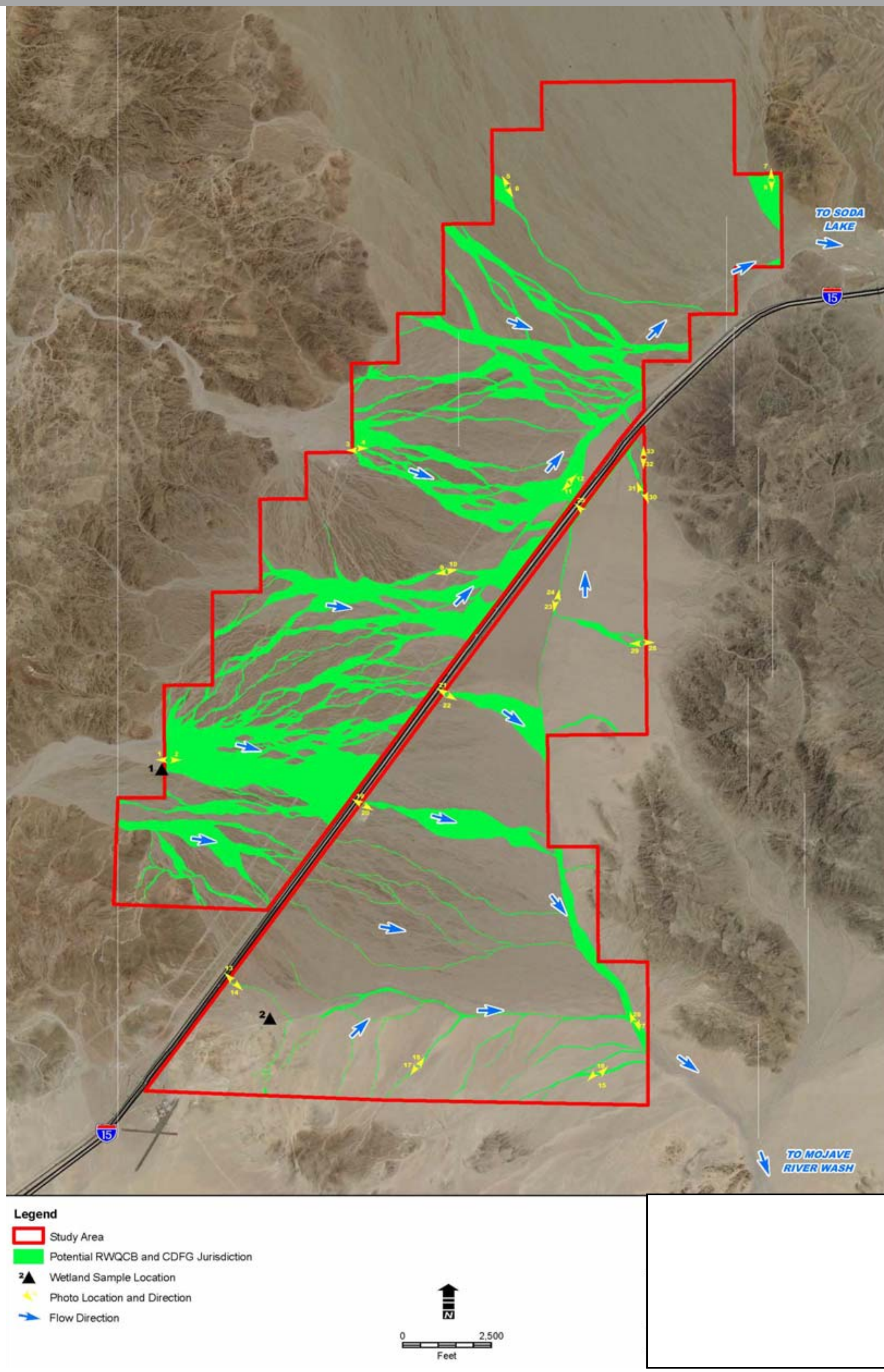
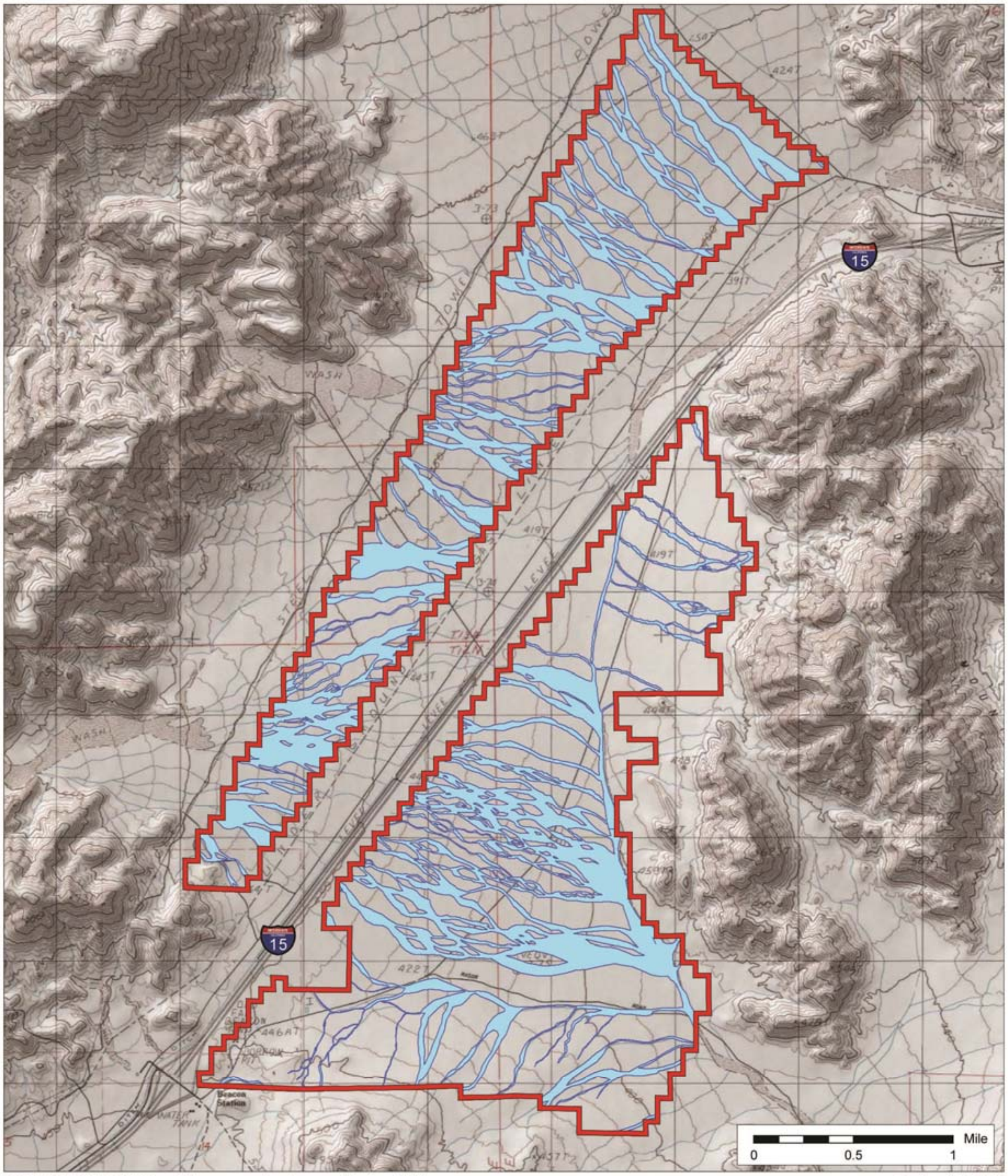


Figure 3.4-3: Waters of the State (2012)



SOURCE: ESRI 2013 and Panorama Environmental, Inc. 2013

Scale: 1:50,000

LEGEND

Proposed Project ROW

State Jurisdictional Drainage

PANORAMA ENVIRONMENTAL, INC.

4 REFERENCES

Abella, Regina. 2012a. Desert Bighorn Sheep Coordinator, California Department of Fish and Wildlife. Memorandum: May 1 Bighorn Sheep Ground Count in the South Soda Mountains. May 14, 2012.

_______. 2012b. Desert Bighorn Sheep Coordinator, California Department of Fish and Wildlife. Personal Communication with Susanne Heim and Laurie Hietter, Panorama Environmental, Inc. November 27, 2012.

_______. Desert Bighorn Sheep Coordinator, California Department of Fish and Wildlife. Personal Communication with Susanne Heim, Panorama Environmental, Inc. January 25, 2013.

AMEC. 2001. Desert Tortoise Survey of the Opah Ditch Mine.

AZDOT (Arizona Department of Transportation). 2008. Evaluation of Distribution and Trans-Highway Movement of Desert Bighorn Sheep: Arizona Highway 68. Prepared by Kirby Bristow and Michelle Crabb of the Arizona Game and Fish Department for AZDOT. http://www.azdot.gov/TPD/ATRC/publications/project_reports/PDF/AZ588.pdf.

Baldwin, B.G., ed. 2012. The Jepson Manual: Higher Plants of California 2d Edition. University of California Press, Berkeley, CA.

Barbour, R. W., and W. H. Davis. 1969. Bats of America. University of Kentucky Press, Lexington, Kentucky, USA.

Bell, G. P. 1982. Behavioral and ecological aspects of gleaning by a desert insectivorous bat Antrozous pallidus (*Chiroptera: Vespertilionidae*). Behavioral Ecology and Sociobiology 10:217-223.

Benson, K. L. P. & K. A. Arnold. 2001. The Texas Breeding Bird Atlas. Texas A&M University System, College Station and Corpus Christi, TX. http://txtbba.tamu.edu. Accessed August 27, 2012.

Birding Information. Undated. Say's Phoebe. http://www.birdinginformation.com/birds/tyrant-flycatchers/says-phoebe/. Accessed August 24, 2012.

Birdzilla. 2012. Cassin's Kingbird. http://www.birdzilla.com/birds/Cassins-Kingbird/bent_life_history.html. Accessed August 27, 2012.

BLM (Bureau of Land Management). 1980. California Desert Conservation Area Plan. http://www.blm.gov/pgdata/etc/medialib//blm/ca/pdf/pdfs/cdd_pdfs.Par.aa6ec747.File.pdf/CA_Desert_.pdf.

_______. 1999. Current Management Situation of Special Status Species in the West Mojave Planning Area. March 2009. http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/pdfs/cdd_pdfs.Par.ae863836.File.pdf/pfp890295548.pdf.

_______. 2005. Final Environmental Impact Report and Statement for the West Mojave Plan. http://www.blm.gov/ca/st/en/fo/cdd/wemo.html.

_______. 2012a. Wildlife Database: Townsend's big-eared bat (*Plecotus townsendii*). http://www.blm.gov/ca/forms/wildlife/details.php?metode=serial_number&search=3005&detaillabelc=Townsend. Accessed August 16, 2012.

_______. 2012b. Wildlife Database: Western pond turtle (*Clemmys marmorata*). http://www.blm.gov/ca/forms/wildlife/details.php?metode=serial_number&search=3060. Accessed August 16, 2012.

_______. 2012c. Western pond turtle (*Clemmys marmorata*). http://www.blm.gov/ca/pdfs/cdd_pdfs/clemmys1.PDF. Accessed August 16, 2012.

BRC (BioResource Consultants). 2011. Golden Eagle Nest Surveys and Desert Bighorn Sheep Observations, March 21-25, 2011 and May 9-10, 2011, Soda Mountain Solar Project. Prepared by BioResource Consultants for RMT, Inc.

Bristow, Kirby D., et al.. 1996. Habitat Use of Desert Bighorn Sheep Near the Silver Bell Mine, Arizona: A Final Report. Arizona Game and Fish Department Research Branch, Technical Report Number 25, Phoenix.

Brown-Berry Biological Consulting. 2012. Bat Habitat Assessment for Bechtel Soda Mountain Solar Project, San Bernardino, California. Prepared for Panorama Environmental, Inc. November 18, 2012.

Brown, Patricia. 2012. Brown-Berry Biological Consulting. Personal communication with Susanne Heim, Panorama Environmental, Inc. December 30, 2012.

Brown, P.E. and A.D. Grinnell. 1980. Echolocation ontogeny in bats. Pp. 355-377, In Animal Sonar Systems (R.G. Busnel and J.F. Fish, eds.). Plenum Press, New York.

Burke, Bob. 2012. Society for the Conservation of Bighorn Sheep. Personal communication with Susanne Heim, Panorama Environmental, Inc. November 27, 2012.

CSESA. 2012. Focused Fall Special-Status Plant Survey Soda Mountain Solar Project. October – November 2012. Prepared for Panorama Environmental, Inc. and BLM.

Caithness. 2010a. Final 2009 Desert Tortoise Survey Report, Soda Mountain Solar Project. Prepared by RMT, Inc. October 2010.

_______. 2010b. Final 2009 Spring and Fall Avian Survey Report, Soda Mountain Solar Project. Prepared by RMT, Inc. October 2010.

_______. 2010c. Final 2009 Biological Resources Technical Report, Soda Mountain Solar Project. Prepared by RMT, Inc. October 2010.

_______. 2010d. Final 2009 Focused Special Status Plant Survey report, Soda Mountain Solar Project. Prepared by RMT, Inc. October 2010.

_______. 2010e. Final 2009 Mojave Fringe-Toed Lizard Survey Report, Soda Mountain Solar Project. Prepared by RMT, Inc. October 2010

CalFlora. 2012. CalFlora Plant Distribution http://www.calflora.org/entry/dgrid.html?crn=6802

Campbell, Wendy. 2012. Environmental Scientist, California Department of Fish and Wildlife. Personal communication with Susanne Heim, Panorama Environmental, Inc. November 29, 2012.

CBOC (The California Burrowing Owl Consortium). 1993. Burrowing owl survey protocol and mitigation guidelines. Tech. Rep. Burrowing Owl Consortium, Alviso, California.

CCH (Consortium of California Herbaria). 2012. Accession results for various species. http://ucjeps.berkeley.edu/consortium/. Accessed October 2012.

CDFA (California Department of Food and Agriculture). 2012. List of Plants Defined as Noxious Weeds by California Law. Division of Plant Health and Pest Preventions Services. http://www.cdfa.ca.gov/plant/ipc/weedinfo/winfo_list-pestrating.htm. Accessed February 27, 2013.

CDFW (California Department of Fish and Wildlife). 1995. Fish Species of Special Concern in California. 2d ed. June 1995.

_______. 2000. Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities. http://www.slocounty.ca.gov/Assets/PL/environmental/CDFG_botanical_survey_guidelines.pdf

_______. 2009. Protocol for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/protocols_for_surveying_and_evaluating_impacts.pdf.

_______. 2012a. Fully Protected Animals. http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/fully_pro.html. Accessed August 16, 2012.

_______. 2012b. California Natural Diversity Database Maps and Data. Prepared by California Department of Fish and Wildlife. http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp

_______. 2012c. RareFind3. Electronic database. Sacramento, California.

CDFW ESD (California Department of Fish and Wildlife, Environmental Services Division). 1994. A Field Guide to Lake and Streambed Alteration Agreements, Sections 1600-1607, California Fish and Game Code.

CEC (California Energy Commission). 2012a. *Draft Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report.* Prepared by Dudek and ICF. March 2012.

_______. 2012b. *Description and Comparative Evaluation of Draft DRECP Alternative.* December 2012.

Chipper Woods Bird Observatory, Inc. 2009. Dark-eyed Junco, Gray-headed Race. http://www.wbu.com/chipperwoods/photos/junco_gh.htm. Accessed August 21, 2012.

Clark, J. P. and S. E. Hygnstrom, 1994. The Handbook: Prevention and Control of Wildlife Damage. Horned Larks. http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1062&context=icwdmhandbook. Accessed August 21, 2012.

Clarke, M.L, et al. 1995. Luminescence dating of Mojave Desert sands. Quaternary Science Reviews 14:783–89.

CNPS (California Native Plant Society). 2001. Botanical Survey Guidelines of the California Native Plant Society.

_______. 2012. Inventory of Rare and Endangered Plants (online edition, v8-01a). California Native Plant Society. Sacramento, CA. Accessed at: http://www.rareplants.cnps.org/

Cornell Lab of Ornithology. 2012. Nestwatch Resource Center. http://www.birds.cornell.edu/nestinginfo/bios/sp_accts/eust. Accessed August 21, 2012.

Cornell University. 2011. The Cornell Lab of Ornithology. All About Birds. http://www.allaboutbirds.org. Accessed August 20, 2012.

Davenport, Arthur. 2013.Consulting bighorn sheep biologist. Personal Communication with Panorama Environmental, Inc. February 8, 2013.

EERE (Office of Energy Efficiency and Renewable Energy) et al. 2012. Final Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States

EL (Environmental Laboratory). 1987. Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, U.S. Army Engineer Waterways Experimental Station, Vicksburg, Mississippi.

Epps, C. W., V. C. Bleich, J. D. Wehausen, and S. G. Torres. 2003. Status of bighorn sheep in California. Desert Bighorn Council Transactions 47:20-35.

ESA. 2012. Draft Methodology Report: Resource by Resource Approach to Analysis in the Draft PA/EIS/EIR. December 14, 2012.

Farmer, A. 2008. *Cathartes aura*. Animal Diversity Web. http://animaldiversity.ummz.umich.edu/site/accounts/information/Cathartes_aura.html. Accessed August 21, 2012.

Fesnock, Amy. 2013. BLM State Office Threatened and Endangered Species Biologist. Personal communication with Laurie Hietter, Panorama Environmental. February 20, 2013.

Fulton, Robert. 2012. Site Manager, Desert Studies Center. 2012. Personal communication with Kristi Black, Environmental Scientist, Panorama Environmental, Inc. August 16, 2012.

Genter, D.L. 1986. Wintering bats of the upper Snake River plain: occurrence in lave-tube caves. Great Basin Nat. 46:241-244.

Graham, R.E. 1966. Observations on the roosting habits of the big-eared bat, *Plecotus townsendii* in California limestone caves. Cave Notes. 8:17-22.

Hagerty, B.E., et al. 2010. "Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise". Landscape Ecology. doi: 10.1007/s10980-010-9550-6.

Henny, C. J. and L. J. Blus. 1981. Artificial burrows provide new insight into Burrowing Owl nesting biology. Raptor Res. 15: 82-85

Hermanson, J. W., and T. J. O'Shea. 1983. *Antrozous pallidus*. Mammalian Species 213:1-8.

Hickman, J.C., ed. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, California.

Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California (California Department of Fish and Game, The Resources Agency, ed). Sacramento, CA.

Hoff, K.S. & Marlow, R.W. 2002. "Impacts of Vehicle Road Traffic on Desert Tortoise Populations with Consideration of Conservation of Tortoise Habitat in Southern Nevada." Chelonian Conservation and Biology (4) 449-456

Hughson, Debra. 2013. Science Advisor, National Park Service, Mojave National Preserve. Personal communication with Panorama Environmental, Inc. February 1, 2013.

Humple, D. 2008. Loggerhead Shrike (Lanius ludovicianus) (mainland populations) in: Shuford, W.D., and Gardali, T., editors. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field

Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

_______. 1999. Point Reyes Bird Observatory. *Blue-gray gnatcatcher*. http://www.prbo.org/calpif/htmldocs/species/oak/bggnacct.html. Accessed August 21, 2012.

Jones, Becky. 2013. Wildlife Biologist, California Department of Fish and Wildlife. Personal communication with Panorama Environmental, Inc. February 4, 2013.

Kiva Biological Consulting. 2012a. Protocol Desert Tortoise Survey for Soda Mountain Solar Project, Fall 2012. Prepared for BLM. November 28, 2012.

_______. 2012b. Protocol Desert Tortoise Survey for 17 Geotech Sites and Access Routes for Soda Mountain Solar Project, Fall 2012. Prepared for BLM. December 4, 2012.

Knight, R. L., et al. 1999. Great Basin Naturalist 59(4). Predatory Bird Populations in the East Mojave Desert, California. 1999. P. 331-338. http://www.conservation-science.com/products/Sci%20Pubs/Knight%20et%20al%2099-GBN-pred%20bird%20pops.pdf.

Lewis, S. E. 1994. Night roosting ecology of pallid bats (*Antrozous pallidus*) in Oregon. American Midland Naturalist 132:219-226.

Lewis Center for Educational Research. 2008. Current Refuges for Mohave tui chub. http://hegel.lewiscenter.org/users/mhuffine/subprojects/Student%20Led%20Research/chubworld/currentrefugia.htm.

Lichvar, R.W., et al. 2006. Distribution of Ordinary High Water Mark (OHWM) Indicators and Their Reliability in Identifying the Limits of "Waters of the United States" in Arid Southwestern Channels. ERDC/CRREL Technical Report 06-5. 21p.

Lichvar, R.W. & J.S. Wakeley, eds. 2004. Review of Ordinary High Water Mark indicators for delineating arid streams in the southwestern United States. ERDC/CRREL TR-04-1. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory. http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR04-21.pdf.

Lichvar R.W. & S.M. McColley. 2008. "A Field Guide to the Identification of the Ordinary High Water Mark in the United States: A Delineation Manual." Cold Regions Research and Engineering Laboratory. ERDC/CRREL TR-08-12, August 2012. Prepared for U.S. Army Corps of Engineers Wetland Regulatory Assistance Program.

Merola, M. 1995. The Condor. Vol. 97, No. 2. pp. 585-587

Miller, G.D. and W.S. Gaud. 1989. Composition and Variability of Desert Bighorn Sheep Diets. Journal of Wildlife Management 53:597–606.

Mirror-pole.com. 2011. Arizona Bird Field Data Resources. Mourning Dove nest with eggs on completely flat ground. http://www.mirror-pole.com/collpage/morndove/mour_dv2.htm. Accessed August 21, 2012.

National Geographic. 2006. Complete Birds of North America. http://animals.nationalgeographic.com/animals/birding/backyard-birds-all/. Accessed August 21, 2012.

NPS (National Park Service). 2001. Environmental Assessment: Dredging of Lake Tuendae, Habitat for the Endangered Mojave tui chub. September 2001.

_______. 2004. Report on a Workshop to Revisit the Mohave Tui Chub recovery Plan and a Management Action Plan. http://www.nps.gov/moja/naturescience/upload/ACF46F1.pdf.

Nussear, K.E., et al. 2009. Modeling Habitat of the Desert Tortoise (*Gopherus agassizii*) in the Mojave and Parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona. U.S. Geological Survey Open-File Report 2009-1102.

Otahal, C. 2009. Personal communications between URS Corporation and Chris Otahal, California Desert District Bureau of Land Management, Barstow Field Office Wildlife Biologist. May 2009.

_______. 2013. Personal communication with Susanne Heim, Panorama Environmental, Inc. February 21, 2013.

Panorama Environmental, Inc. 2013. "Response to Updates to WOUS Needed: Soda Mountain Solar Project JD (ACOE file reference # SPL-2010-1042-CO)". January 29, 2013.

Pagel, J.E., et al. 2010. Interim Golden Eagle technical guidance: inventory and monitoring protocols; and other recommendations in support of eagle management and permit issuance. Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

Penrod, K., et al. 2012. A Linkage Network for the California Deserts. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA.

Perkins, J.M. and C.E. Levesque. 1987. Distribution, status and habitat affinities of Townsend's big-eared bat (*Plecotus townsendii*) in Oregon. OR Dept. Fish & Wildlife Tech. Report #86-6-01. 50 pp.

Perkins, J.M. et al. 1994. Roost selection in hibernating *Plecotus townsendii*. Bat Research News 35(4): 110 [ABS].

Pierson, E. D., et al.. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (Corynorhinus townsendii townsendii and Corynorhinus townsendii pallescens). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho.

Pierson, E.D. 1998. In Brylski P.V., P.W. Collins, E.D. Pierson, W,E. Rainey and T.E. Kucera. 1998. Mammal Species of Special Concern in California. Draft final report submitted to California Dept. of Fish and Game Wildlife Management Division, Sacramento, CA.

Pierson, E.D. and W.E. Rainey. 1996a. The distribution, status, and management of Townsend's big-eared bat (*Corynorhinus townsendii*) in California. Report to California Department of Fish and Game, Sacramento, CA. Bird and Mammal Conservation Program Rep.96-7, 49 pp.

Porter, Michael. 2012. Water Sources Can Be Managed to Benefit Mourning Dove. The Samuel Roberts Nobel Foundation. http://www.noble.org/ag/wildlife/mourningdovewater/. Accessed August 21, 2012.

PRBO Conservation Science. CalPIF Bird Conservation Plans. http://www.prbo.org/calpif/ plans.html. Accessed August 24, 2012.

Presch, William. 2007. Notes on the fringe-toed lizard (*Genus Uma*) habitat in the east Mojave Desert, San Bernardino and Riverside Counties. 2007 Desert Symposium.

Ralph, C.J., et al. 1995. *Managing and monitoring birds using point counts: Standards and Applications*. In: Monitoring Bird Populations by Point Counts (C.J. Ralph, S. Droege, and J.R. Sauer, technical editors) PSW-GTR-149. U.S. Department of Agriculture, Forest Service. Albany, CA.

RMT, Inc. 2010. Geologic Field Reconnaissance Report: Percolation, Stormwater Runoff, and Channel Scour Potential. December 2010.

Rowe, S. P. & T. Gallion. Kern River Research Center. Fall Migration of Turkey Vultures and Raptors through the Southern Sierra Nevada, California. September 18, 1995. http://elibrary.unm.edu/sora/wb/v27n01/p0048-p0053.pdf. August 21, 2012.

Ryser, Jr., F. A. 1985. Birds of the Great Basin: A Natural History.

San Diego Natural History Museum. 2004. San Diego County Bird Atlas. http://www.sdnhm. org/science/birds-and-mammals/projects/san-diego-county-bird-atlas/. Accessed August 27, 2012.

Sanders, Andrew C. 2012a. Small-Flowered Androstephium. http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/pdfs/cdd_pdfs.Par.655eaca8.File.tmp/Androstephium1.PDF. Accessed August 15, 2012.

_______. 2012b Crucifixion Thorn. http://www.blm.gov/pgdata/etc/medialib//blm/ca/pdf/pdfs/cdd_pdfs.Par.85b9ffcf.File.pdf/crucif1.PDF. Accessed August 15, 2012.

Sawyer, J.O., et al. 2009. A Manual of California Vegetation, 2d Edition. California Native Plant Society Press. Sacramento, California.

Sawyer, J.O. & Keeler-Wolf. 1995. A Manual of California Vegetation.

Schnurrenberger, Catherine. 2012. Personal communication with Susanne Heim, Panorama Environmental. October 30, 2012.

Sibley, D. A. 2000. National Audubon Society the Sibley Guide to Birds. New York, NY: Alfred A. Knopf, Inc.

Sierra Club. Undated. Mountains Group. San Gorgonio Chapter. http://sangorgonio.sierraclub.org/mountains/animals/birds/orioles.htm. Accessed August 24, 2012.

SMS (Soda Mountain Solar, LLC). 2012. Comments on the DRECP July 25 and 26, 2012 Stakeholder Meeting Materials Docket Number 09-RENEW EO-01. August 9, 2012.

_______. 2013. Comments on Description and Comparative Evaluation of Draft DRECP Alternatives. January 23, 2013.

Stebbins, R.C. 2003. Western Reptiles and Amphibians. 3d ed. Houghton Mifflin Company: New York.

Turner, Dr. Jack. 2010. Personal communication with Brent Miyazaki (RMT). February 18, 2010.

Urban, Frank. 2013. Personal communication with Laurie Hietter, Panorama Environmental, Inc. January 31, 2013.

URS. 2009a. 2009 Desert Tortoise Survey Report Soda Mountain Solar Project San Bernardino County, California. December 2009.

_______. 2009b. Biological Resources Technical Report, Soda Mountain Solar Project San Bernardino County, California.

_______. 2009c. Focused Special Status Plant Survey Report Soda Mountain Solar Project, San Bernardino County, California.

_______. 2009d. Final 2009 Mojave Fringe-toed Lizard Survey Report, Soda Mountain Solar Project, San Bernardino, California.

_______. 2009e. Draft Jurisdictional Determination Report. Soda Mountain Solar Project, San Bernardino California.

_______. 2010. 2009 Spring and Fall Avian Survey Report, Soda Mountain Solar Project San Bernardino, California. August 2010.

USACE (U.S. Army Corps of Engineers). 2006. Interim regional supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region. J. S. Wakeley, R.W. Lichvar, and C. V. Noble (Eds.). ERDC/EL TR-06-16. Vicksburg, MS: U.S. Army Engineer Research and Development Center. http://www.usace.army.mil/cw/cecwo/reg/inte_aridwest_sup.pdf.

U.S. Army Corps of Engineers (USACE). 2007. U.S. Army Corps of Engineers Jurisdictional Determination (JD) Form Instructional Guidebook. 60p. + Appendices A – H. http://www.usace.army.mil/cw/cecwo/reg/cwa_guide/jd_guidebook_051207final.pdf.

USACE (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency). 2008. Memorandum Re: CWA Jurisdiction Following U.S. Supreme Court discussion in *Rapanos v. United States*.

USDA-NRCS (United States Department of Agriculture, Natural Resources Conservation Service, Soil Survey Staff). 2009. Web Soil Survey. http://websoilsurvey.nrcs.usda.gov.

USFWS (U.S. Fish and Wildlife Service). 1992. U.S. Fish and Wildlife Service, Field Survey Protocol for Any Federal Action That May Occur Within the Range of the Desert Tortoise. January 1992. Ventura, CA.

_______. 1994. Desert Tortoise (Mojave Population) Recovery Plan. Prepared by the Desert Tortoise Recovery Team.

_______. 1996. Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed, and Candidate Plants. USFWS, September 23, 1996. http://www.fws.gov/sacramento/es/documents/listed_plant_survey_guidelines.htm

_______. 2000. Recovery plan for bighorn sheep in the Peninsular Ranges, California. U.S. Fish and Wildlife Service, Portland, OR. xv+251 pp.

_______. 2009a. Mohave tui chub 5-Year Review: Summary and Evaluation. http://ecos.fws.gov/docs/five_year_review/doc2392.pdf.

_______. 2009b. United States Fish and Wildlife Service, Preparing for any action that may occur within the range of the Mojave desert tortoise (Gopherus agassizii). April 2009. Ventura, CA.

_______. 2010. Preparing for any action that may occur within the range of the Mojave desert tortoise (Gopherus agassizii). Ventura, California. 18 pp.

_______. 2011. Revised Recovery Plan for the Mojave Population of the Desert Tortoise (*Gopherus agassizii*). Region 8, Pacific Southwest Region USFWS, Sacramento Office. May 2011.

_______. 2012. "Status of the Species and its Critical Habitat- Rangewide: February 9, 2012". http://www.fws.gov/nevada/desert_tortoise/documents/misc/Status_of_the_Species-DT_February_9_2012.pdf

Virginia Department of Game and Inland Fisheries. 2012. Attracting Mourning Doves to Your Property. http://www.dgif.virginia.gov/habitat/landowners/infosheets/attracting-mourning-doves.asp. Accessed August 21, 2012.

Vyverberg, Kris. 2010. A Review of Stream Processes and Forms in Dryland Watersheds. December 2010. Prepared for California Department of Fish and Game.

Weasma, Ted. 2012. Geologist, National Park Service, Mojave National Preserve. Personal communication. June 21, 2012.

Wehausen, J.D. 2006. Nelson Bighorn Sheep. West Mojave Plan Species Accounts. U.S. Department of the Interior, Bureau of Land Management. January 2006. Accessed September 25, 2012. http://www.blm.gov/ca/pdfs/cdd_pdfs/Bighorn1.PDF.

_______. 2012. Personal communication with Susanne Heim, Panorama Environmental, Inc. October 22, 2012.

WRCC (Western Regional Climate Center). 2013. Baker, California (040436). http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca0436

Wild Bird Watching. 2012. Common Backyard Birds List. http://www.wild-bird-watching.com/. Accessed August 27, 2012.

Wilson, Bert. 2012. Mourning Dove, Zenaida macroura. Las Pilitas Nursery. http://www.laspilitas.com/California_birds/Pigeons_and_Doves/Mourning_Dove/Mourning_Dove_in_your_garden.htm. Accessed August 21, 2012.

Woodman, Peter. 2012. Personal communication with Laurie Hietter, Panorama Environmental, Inc. December 1, 2012.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*). In The Birds of North America, No. 231 (A. Poole and F. Gill [eds.]). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C

Zarn, M. 1974. Burrowing Owl *Speotyto cunicularia hypugaea*. U.S.Department of the Interior, Bureau of Land Management, Habitat Management Series for Endangered Species, Technical Note 11:1-25.

Zeiner, D.C., W.F. Laudenslayer Jr., K.E. Mayer, and M. White, eds. 1990. "CWHR: Life History Accounts and Range Maps."Accessed September 25, 2012. http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx.

APPENDIX A
VEGETATION SPECIES OBSERVED IN THE SODA MOUNTAIN PROJECT AREA

APPENDIX A

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

SODA MOUNTAIN SOLAR

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

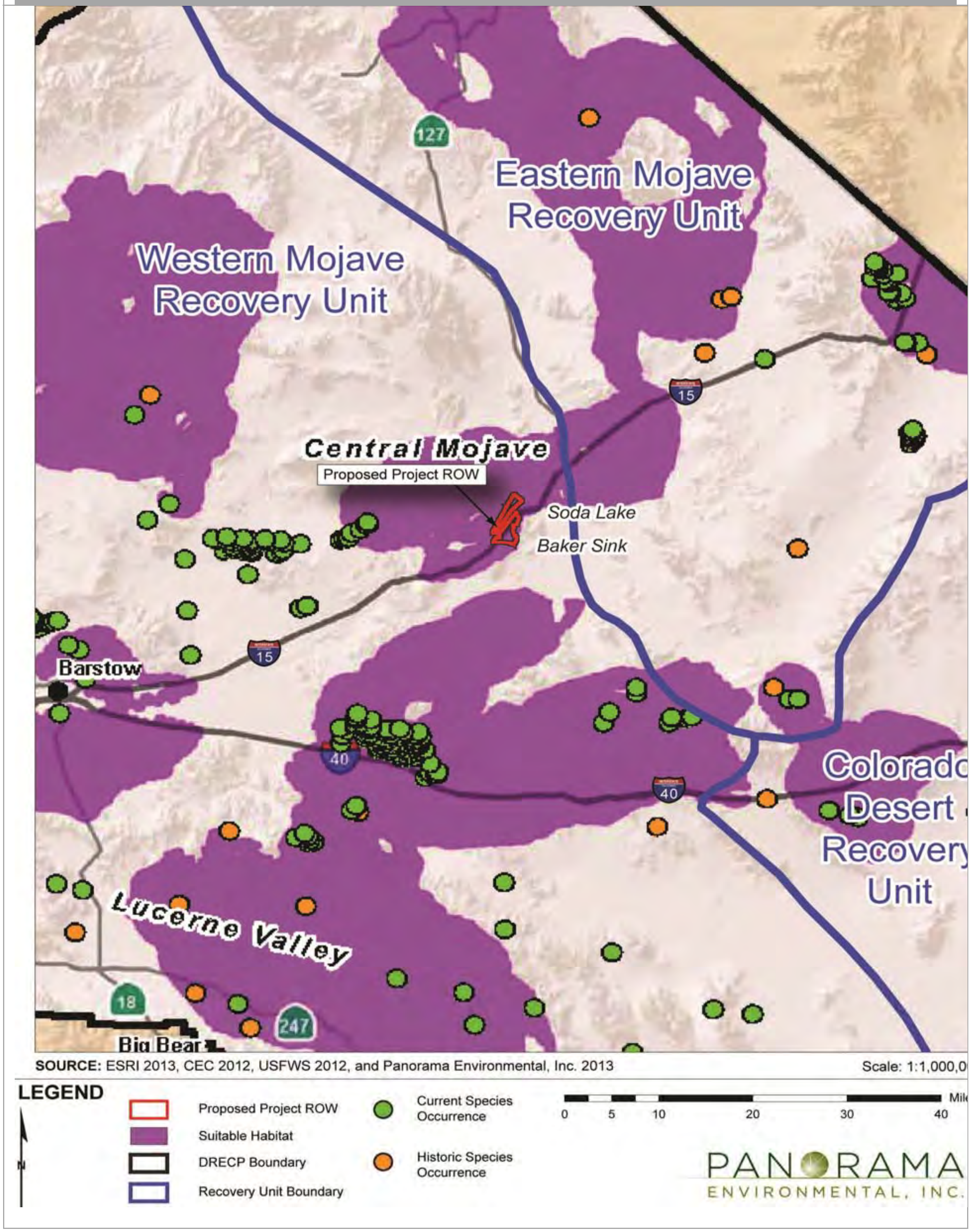
Figure SM-R3B, "Draft Species Habitat Model Results for Desert Tortoise (USFWS Least Cost Corridors)"shows the SMS project area as within a least-cost corridor for desert tortoise (Figure 1). This modeling was conducted by USFWS using the habitat suitability results of Nussear et al. (2009). SMS presented 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.

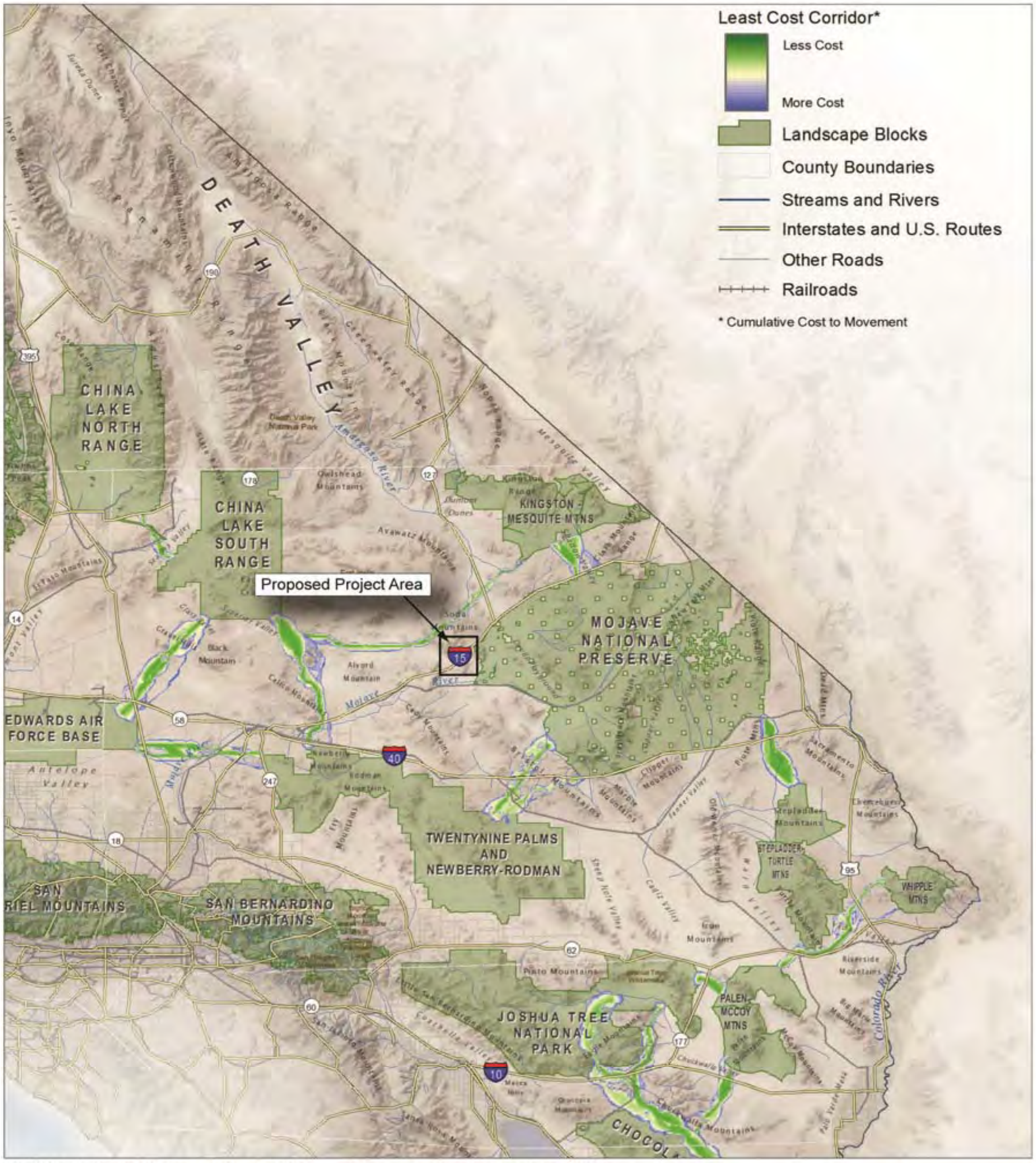
The designation of a least-cost corridor between the Ivanpah critical habitat unit and Superior-Cronese critical habitat unit is inconsistent with the *Revised Recovery Plan for the Mojave Population of the Desert Tortoise* (USFWS 2011), other studies, and the physical environment. The Mojave population 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:

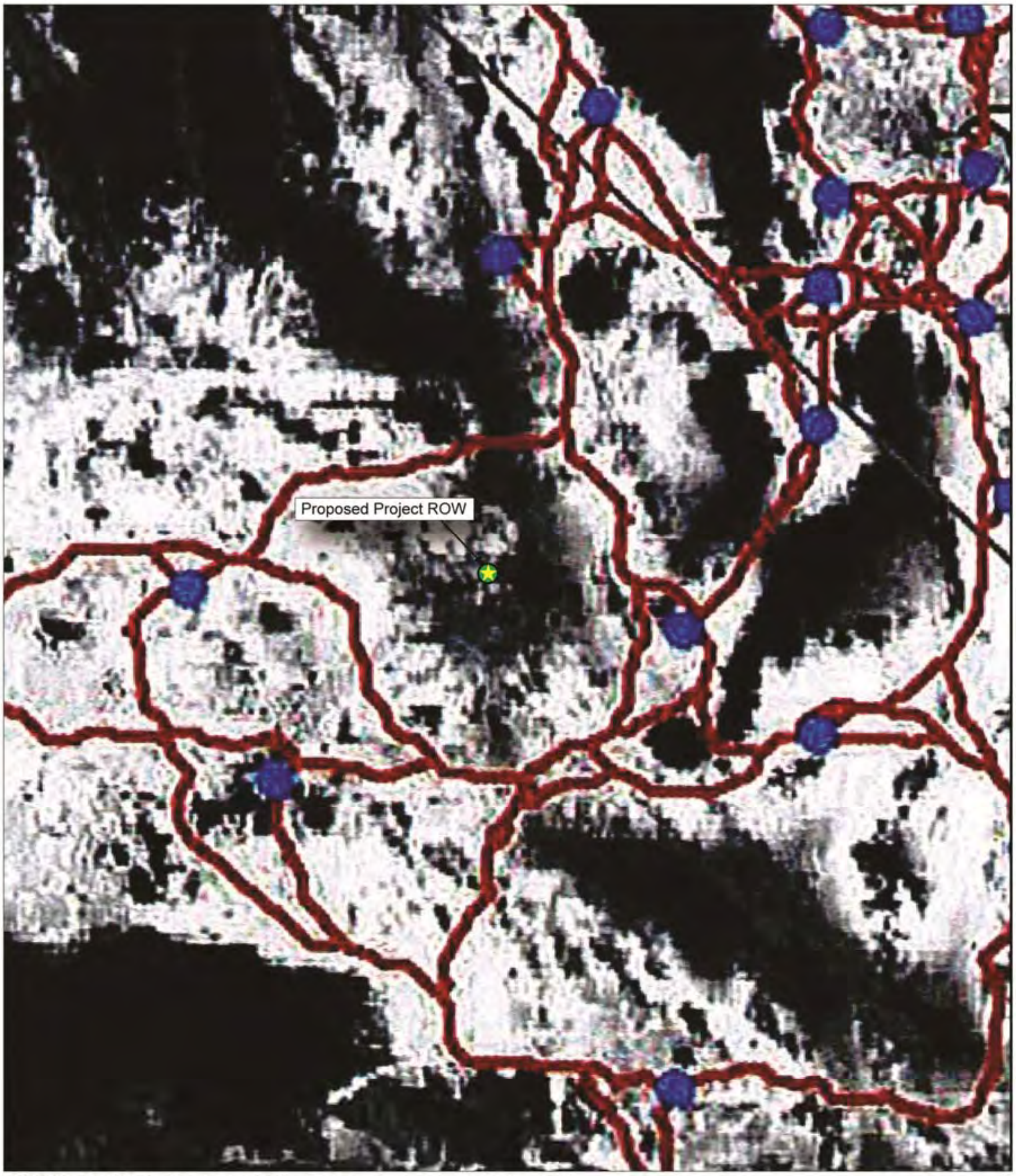
> "*Although gene flow likely occurred intermittently during favorable conditions across this western edge of the recovery unit, this area contains a portion of the Baker Sink, a low-elevation, extremely hot and arid strip that extends from Death Valley to Bristol Dry Lake. This area is generally inhospitable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

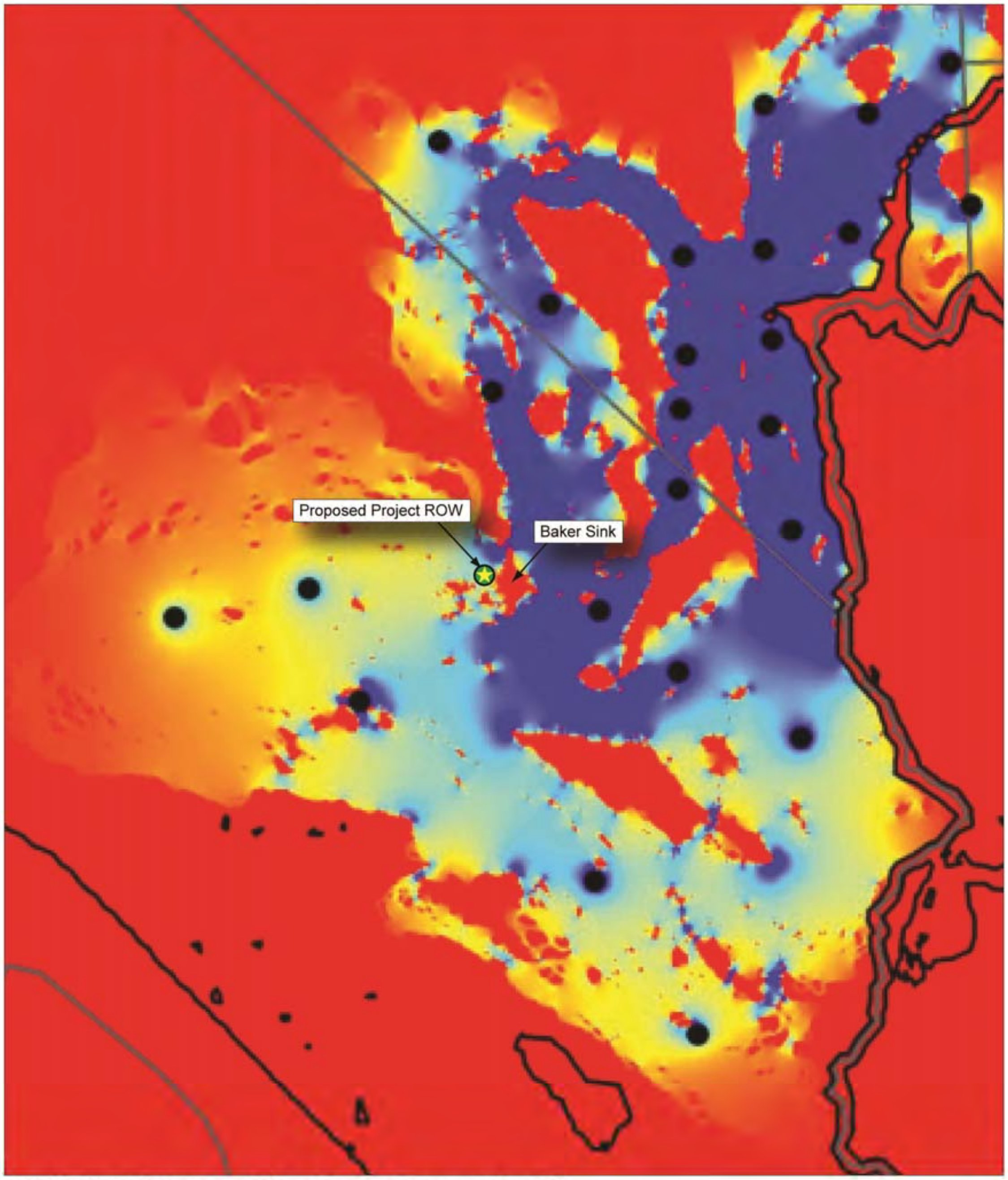
Movement areas from Hagerty et al. are shown in Figure 3. The Baker Sink is shown in Figure 4. In short, substantial evidence –in the form of (i) site-specific survey results and habitat suitability analysis; (ii) USFWS' own Revised Recovery Plan; and (iii) genetic studies strongly indicate that tortoise 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



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

Figure 4: Baker Sink Barrier to Movement



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

PANORAMA ENVIRONMENTAL, INC.

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

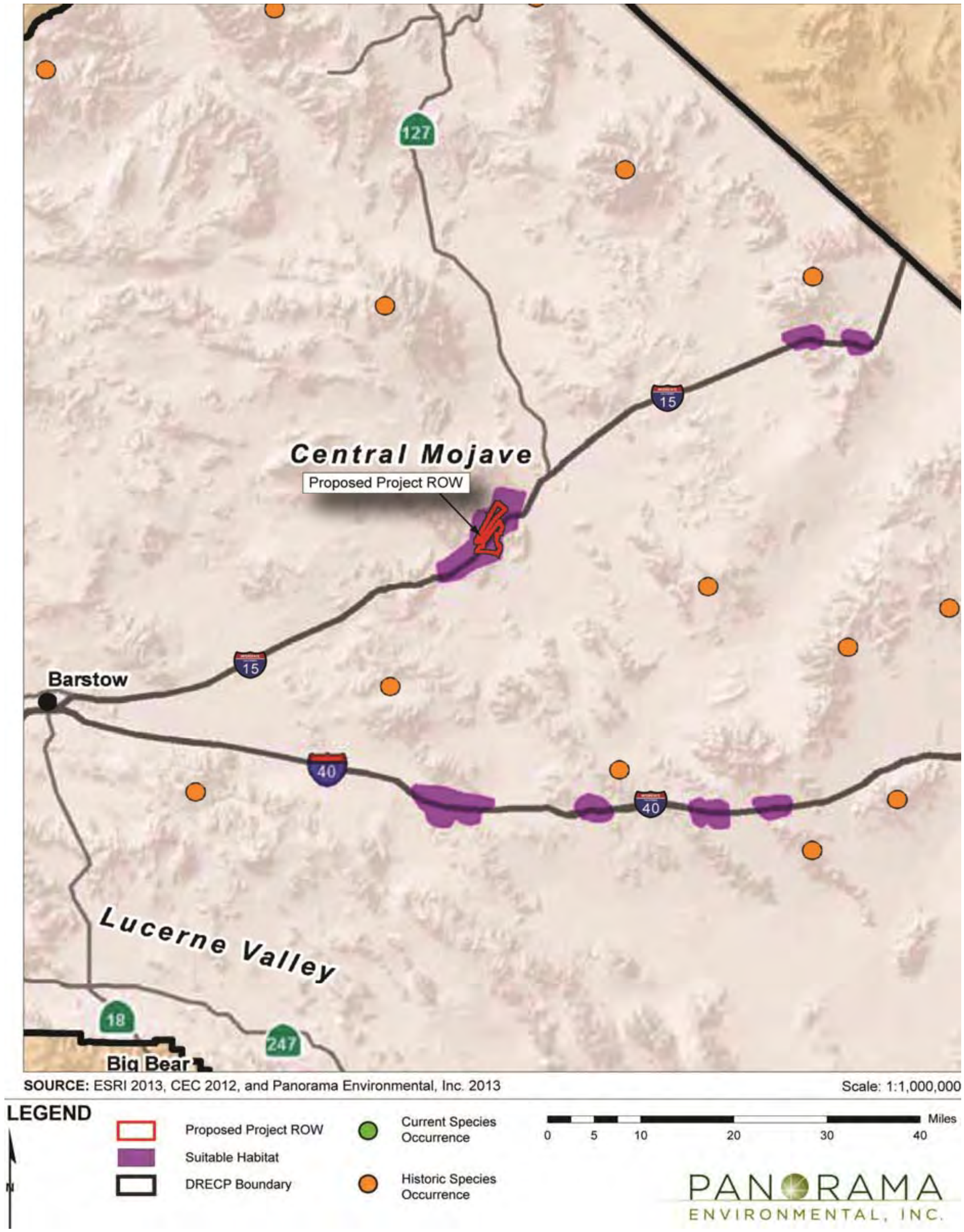
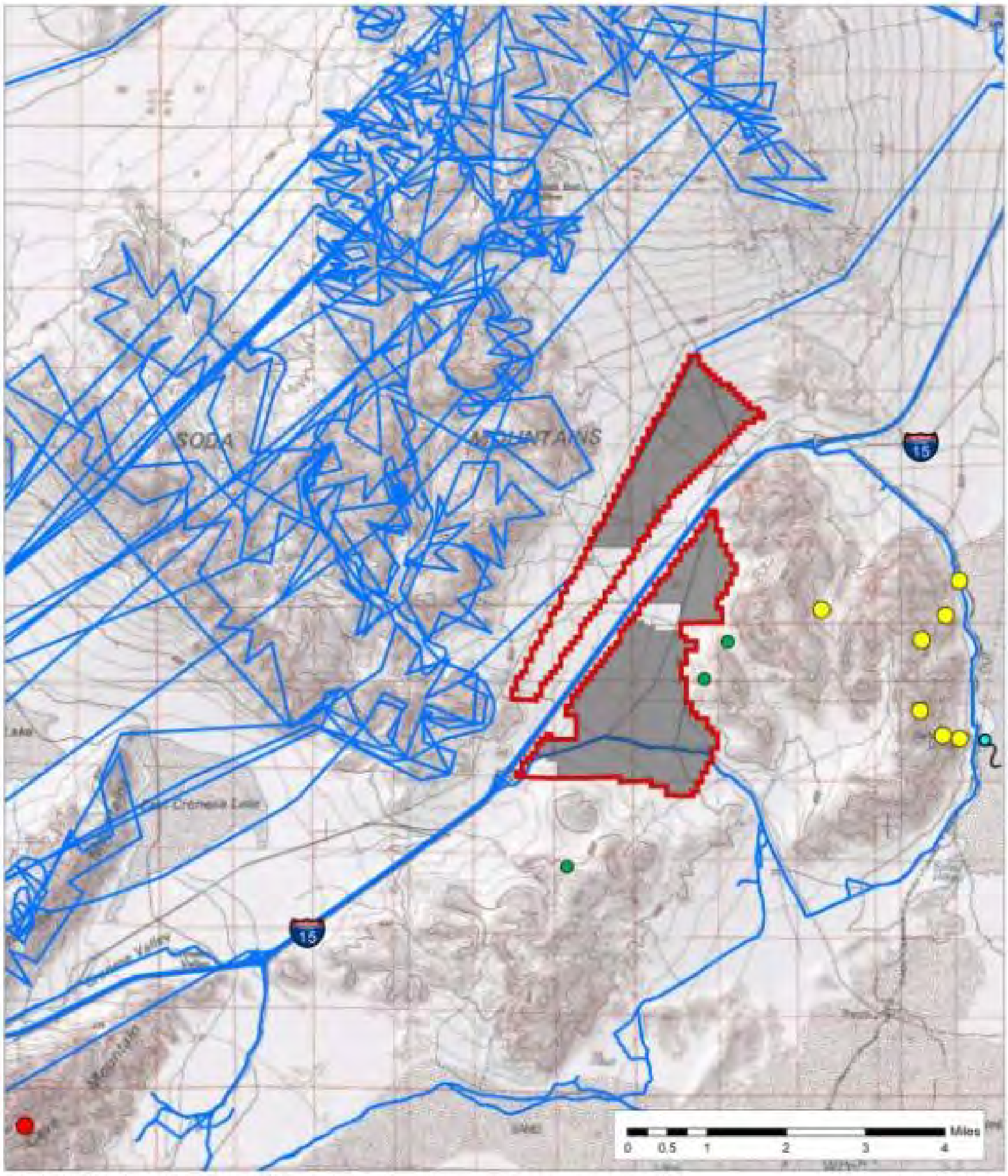


Figure 6: Bighorn Sheep Surveys and Populations in Soda Mountain Region



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 Survey Routes
- BRC Bighorn Sheep and Golden Eagle Location
- CDFG Bighorn Sheep Location
- Kiva Bighorn Sheep or Sign

PANORAMA ENVIRONMENTAL, INC.

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

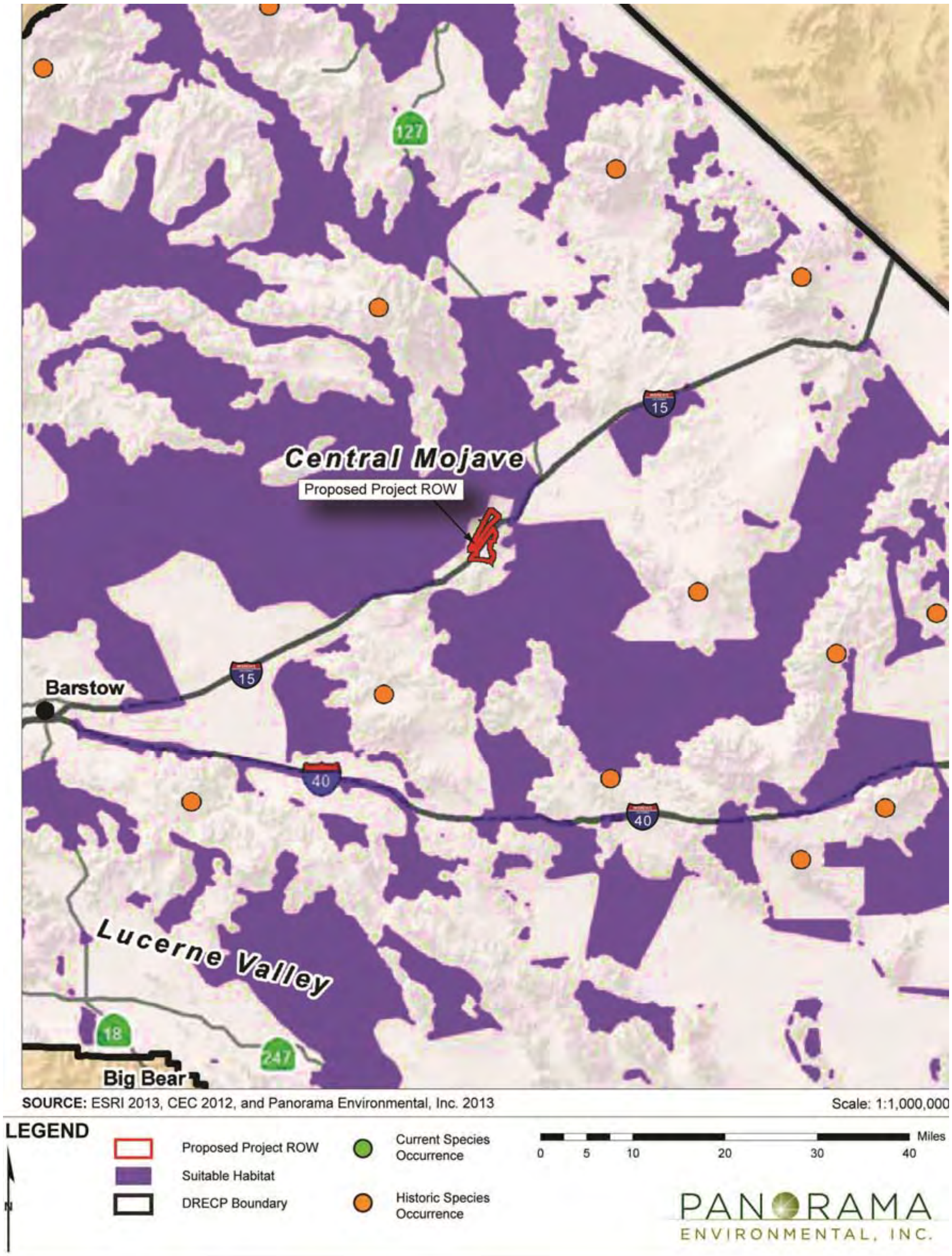
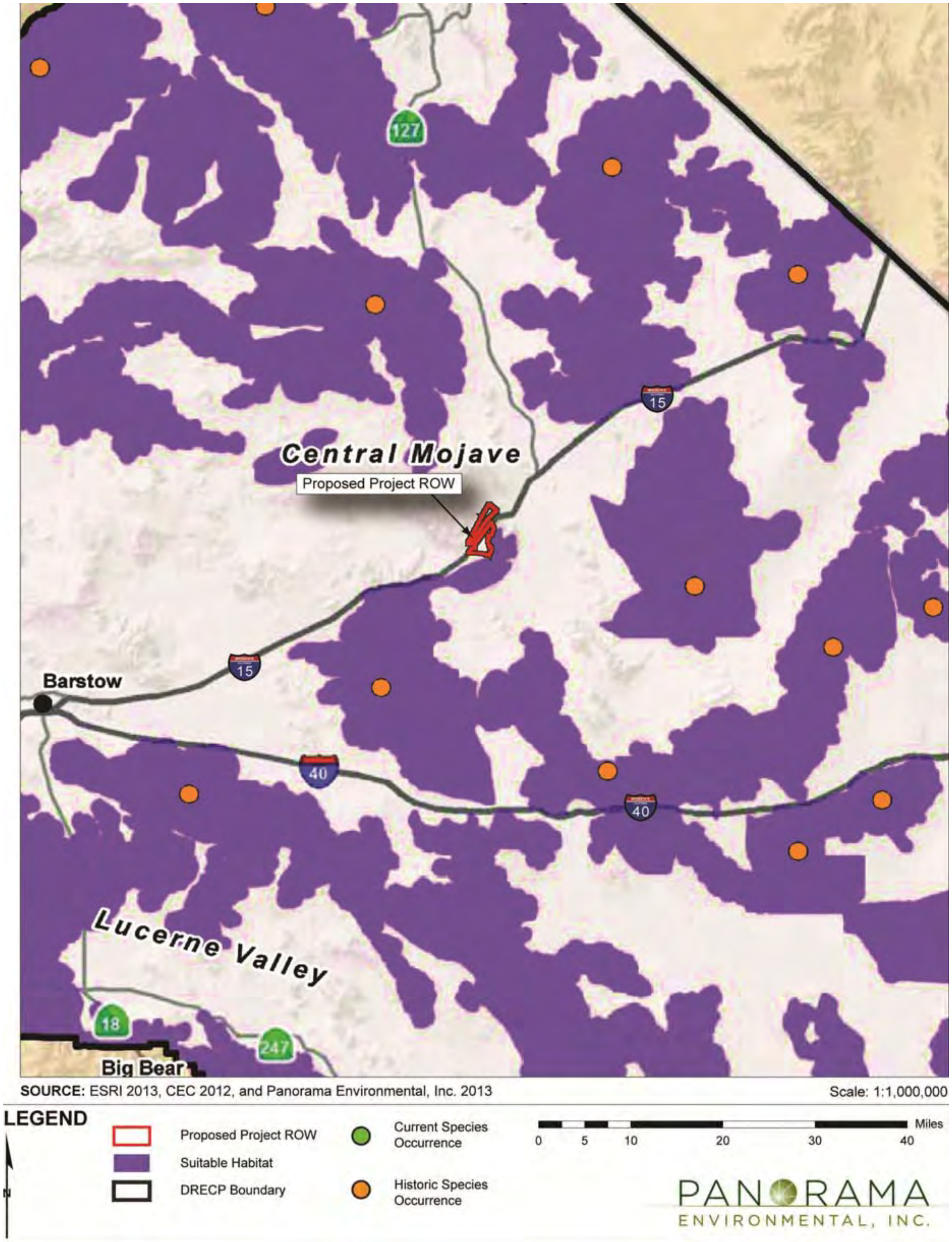


Figure 8: DRECP Bighorn Sheep Mountain Habitat and SMS Project



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

PANORAMA 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

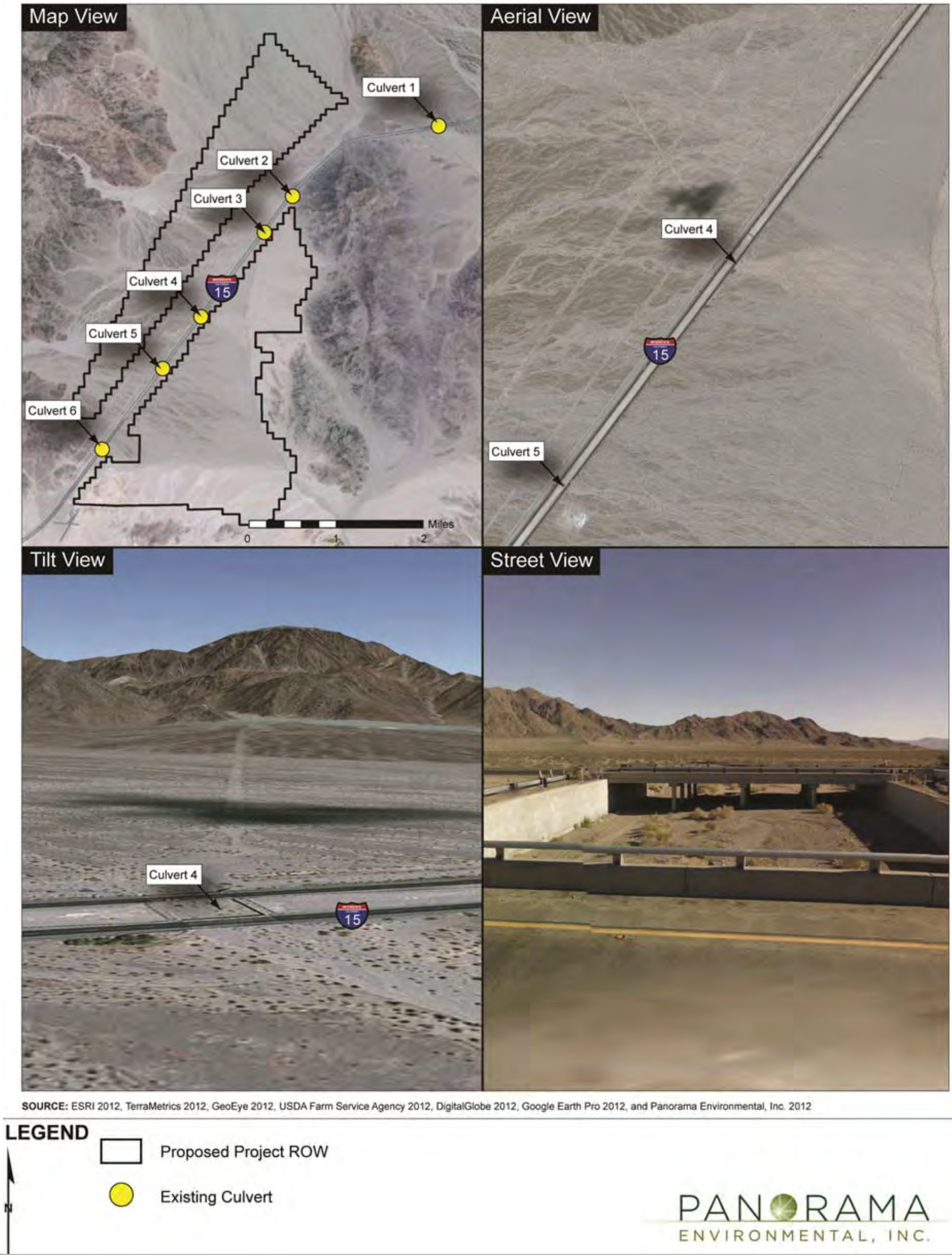
LEGEND

Proposed Project ROW

Existing Culvert

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

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

REFERENCES CITED

Abella, Regina. 2012a. May 1 Bighorn Sheep Ground Count in the South Soda Mountains. Memorandum dated May 14, 2012.

Abella, Regina, 2012b. California Department of Fish and Game. Personal Communication with Susanne Heim (Panorama Environmental, Inc). November 27, 2012.

AZDOT (Arizona Department of Transportation). 2008. Evaluation of Distribution and Trans-Highway Movement of Desert Bighorn Sheep: Arizona Highway 68. Prepared by Kirby Bristow and Michelle Crabb of the Arizona Game and Fish Department for AZDOT. http://www.azdot.gov/TPD/ATRC/publications/project_reports/PDF/AZ588.pdf.

BLM. 1990. *California Statewide Wilderness Study Report Part 4 Volume 5.* Accessed at http://www.blm.gov/ca/pa/wilderness/wilderness_pdfs/wsa/Volume-5/Soda%20Mountains.pdf.

BRC (BioResource Consultants). 2011. Caithness Energy Soda Mountain Solar Project, San Bernardino County, Golden Eagle Nest Surveys and Desert Bighorn Sheep Observations, March 21–25, 2011 and May 9–10, 2011. Prepared for RMT, Inc. and Caithness Soda Mountain Solar, LLC.

Burke, Bob. 2012. Society for the Conservation of Bighorn Sheep. Personal Communication with Susanne Heim (Panorama Environmental, Inc.). November 27, 2012.

CEC (California Energy Commission). 2012. "Description and Comparative Evaluation of Draft DRECP Alternatives". December 17, 2012.

CEC (California Energy Commission). 2012. "Baseline Biology Report." March 27, 2012.

Epps, Clinton; Bleich, Vernon; Wehausen, John; and Steven Torres. 2005. Status of Bighorn Sheep in California. 2003 Desert Bighorn Council Transactions Volume 47.

Hagerty, B.E., Nussear, K.E., Esque T.C., Tracy, C.R. 2010. "Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise". Landscape Ecology. doi: 10.1007/s10980-010-9550-6.

Penrod, K., P. Beier, E. Garding, and C. Cabañero. 2012. *A Linkage Network for the California Deserts*. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org and Northern Arizona University, Flagstaff, Arizona http://oak.ucc.nau.edu/pb1/.

Penrod, K., C. Cabañero, P. Beier, C. Luke, W. Spencer, E. Rubin, and C. Paulman 2008. A Linkage Design for the Joshua Tree-Twentynine Palms Connection. South Coast Wildlands. http://www.scwildlands.org/reports/Default.aspx#17.

Turner, Dr. Jack. 2010. Personal communication with Brent Miyazaki (RMT). February 18, 2010.

URS. 2009a. 2009 Desert Tortoise Survey Report Soda Mountain Solar Project San Bernardino County, California. December 2009.

URS. 2009b. 2009 Biological Resources Technical Report: Soda Mountain Solar Project, San Bernardino County, California. October 2009. Prepared for Caithness Soda Mountain.

USFWS (U.S. Fish and Wildlife Service). 2011. Revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. 222 pp.

USFWS. 2000. Recovery plan for bighorn sheep in the Peninsular Ranges, California. U.S. Fish and Wildlife Service, Portland, OR. xv+251 pp.

Wehausen, J.D. 2006. Nelson Bighorn Sheep. West Mojave Plan Species Accounts. U.S. Department of the Interior, Bureau of Land Management. January 2006. Accessed September 25, 2012. http://www.blm.gov/ca/pdfs/cdd_pdfs/Bighorn1.PDF.

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]

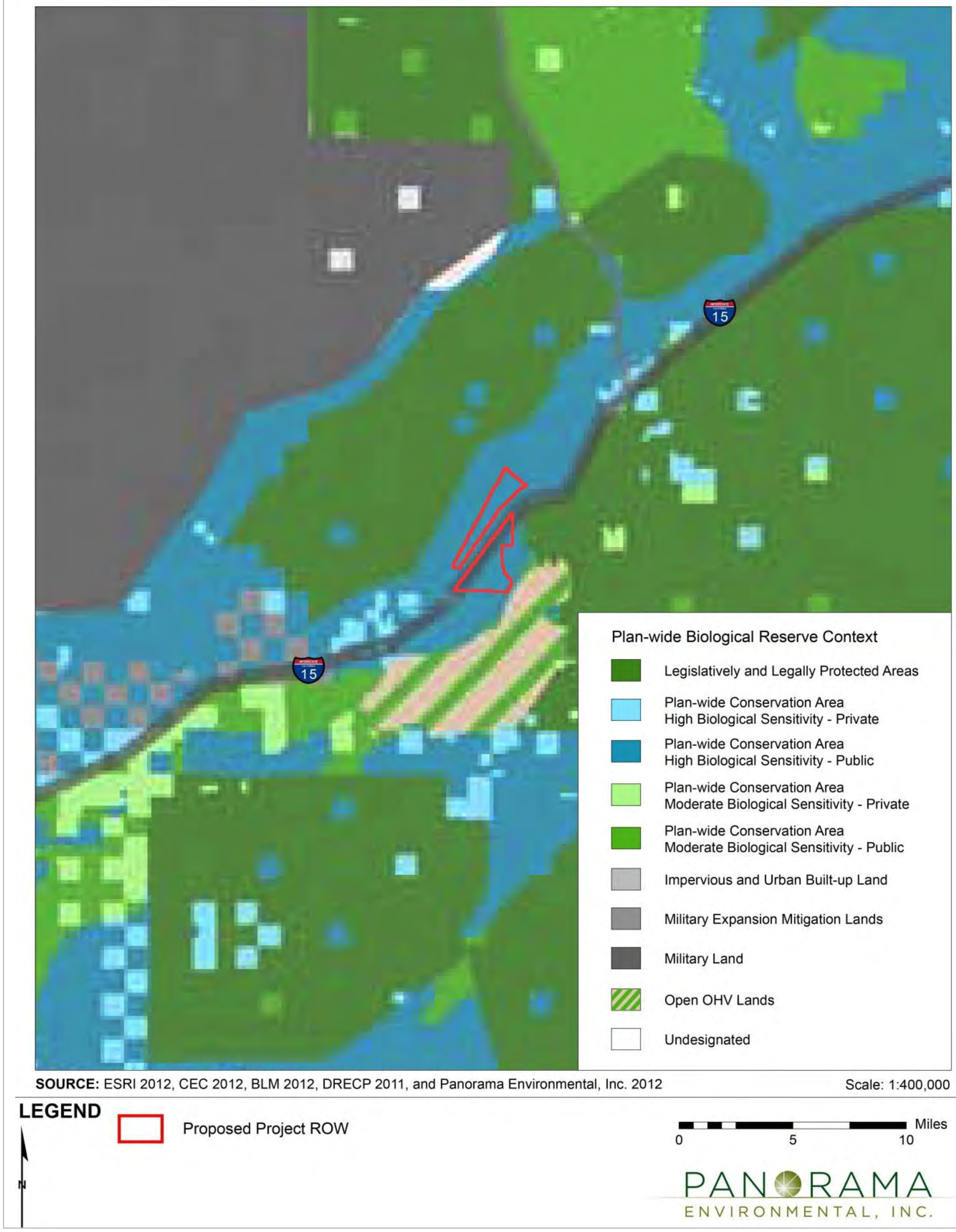
---

[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).

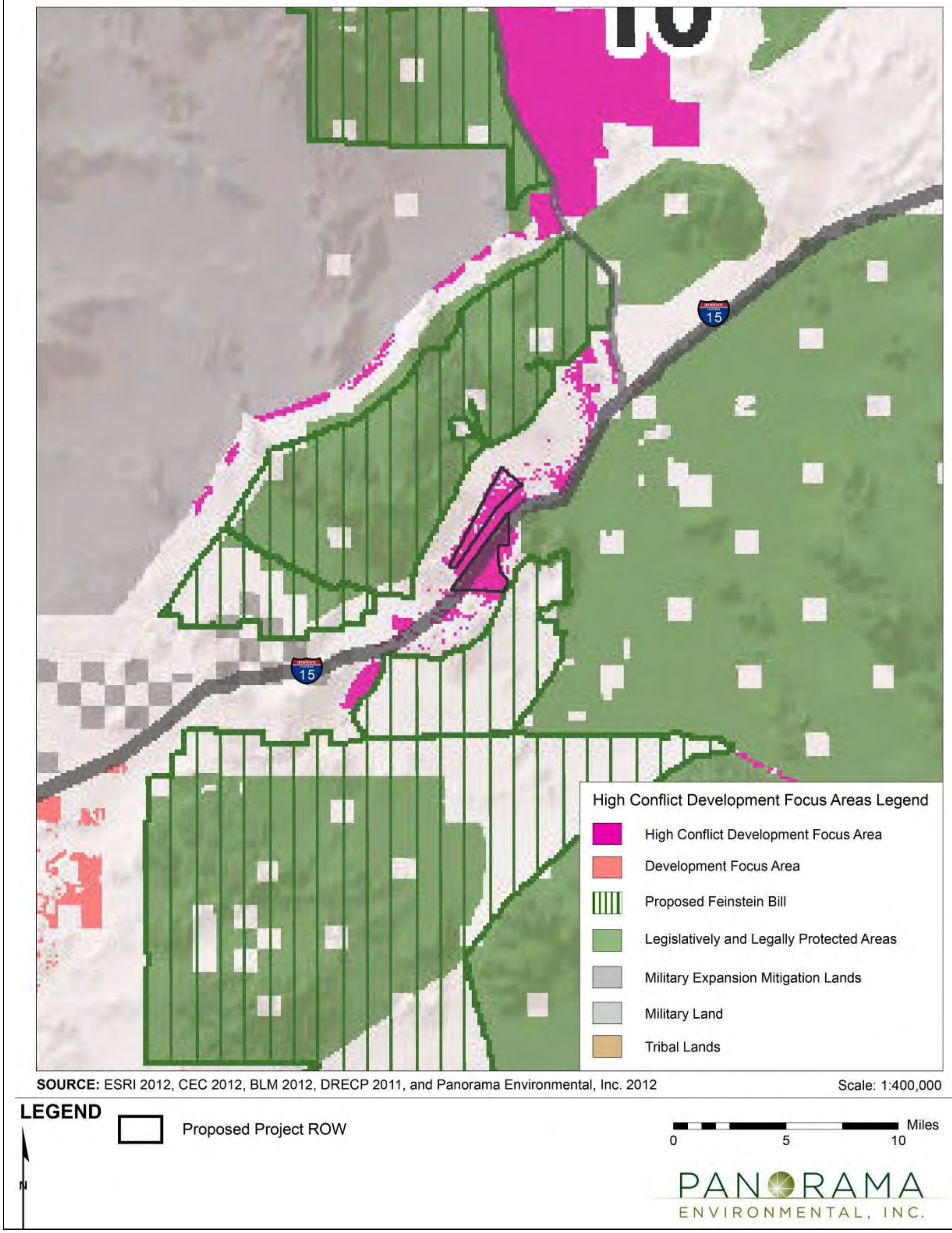
While Senator Feinstein's Desert Protection Act of 2011 does propose designation of a portion of the Soda Mountain WSA as wilderness, the following express provisions of Section 1502 of the bill resolve any potential conflicts posed by renewable energy development of the Project site:

- 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

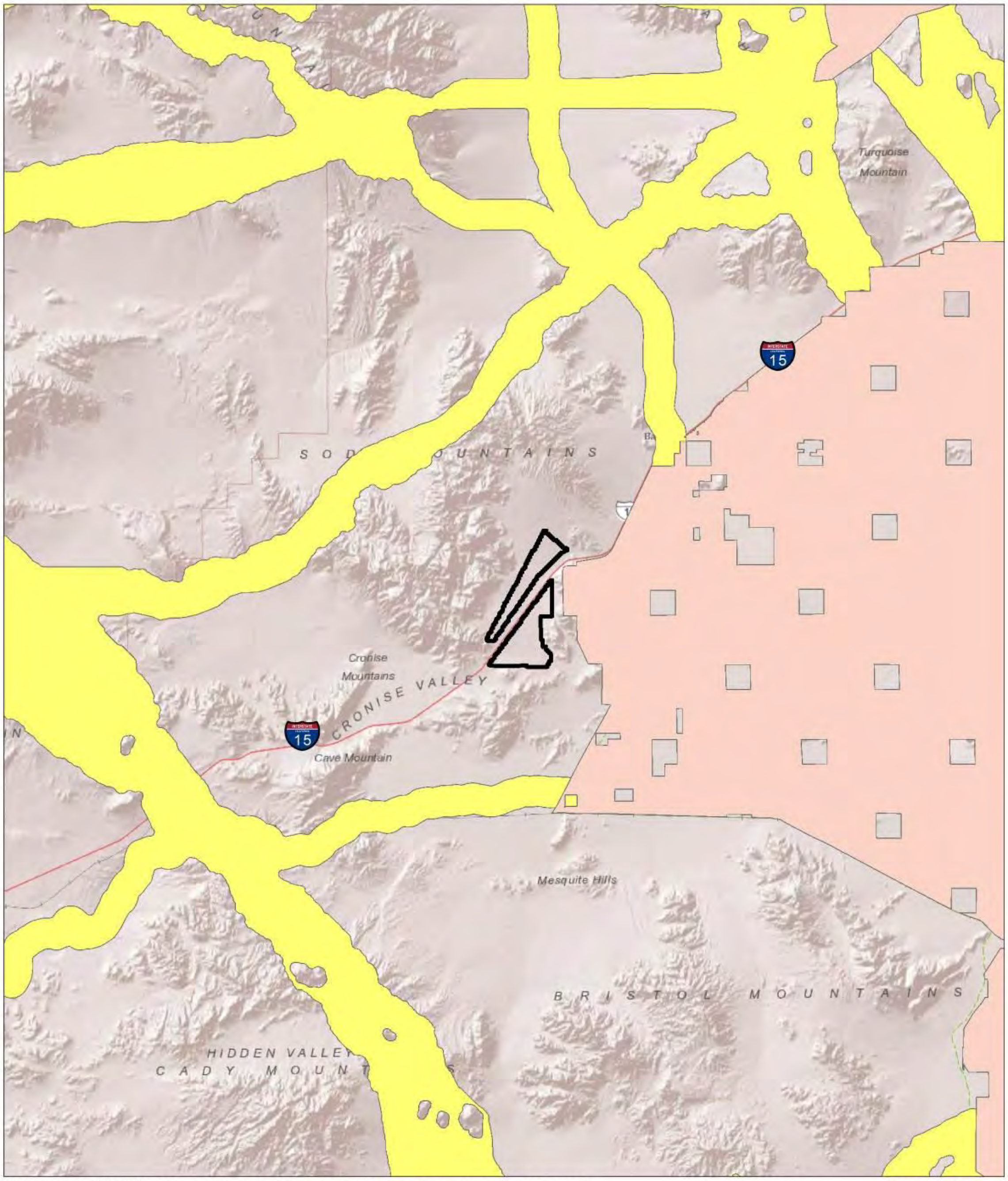


SOURCE: ESRI 2012, CEC 2012, BLM 2012, DRECP 2011, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

PANORAMA ENVIRONMENTAL, INC.

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

Adriane Wodey
Soda Mountain Solar, LLC

REFERENCES

Abella, Regina. 2012. May 1 Bighorn Sheep Ground Count in the South Soda Mountains. Memorandum dated May 14, 2012.

Abengoa Solar, et al. 2012. Letter to Secretary of the Interior regarding joint comments on supplemental draft PEIS for solar development dated January 27, 2012.

Ball, I.R., and H.P. Possingham, 2000. MARXAN (V1.8.2): Marine Reserve Design Using Spatially Explicit Annealing, a Manual.

Ball, I.R., H.P. Possingham, and M. Watts. 2009. Marxan and relatives: Software for spatial conservation prioritisation. Chapter 14: Pages 185-195 in Spatial conservation prioritisation: Quantitative methods and computational tools. Eds Moilanen, A., K.A. Wilson, and H.P. Possingham. Oxford University Press, Oxford, UK.

BLM 1990, *California Statewide Wilderness Study Report.*

BLM 2009, Letter from Steven Borchard to Mitchell Garber regarding CACA-49584 corridor constraints evaluation dated December 16, 2009.

CEC. 2012. *Draft Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report.* Prepared by Dudek and ICF. March 2012.

Desert Renewable Energy Conservation Plan (DRECP). 2012a. "Overview of Preliminary Plan-Wide Biological Reserve Design and Renewable Energy Development Scenarios". Presented at the DRECP Stakeholders Meeting, April 25 and 26, 2012.

DRECP. 2012b. "Overview of DRECP Alternatives Briefing Materials". Prepared for DRECP Stakeholers Committee Meeting July 25, 2012.

Heim, Susanne and Hietter, Laurie. 2012. *Analysis of Habitat Suitability and Connectivity in the Soda Mountain Area, San Bernardino County, California*. August 2012.

RMT 2010. *Final 2009 Mojave Fringe-Toed Lizard Survey Report, Soda Mountain Solar Project, San Bernardino, CA*. Prepared for Caithness Soda Mountain, LLC. October 2010

RMT, Inc. 2011. *Golden Eagle Nest Surveys and Desert Bighorn Sheep Observations (March 21-25, 2011 and May 9-10, 2011), Soda Mountain Solar Project*. Prepared by BioResource Consultants.

Spencer, W.D., P. Beier, K. Penrod, K. Winters, C. Paulman, H. Rustigian-Romsos, J. Strittholt, M. Parisi, and A. Pettler. 2010. *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California*. Prepared for California Department of

Transportation, California Department of Fish and Game, and Federal Highways Administration.

URS Corporation 2009a. *Biological Resources Technical Report, Soda Mountain Solar Project San Bernardino County, California*.

URS Corporation 2009b. *2009 Desert Tortoise Survey Report Soda Mountain Solar Project San Bernardino County, California. December 2009*.

URS Corporation 2010. 2009 Spring and Fall Avian Survey Report, Soda Mountain Solar Project San Bernardino, California. August 2010.

Wilson Geosciences, Inc. 2011. *Geologic Characterization report, Soda Mountain Solar Project, BLM Case Number – CACA49584.* Prepared for Caithness Soda Mountain, LLC. March 2011.

Soda Mountain Solar, LLC
5275 Westview Drive
Frederick, MD 21703

July 24, 2012

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

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

---

[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.

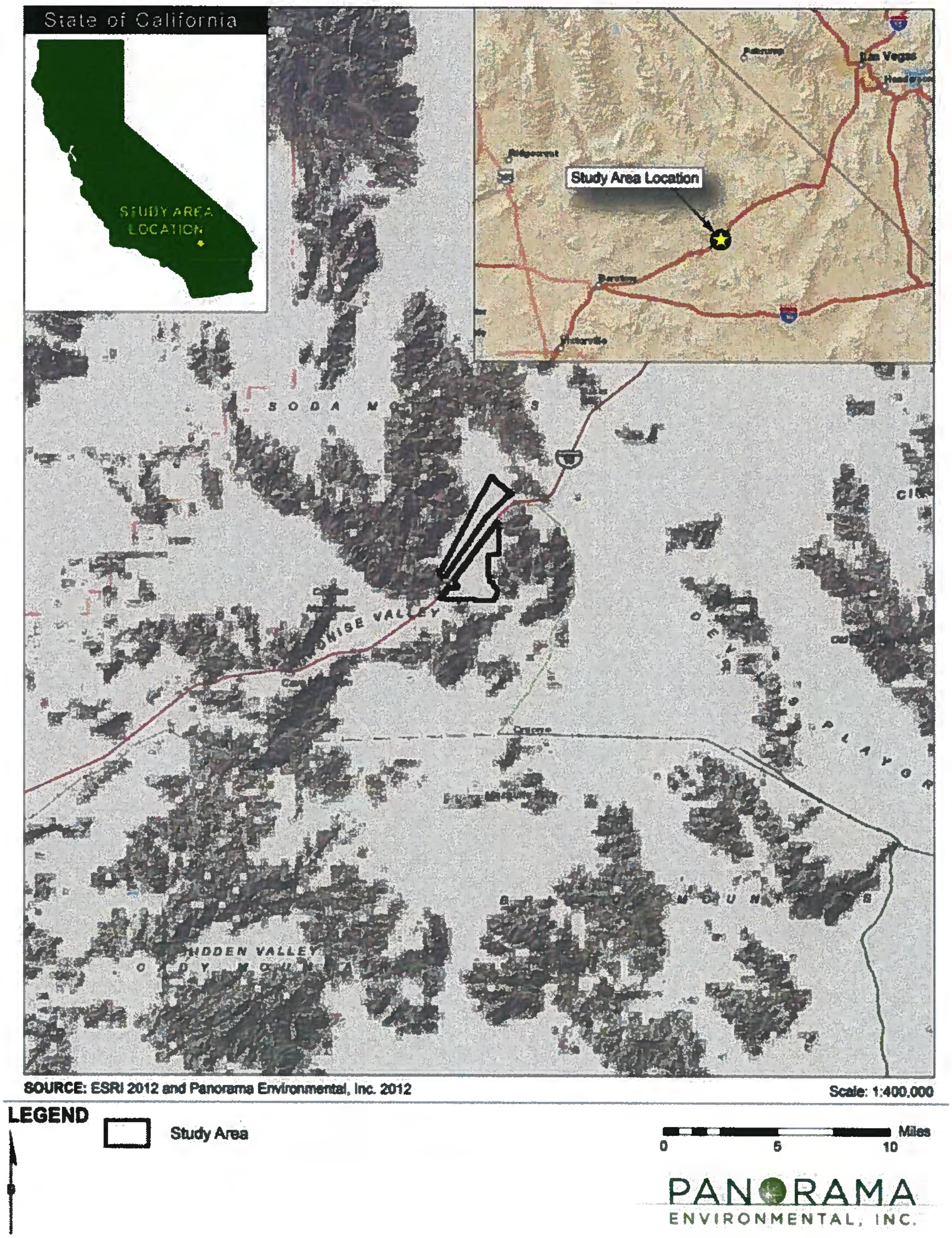
Sincerely,

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
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.

One Embarcadero Center, Suite 740 San Francisco, CA 94111 650-373-1200
www.panoramaenv.com

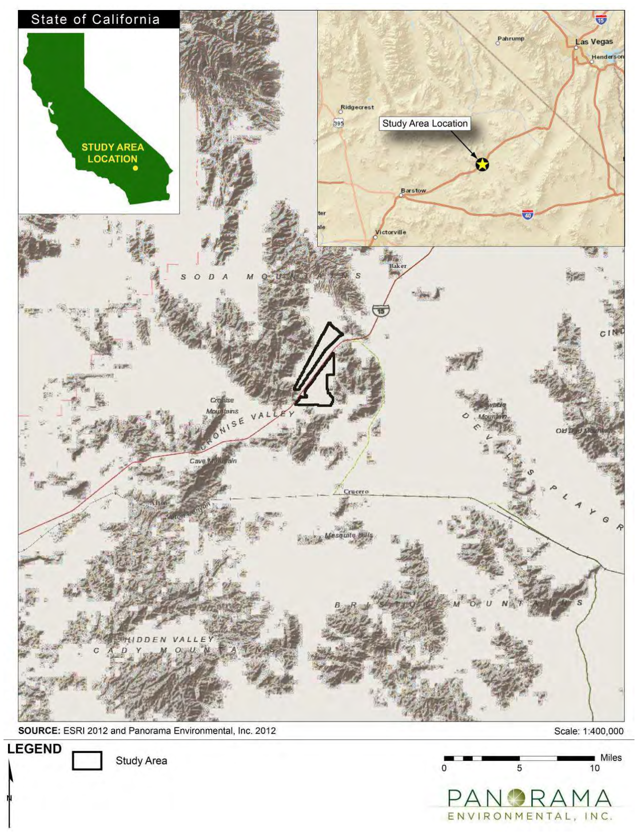
TABLE OF CONTENTS

List of Tables

List of Figures

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

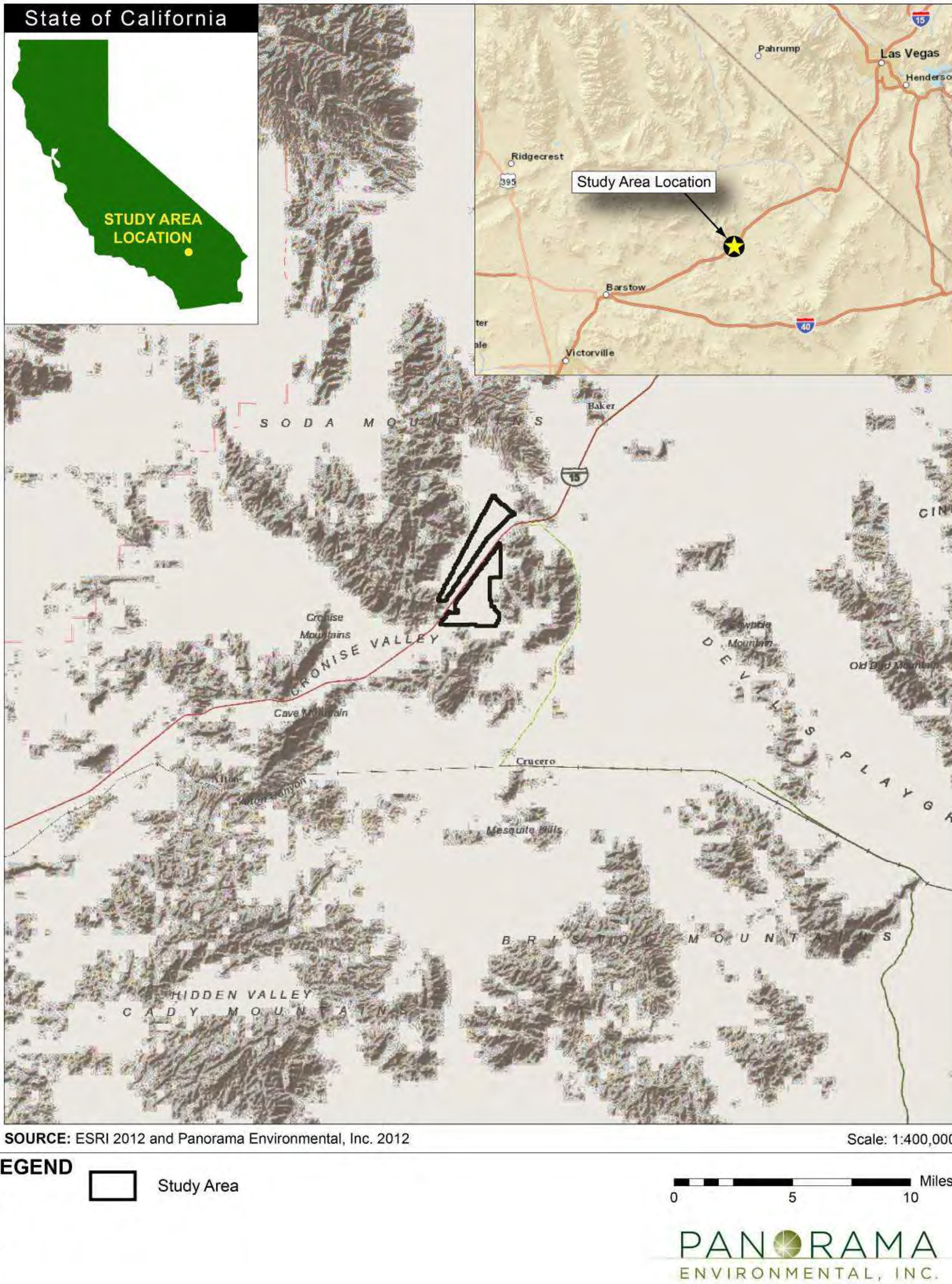
Recent studies of habitat suitability and linkage corridors in the Mojave Desert have used habitat modeling to predict suitability of species habitat and connectivity over multi-state, state, and regional geographic areas. The model results are being used to guide land use decisions related to development 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



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.

---

[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).

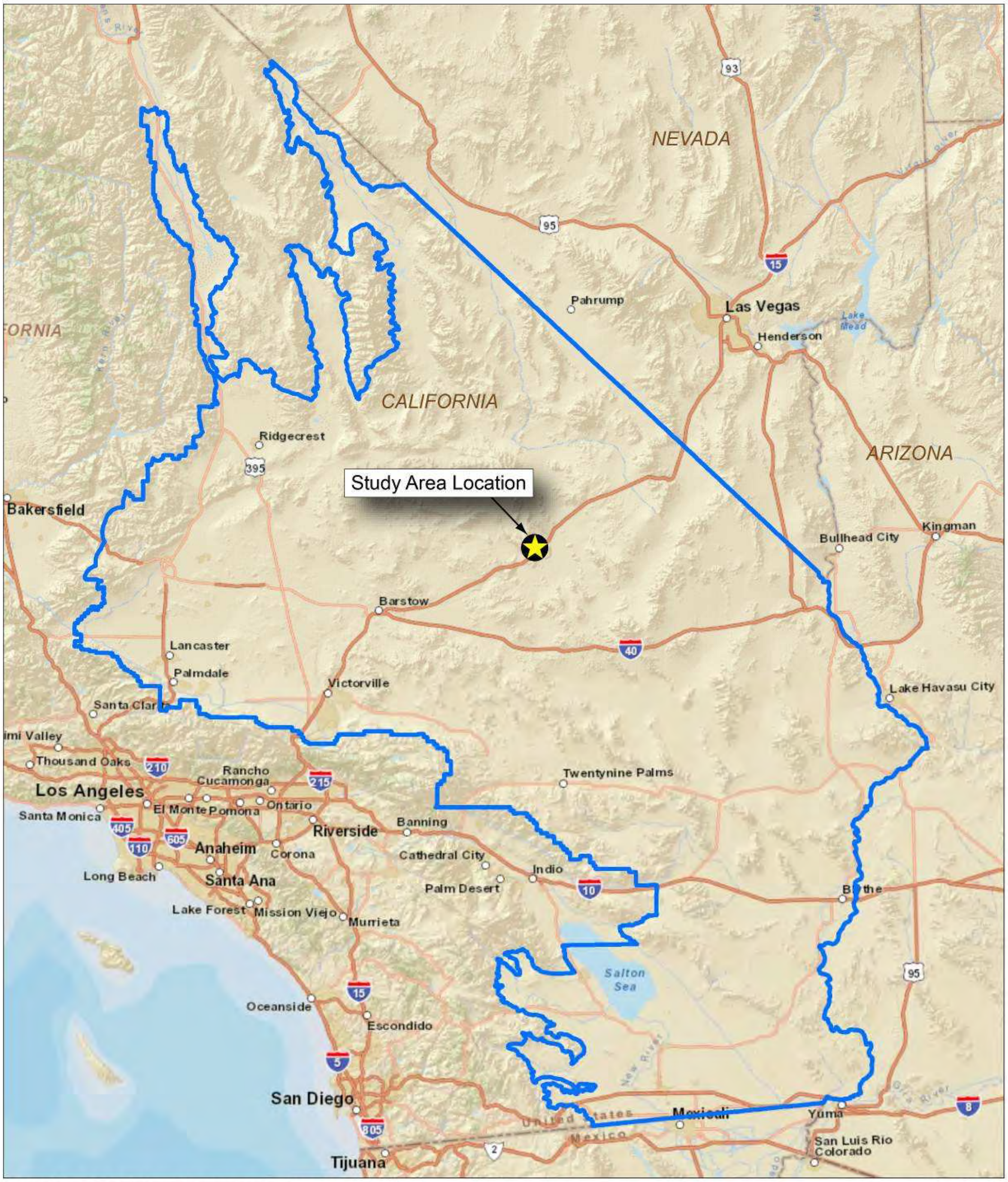
Bighorn Sheep. The following aspects are limitations of the model for bighorn sheep:

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). -

---

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

Figure 2: DRECP Plan Area



SOURCE: ESRI 2012 and Panorama Environmental, Inc. 2012

Scale: 1:3,000,000

LEGEND

Study Area Location

DRECP Boundary

0 25 50 75 100 Miles

PANORAMA ENVIRONMENTAL, INC.

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

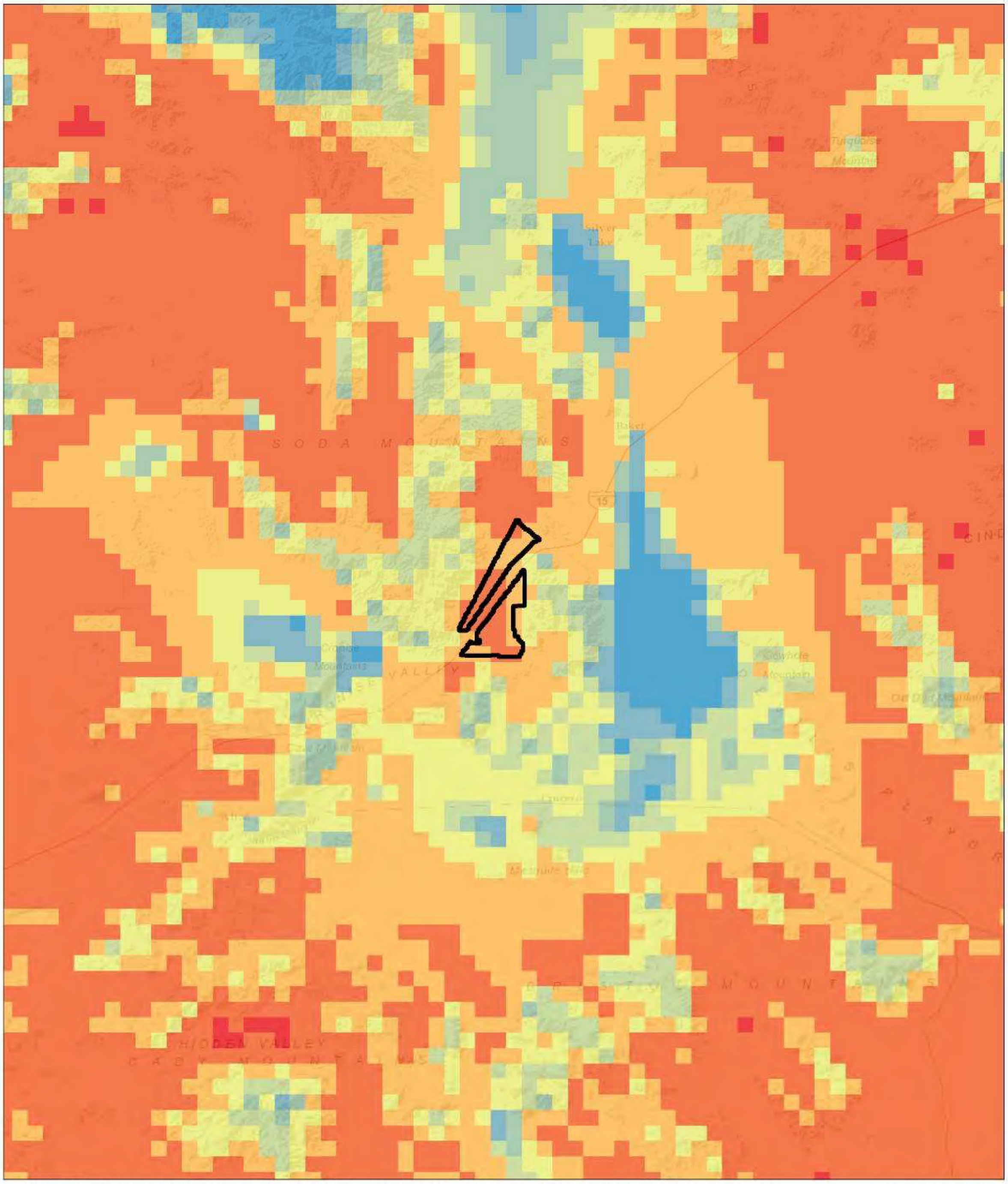
Table 1: Modelled Results for the Study Area

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)



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

Scale: 1:400,000

LEGEND

N

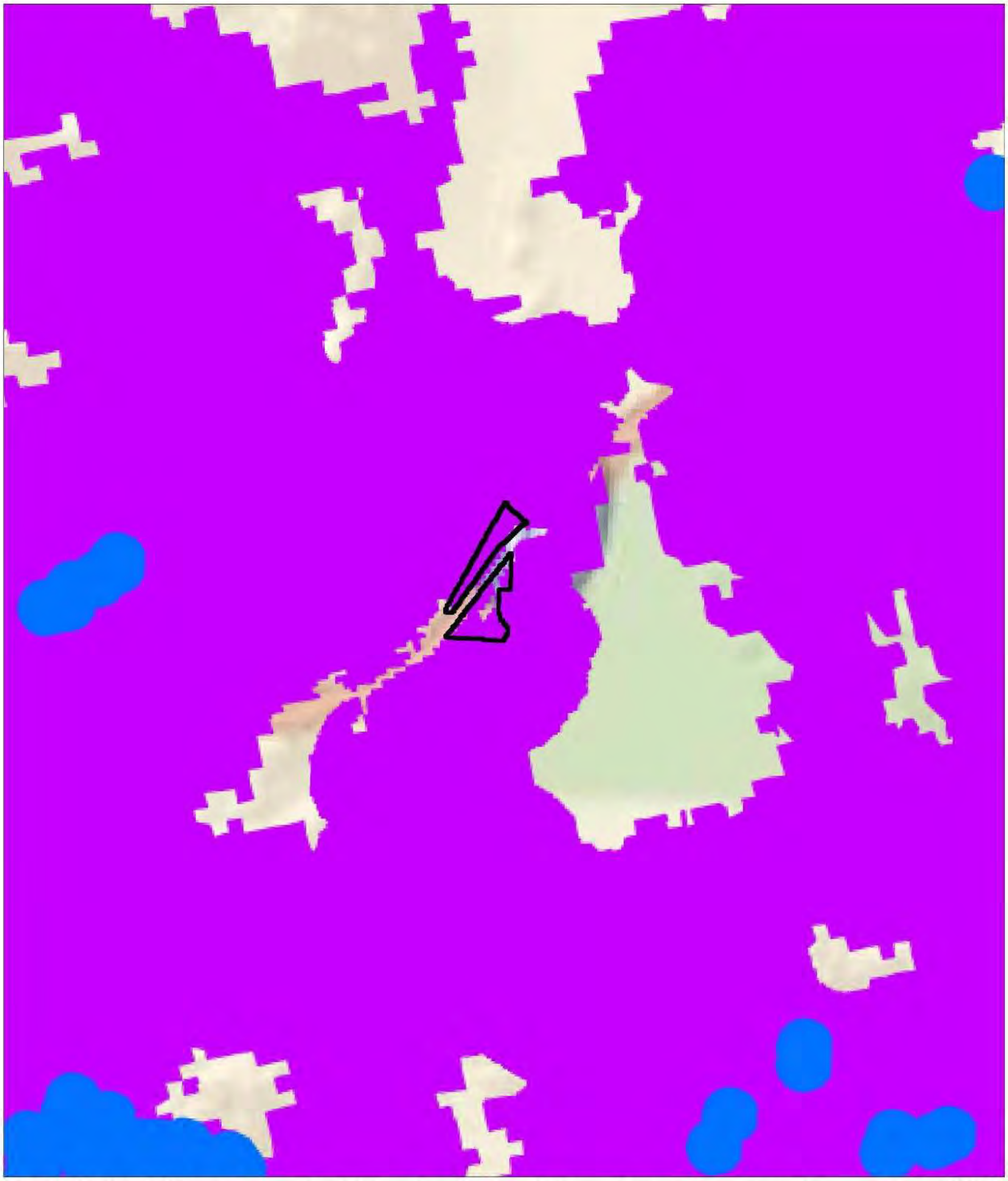
Study Area

0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1

Miles 0 5 10

PANORAMA ENVIRONMENTAL, INC.

Figure 4: Desert Tortoise Suitable Habitat (CEC 2012)



SOURCE: ESRI 2012, DRECP Species Database 2011, DRECP Land Cover 2011, Dudek ICF 2011, and Panorama Environmental, Inc. 2012

Scale: 1:400,000

LEGEND

Figure 5: Bighorn Sheep Suitable Habitat (CEC 2012)

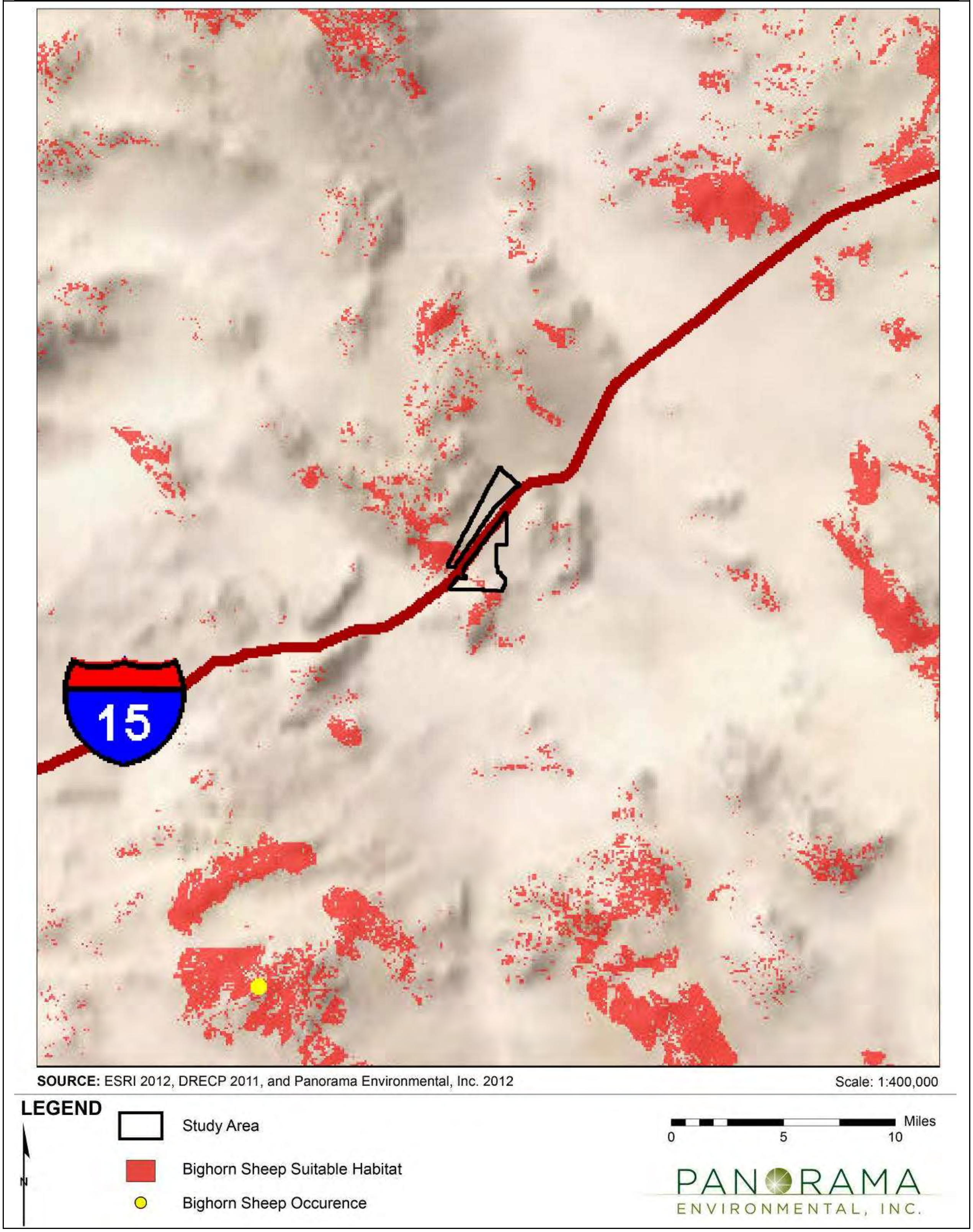
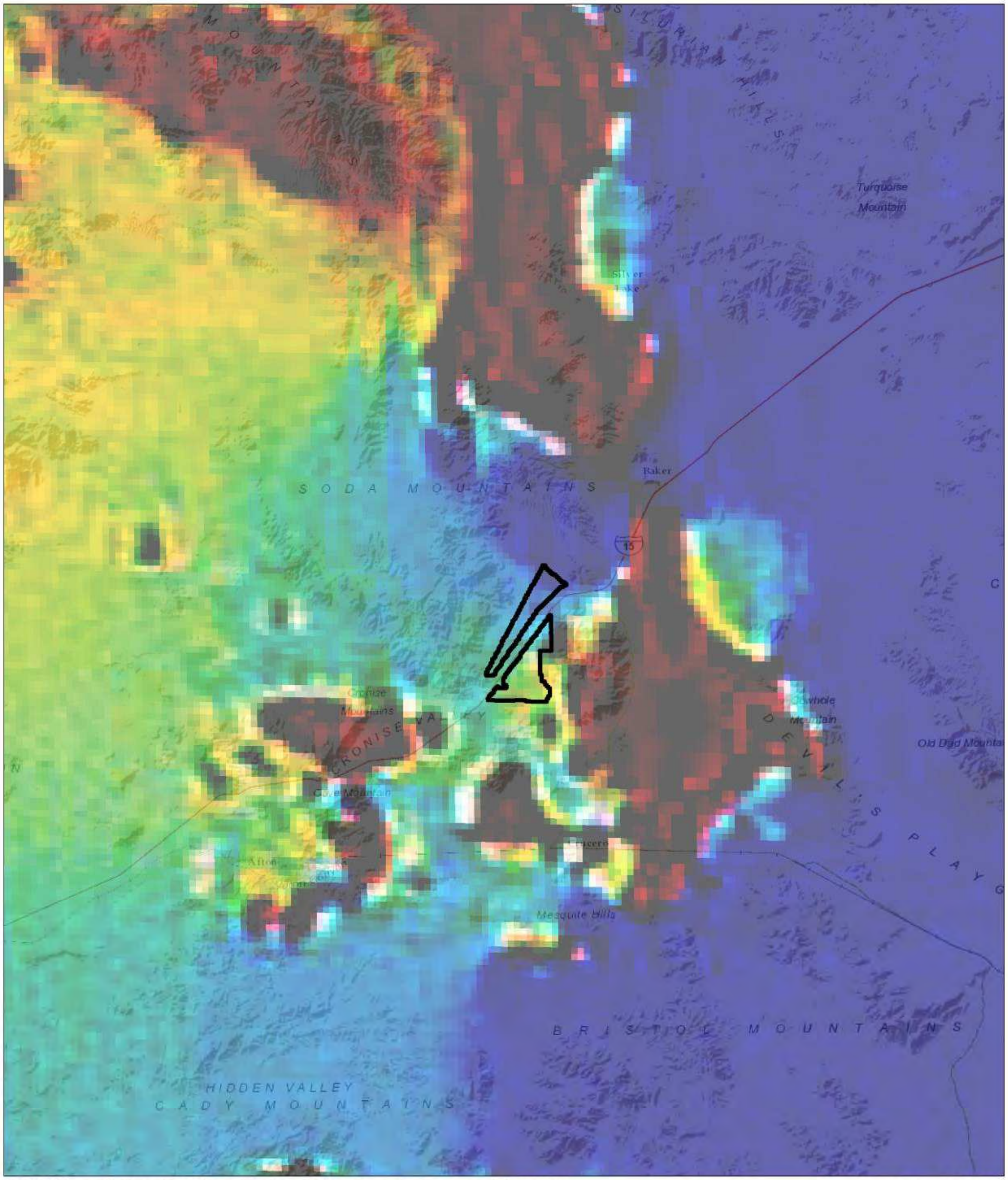


Figure 6: Barriers to Desert Tortoise Movement (Hagerty et al. 2010)



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

Scale: 1:400,000

LEGEND

Study Area

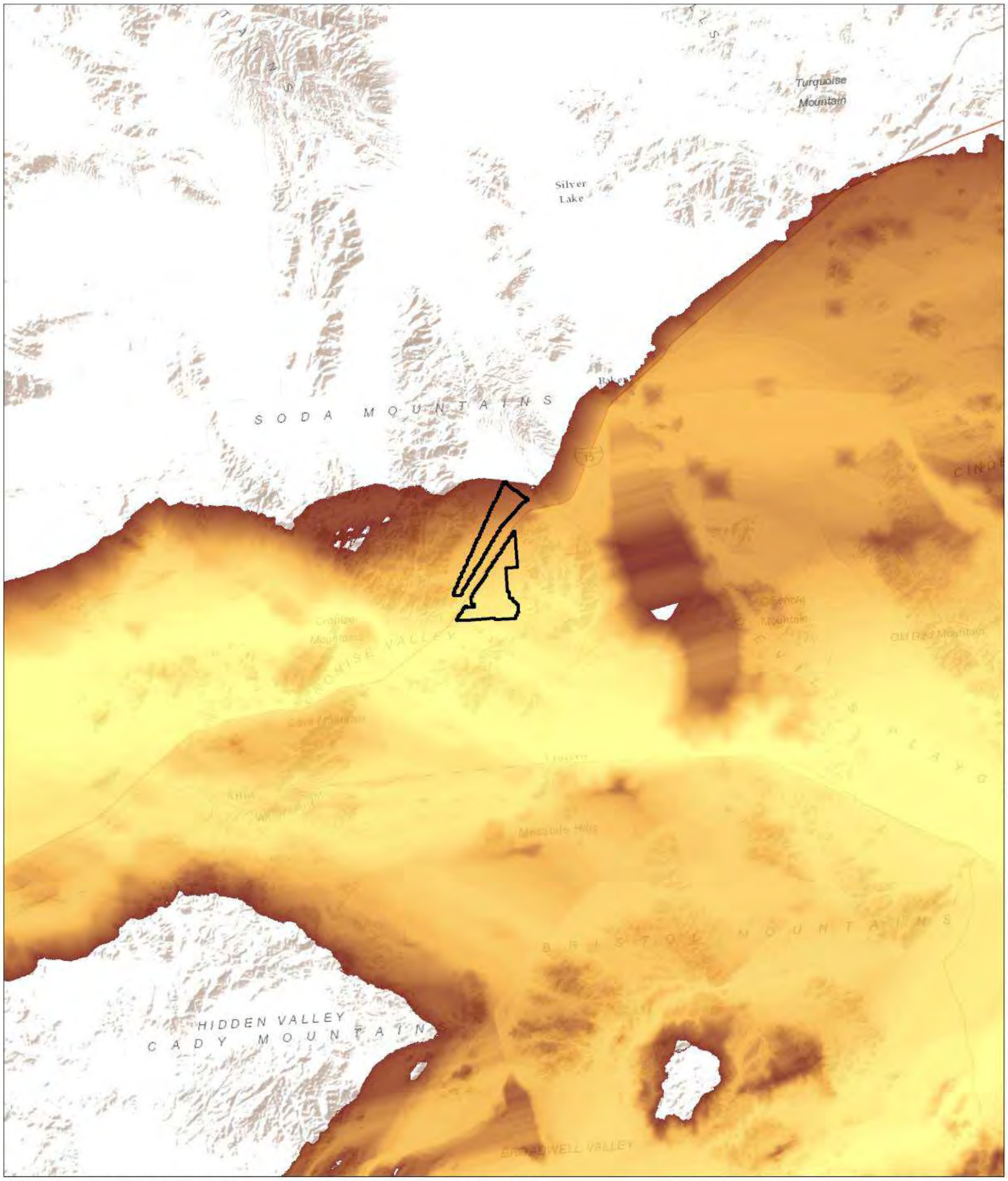
Barrier

N

Miles 0 5 10

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

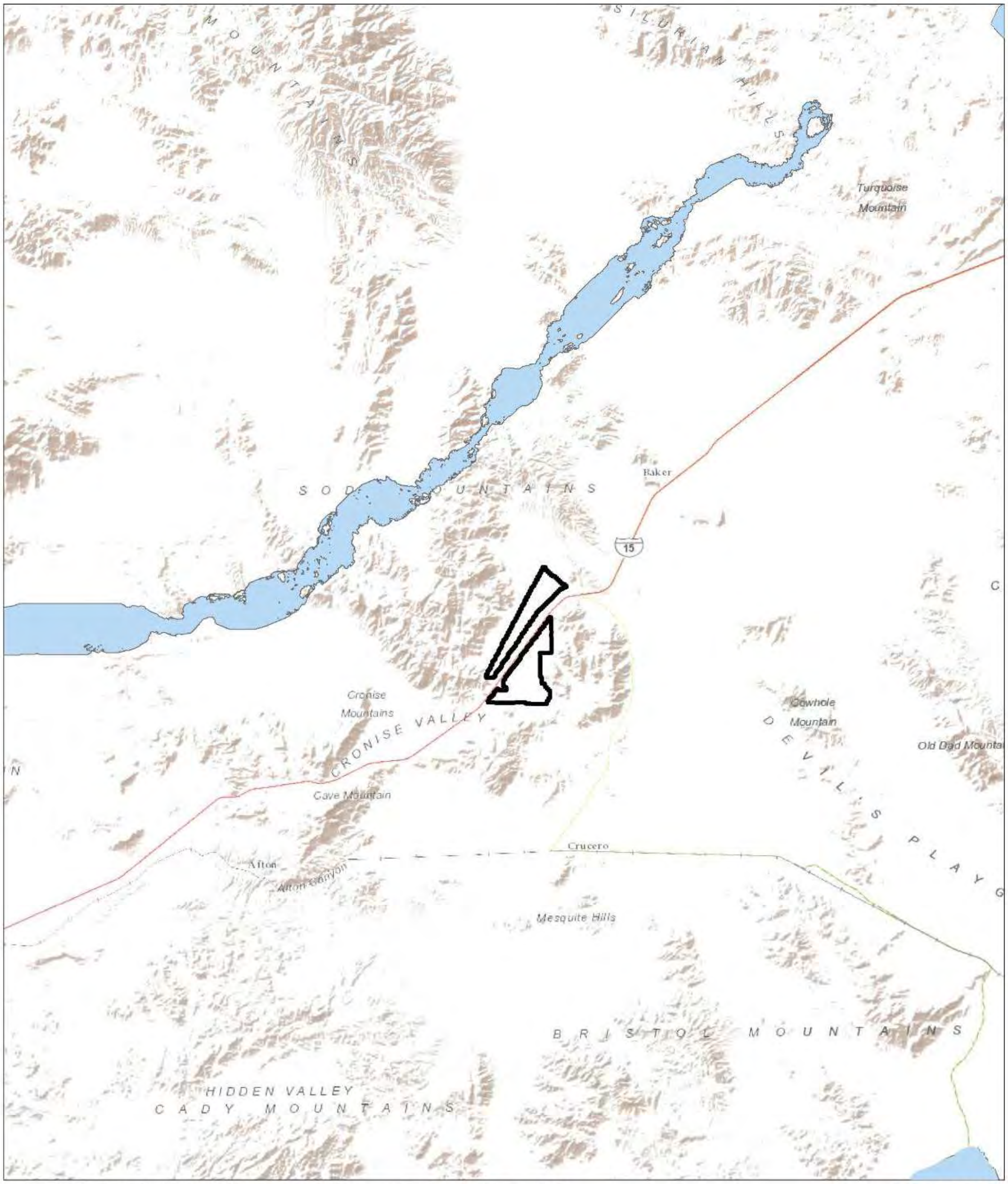
Essential Connectivity Area

More Cost — Less Cost

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

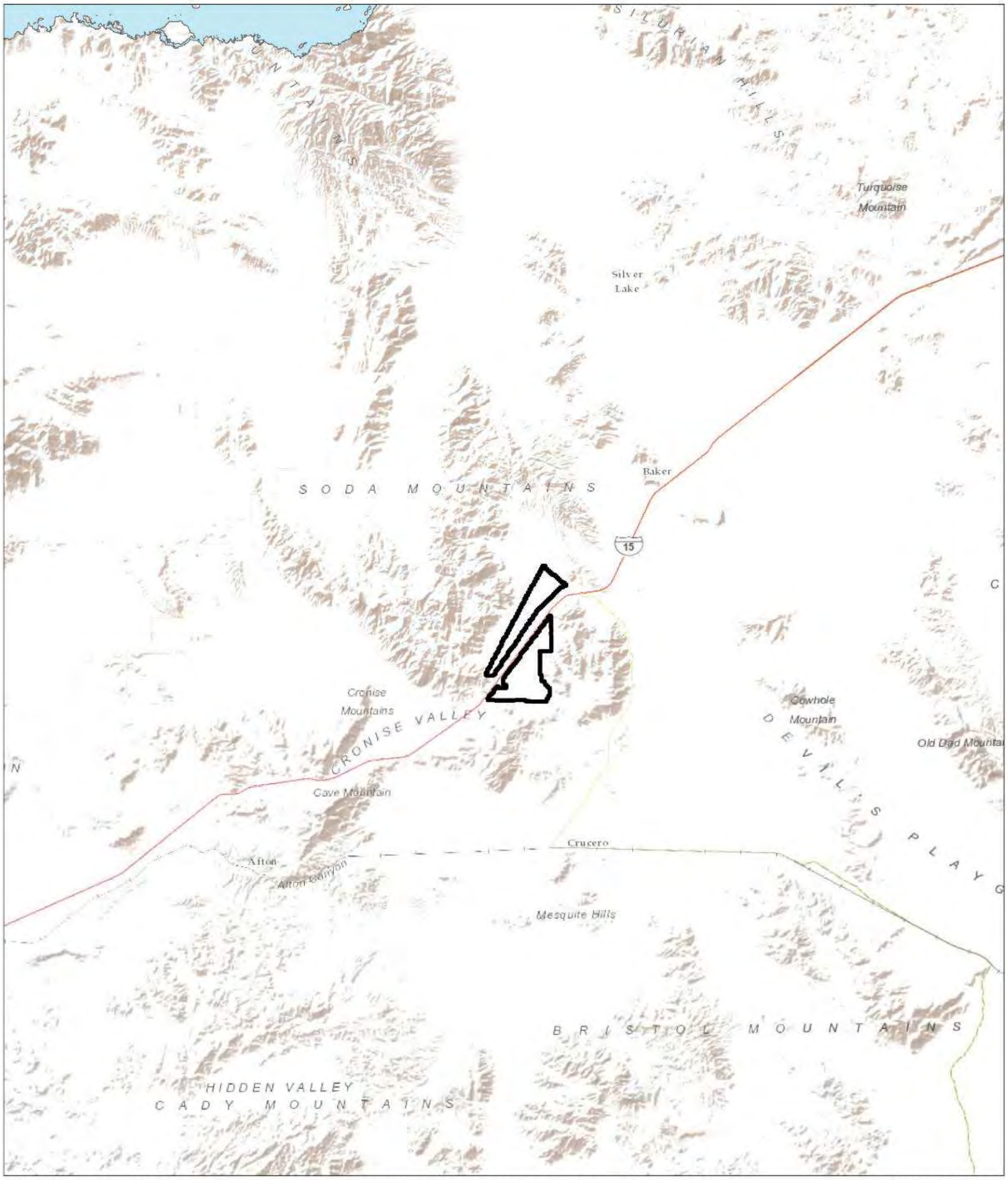
Desert Tortoise Linkage

Miles 0 5 10

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

Miles 0 5 10

N

PANORAMA ENVIRONMENTAL, INC.

2.3.1 Methods

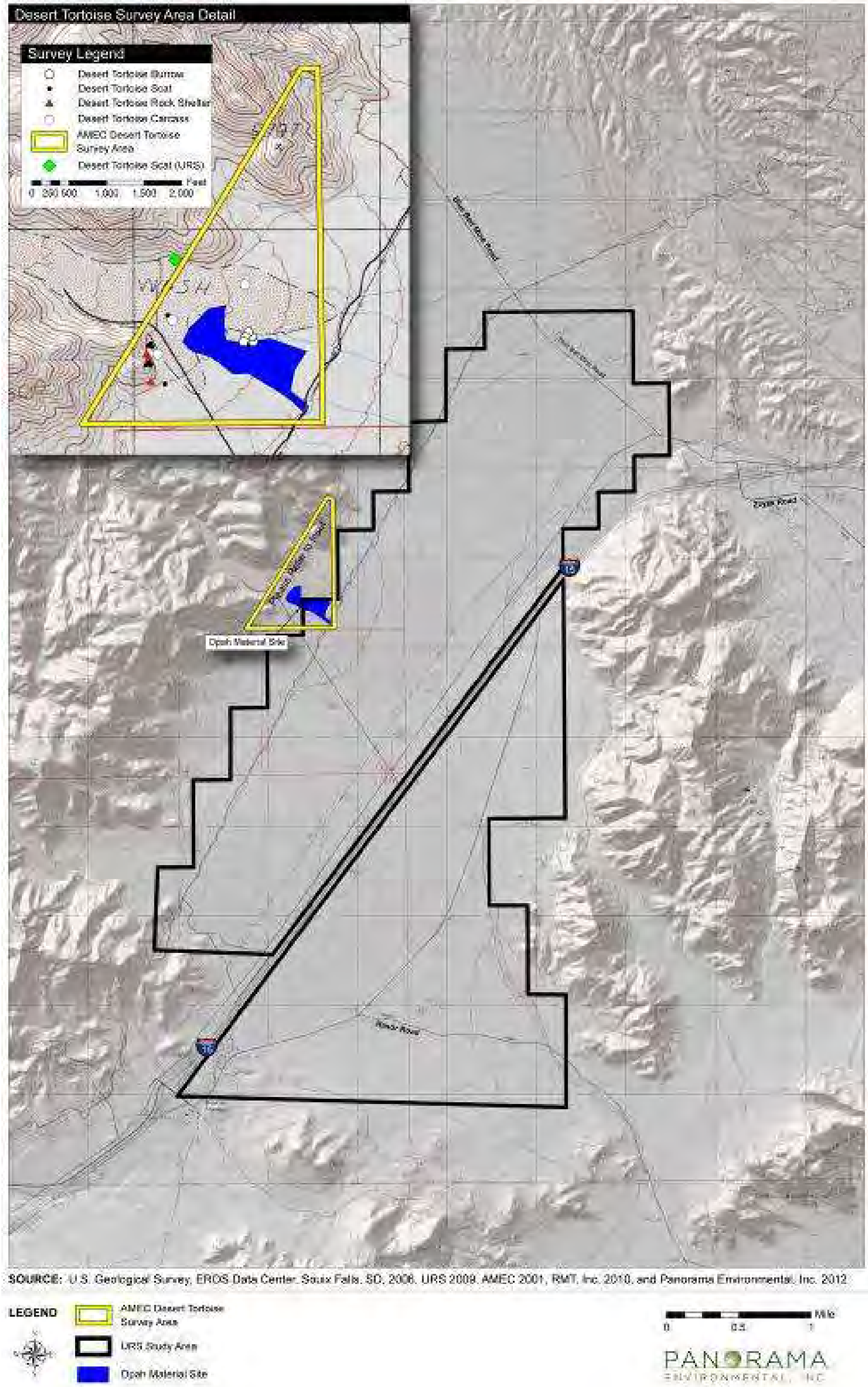
Desert Tortoise

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.

[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

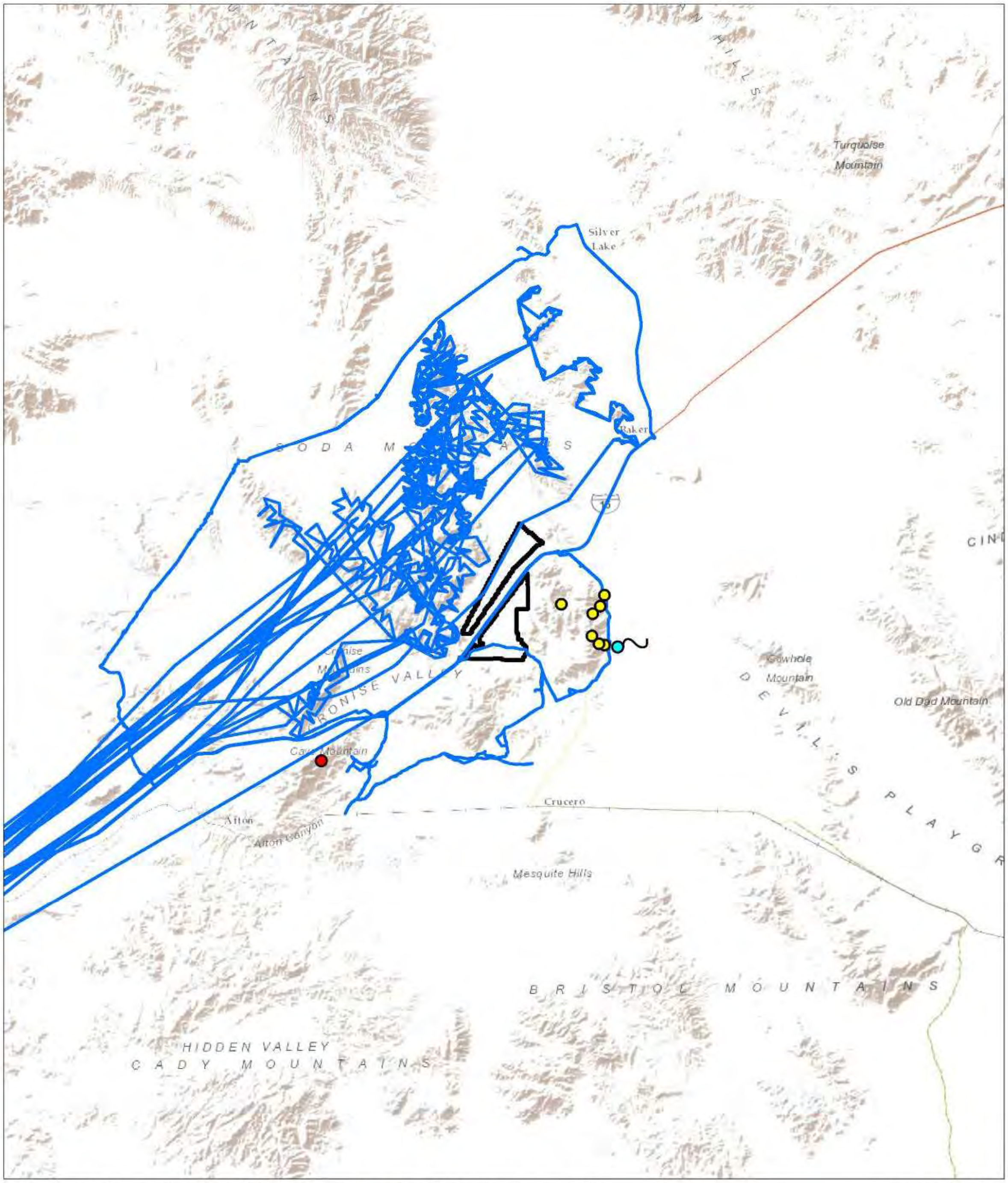
Surveys for bighorn sheep in the Soda Mountains were conducted in 2011 and 2012. Aerial surveys for bighorn sheep were conducted by BioResource Consultants on March 21 and 22, 2011 and May 9, 2011, and ground surveys between March 23 and 25, 2011 (RMT 2011c). The aerial surveys were six two-hour flights. 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

- Study Area
- BRC Survey Routes
- BRC Survey Point
- CDFG Survey Point
- Zzyzx Spring

Miles 0 5 10

PANORAMA ENVIRONMENTAL, INC.

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.

8 REFERENCES

Abella, Regina. 2012. May 1 Bighorn Sheep Ground Count in the South Soda Mountains. Memorandum dated May 14, 2012.

AMEC. 2001. Desert Tortoise Survey of the Opah Ditch Mine.

BLM. 2009. Solar Facility Point Count Protocol. Unpublished.

Bare, Lucas, Bernhardt, Tessa, Chu, Toby, Gomez, Melissa, Noddings, Christopher, and Viljoen, Milena. 2009. *Cumulative Impacts of Large-scale Renewable Energy Development in the West Mojave*. Donald Bren School of Environmental Management; University of California at Santa Barbara. April 2, 2009.

CDFG, California Energy Commission, BLM, and USFWS. 2010. *Planning Agreement by and among the California Department of Fish and Game, California Energy Commission, United States Bureau of Land Management, and United States Fish and Wildlife Service for the Desert Renewable Energy Conservation Plan*. May 2010.

CEC. 2012. *Draft Desert Renewable Energy Conservation Plan (DRECP) Baseline Biology Report.* Prepared by Dudek and ICF. March 2012.

Greenald, Sander and O'Rourke, K. 2001. "On the Bias Produced by Quality Scores in Meta-Analysis, and Hierarchical View of Proposed Solutions". Biostatistics (2) 463-471.

Hagerty, B.E., Nussear, K.E., Esque T.C., Tracy, C.R. 2010. "Making Molehills Out of Mountains: Landscape Genetics of the Mojave Desert Tortoise". Landscape Ecology. doi: 10.1007/s10980-010-9550-6.

Hoff, K.S. and Marlow, R.W. 2002. "Impacts of Vehicle Road Traffic on Desert Tortoise Populations with Consideration of Conservation of Tortoise Habitat in Southern Nevada." Chelonian Conservation and Biology (4) 449-456

Kearney, Michael and Porter W. 2009. "Mechanistic Niche Modelling: Combining Physiological and Spatial Data to Predict Species' Ranges". Ecology Letters. doi: 10.1111/j.1461-0248.2008.01277.x

Kerr, George. 2010. Personal communication with Bonny O'Connor (RMT). September 22, 2010.

Nussear, K.E., Esque, T.C., Inman, R.D., Gass, L., Thomas, K.A., Wallace, C.S.A., Blainey, J.B., Miller, D.M., Webb, R.H. 2009. *Modeling Habitat of the Desert Tortoise (Gopherus agassizii) in the Mojave and Parts of the Sonoran Deserts of California, Nevada, Utah, and Arizona*. U.S. Geological Survey Open-File Report 2009-1102.

Otahal, Chris. 2010. Bureau of Land Management. Personal communication with Brent Miyazaki (RMT) March 1, 2010.

Pauli, Andy. 2010. Personal communication with Brent Miyazaki (RMT). March 11, 2010.

Penrod, K., P. Beier, E. Garding, and C. Cabañero. 2012. *A Linkage Network for the California Deserts*. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org and Northern Arizona University, Flagstaff, Arizona http://oak.ucc.nau.edu/pb1/.

Phillips, Steven J., Robert P. Anderson, and Robert E. Schapire. 2006. "Maximum Entropy Modeling of Species Geographic Distributions". Ecological Modelling (190) 231-259.

Prism Climate Group. 2012. Prism Data Viewer. Climate Normals, 1971-2000. Accessed June 12, 2012. http://prism.nacse.org/

Ralph, C.J., S. Droege, and J.R. Sauer. 1995. *Managing and monitoring birds using point counts: Standards and Applications*. In: Monitoring Bird Populations by Point Counts (C.J. Ralph, S. Droege, and J.R. Sauer, technical editors) PSW-GTR-149. U.S. Department of Agriculture, Forest Service. Albany, CA.

Rochet, M.J. and Rice, J.C. 2004. "Do Explicit Criteria Help in Selecting Indictors for Ecosystem-Based Fisheries Management?" ICES Journal of Marine Science (62) 528-539.

RMT, Inc. 2011a. Preliminary Hydrologic Study Report, Soda Mountain Solar Project.

RMT, Inc. 2011b. Groundwater Evaluation and Geohydrologic Characterization Report.

RMT, Inc. 2011c. Golden Eagle Nest Surveys and Desert Bighorn Sheep Observations (March 21-25, 2011 and May 9-10, 2011), Soda Mountain Solar Project. Prepared by BioResource Consultants.

Spencer, W.D., P. Beier, K. Penrod, K. Winters, C. Paulman, H. Rustigian-Romsos, J. Strittholt, M. Parisi, and A. Pettler. 2010. *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California*. Prepared for California Department of Transportation, California Department of Fish and Game, and Federal Highways Administration.

Tracy, Richard C. 2012. University of Nevada Reno. Personal communication with Susanne Heim (Panorama Environmental, Inc.) July 9, 2012.

Turner, Dr. Jack. 2010. Personal communication with Brent Miyazaki (RMT). February 18, 2010.

URS Corporation 2009a. *2009* Desert Tortoise Survey Report Soda Mountain Solar Project San Bernardino County, California. December 2009.

URS Corporation 2009b. Biological Resources Technical Report, Soda Mountain Solar Project San Bernardino County, California.

URS Corporation 2009c. 2009 Focused Special Status Plant Survey Report Soda Mountain Solar Project, San Bernardino County, California.

URS Corporation 2009d. 2009 Draft Jurisdictional Determination Report Soda Mountain Solar Project, San Bernardino County, California.

URS Corporation 2010. 2009 Spring and Fall Avian Survey Report, Soda Mountain Solar Project San Bernardino, California. August 2010.

U.S. Fish and Wildlife Service. 1992. U.S. Fish and Wildlife Service, Field Survey Protocol for Any Federal Action That May Occur Within the Range of the Desert Tortoise. January 1992. Ventura, CA.

U.S. Fish and Wildlife Service. 1994. Desert Tortoise (Mojave Population) Recovery Plan. Prepared by the Desert Tortoise Recovery Team.

U.S. Fish and Wildlife Service. 2009. United States Fish and Wildlife Service, Preparing for any action that may occur within the range of the Mojave desert tortoise (Gopherus agassizii). April 2009. Ventura, CA.

U.S. Fish and Wildlife Service. 2011. Revised Recovery Plan for the Mojave Population of the Desert Tortoise (*Gopherus agassizii*). Region 8, Pacific Southwest Region USFWS, Sacramento Office. May 2011.

Weasma, Ted. 2012. National Parks Service, Mojave National Preserve. Personal communication. June 21, 2012.

Wilson Geosciences Inc. 2011. *Geologic Characterization Report for the Proposed Caithness Soda Mountain Solar Facility Project Site near Baker, San Bernardino County, California*. March 2011.

Woodman, Peter. 2012. Kiva Biological. Personal communication with Susanne Heim (Panorama Environmental, Inc.). June 29, 2012.