Biological Resources Surveys for Amargosa Farm Road Solar Project

August 2009

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1.0 Introduction

This report describes surveys conducted in support of the planned development of two commercial solar parabolic trough generating stations, with a total generation output rating of approximately 500 MW (Solar Millennium 2008). The facility is being planned by Solar Millennium LLC, under a right-of-way application with the U.S. Bureau of Land Management (BLM) in the Mojave Desert region of the Amargosa Valley in Nye County, Nevada. This project addresses the Amargosa-Farm Road Solar Project identified as BLM Land Use Application File NVN 84359.

The approximately 7,800 acre site is located south of US-95 and west of Highway 373. Proposed facilities will occupy about 4,000 acres of the site, and generally consist of two parabolic solar trough solar fields, two power block facilities, office building structures, parking areas, septic field, switch yard, evaporation ponds, concrete/riprap lined drainage channels, and re-aligned Amargosa Farm Road. The proposed two solar power plants will be equipped with thermal energy storage capability, allowing the plants to continue generating energy for several hours after sundown (Solar Millennium 2008). Each field will be equipped with a central power block housing a steam turbine, cooling equipment, and thermal energy storage tanks. The stations would also share common facilities such as an office, maintenance building, roads, 230 kV substation and transmission line, and a storm water pond. If evaporative cooling is utilized, the facilities would include evaporative water ponds, and a water pipe line would be used to transport water to the site. Ancillary construction will consist of, but is not limited to underground utilities, exterior concrete flatwork, temporary construction laydown area, temporary assembly hall building, and pavement improvements (parking areas and interior roadways).

The proposed facilities will produce clean, renewable energy sufficient for approximately 150,000 Nevada households.

The surveys described in this report are intended to fully document the biological resources present on the proposed site that might be affected by the project. Specific surveys conducted include:

- Mapping of vegetation communities (Section 3);
- Rare plant surveys (Section 4);
- Invasive weed mapping (Section 5);
- General general wildlife surveys for invertebrate, reptiles and amphibians, birds, and small mammals (Section 6); and
- Wetlands delineation (Section 7).

1.1 Project Objective

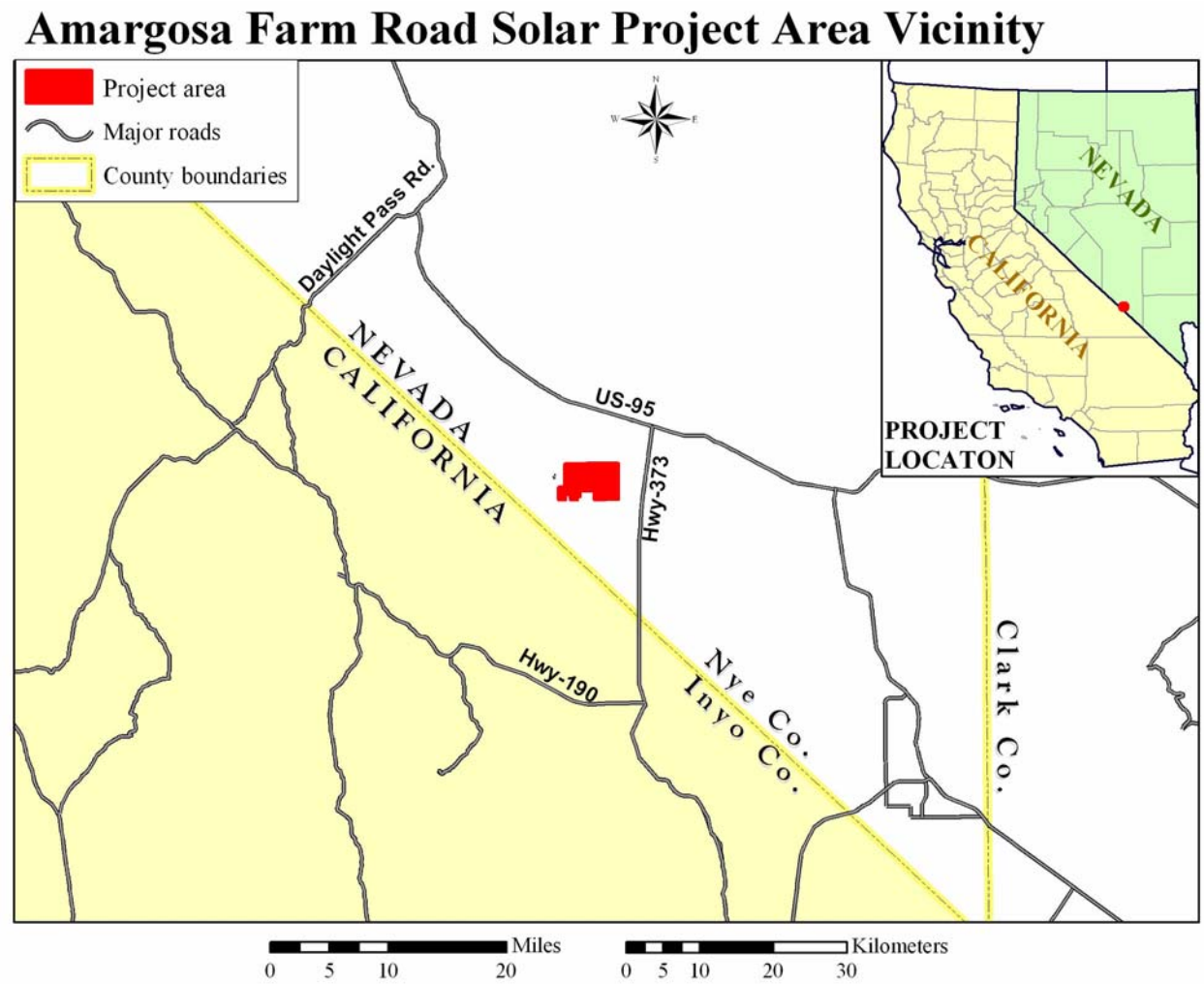
The primary objective of these survey efforts is to identify and map natural resources values sufficient to support an Environmental Impact Statement (EIS) on the Amargosa Farm Road Solar Plan of Development that meets requirements of the BLM and all associated needs for permits and developing avoidance, minimization, and mitigation measures. Surveys were conducted to document the vegetation communities, flora and fauna, sensitive species known to occur or with the potential to occur, and water resources within and in the immediate vicinity of the project site.

1.2 Project Location

The Amargosa-Farm Road Solar Project site (hereafter referred and 'the project site' or 'site') is located in southwest Nye County, Nevada, in an unincorporated area known as the Amargosa Valley (Map 1-1). The site is located west of Highway 373 and south of US-95, approximately 80 miles northwest of Las Vegas and 360 miles southeast of Reno.

1.3 General Site Conditions

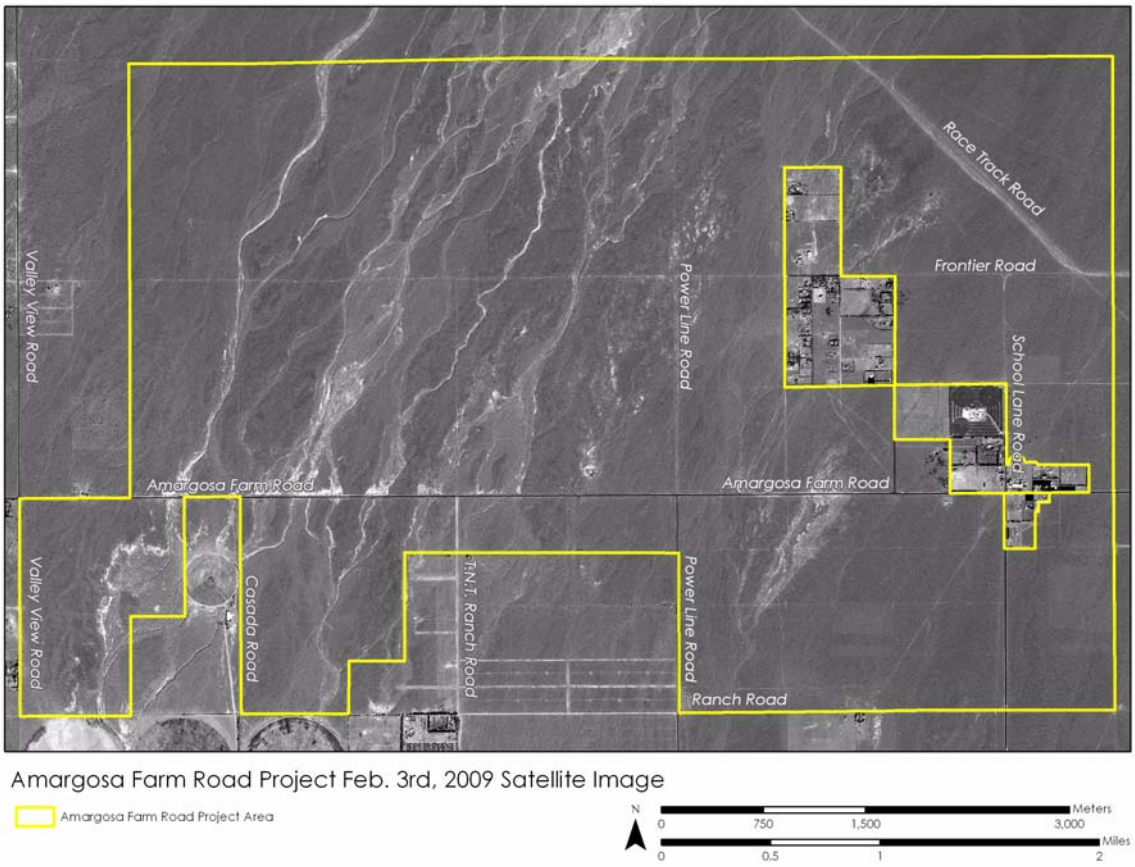
A literature review was conducted to support the assessment and mapping of natural resources values and constraints, including special status species. This review helped to provide efficiency and focus to the field work, and validate and build on work of the critical issues study (CH2MHill, 2008). The latter based their analysis on Las Vegas District Resources Management Plan (RMP) and its associated Record of Decision, supported by reconnaissance-level surveys. These more detailed surveys were designed to fill in any potential data gaps that might contribute to project constraints. We reviewed geographic information system (GIS) datasets to assess their level of completeness and made every effort to address any data gaps coincident with other surveys. The literature review surveyed all known databases of the BLM, National Park Service, Nevada Natural Heritage Program, Nevada Department of Wildlife (NDOW), California Natural Diversity Database (CNDDB), Nevada Native Plant Society, and Nye County records, as well as those of non-government native plant societies. This review was important for large mammals, since focused methods are not developed for them except for tracking of prints and other sign. The literature review also included interviews with subject matter experts.



Map 1-1. Regional location of the Amargosa Farm Road Solar Millennium project site.

1.3.1 Habitat and Topography Summary

The project site is located in the Northern Mojave Desert ecoregion, and is characterized as creosote desert scrub, dominated by creosote (*Larrea tridentata*). Map 1-2 depicts a high resolution aerial photograph of the site. It is a typical dry region of Mojave Desert, with relatively sparse shrub canopy and very little annual herbaceous growth. The topography of the site shows little variation aside from the occasional low rise of a few feet at most and a few small shallow washes that cross the site from north to south. The site lies between the Yucca Mountains to the north and the Funeral Mountains to the southwest (CH2MHill 2008).



Map 1-2. Aerial photograph (ca. 2009) of the Amargosa Farm Road Solar Millennium project site.

1.3.2 Climate

The Amargosa Desert is characterized as having extreme climatic conditions, with hot, dry summers and cool, dry winters.

Rainfall

Located in the northern Mojave Desert, the Amargosa Valley receives an average of 4.2 inches of rain annually (Figure 1-1), with annual extremes of anywhere from less than half an inch (in.) (0.45 in. in 2002) to more than 10 inches (10.4 in. in 1983) (Data source: Western Regional Climate Center, Amargosa Farms Garey, Nevada (Station 260150). Most of the rains occur from January through March (Figure 1-2), although rainfall can occur throughout the year. The last several years have been particularly dry, as evidenced by comparison with long-term monthly and overall average rainfall (Figure 1-3).

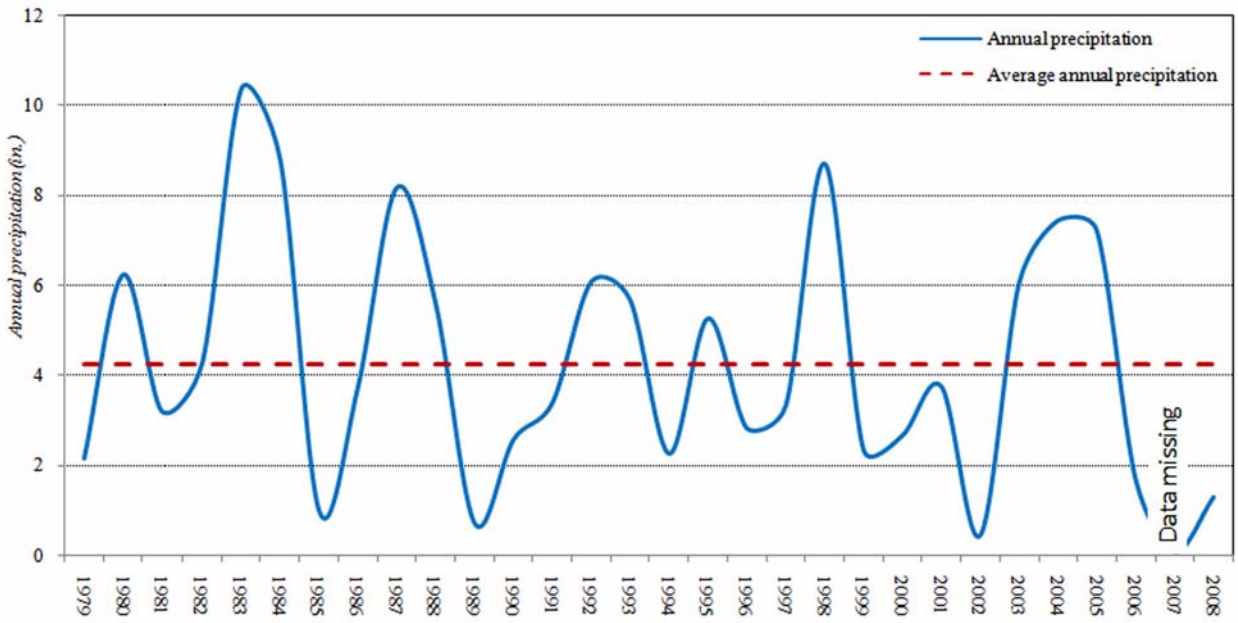


Figure 1-1. Annual rainfall from 1964 - 2009 in the Amargosa Valley area. (Data source: Western Regional Climate Center, Amargosa Farms Garey, Nevada (Station 260150).

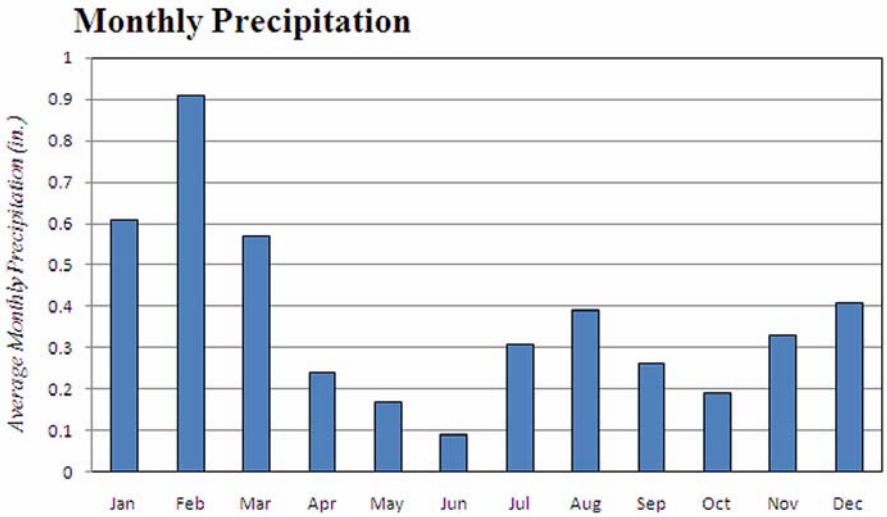


Figure 1-2. The average monthly precipitation based on Western Regional Climate Center data from Amargosa Farms Garey, Nevada (Station 260150).

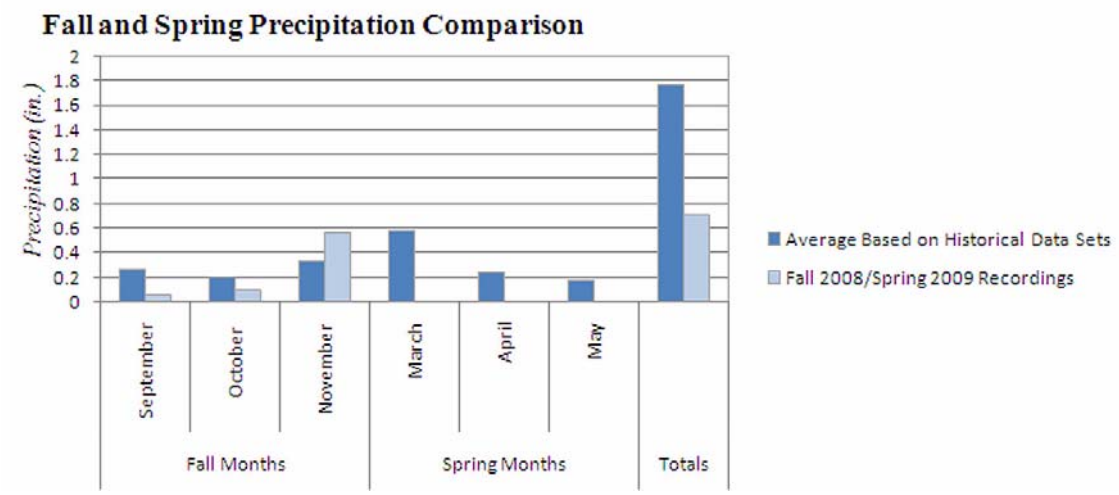


Figure 1-3. The average monthly precipitation during fall and spring compared to recent seasons based on Western Regional Climate Center data from Amargosa Farms Garey, Nevada (Station 260150).

Monthly Temperatures

Average monthly temperatures in the Amargosa Valley range from a low of 45.8° Farenheit (F) in December, with an average minimum temperature of 30.6°F and average maximum temperature of 60.9°F, to a high of 86.5°F in July, with an average minimum temperature of 69.1°F and average maximum temperature of 103.8°F (Figure 1-4; Data source: Western Regional Climate Center, Amargosa Farms Garey, Nevada [Station 260150]).

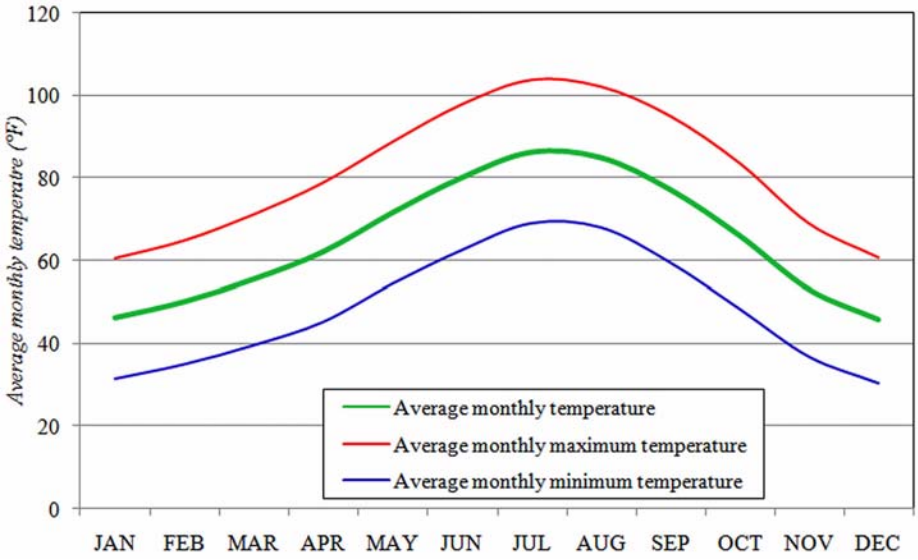


Figure 1-4. Average monthly temperature regime in the Amargosa Valley (Data source: Western Regional Climate Center, Amargosa Farms Garey, Nevada, Station 260150).

1.3.3 Disturbance Conditions

The site generally displays typical Mojave Desert vegetation of creosote *(Larrea tridentata)* scrub on an alluvial fan. It is gridded by unpaved roads, and shows other signs of past disturbance as shown in Photo 1-1 through Photo 1-4. Off-road vehicle tracks are present (see photo examples), including an organized race track in the northeast portion of the project area (see Photo 1-3). A trash dump also occurs near this location. Especially on the eastern portions of the property, past farming including disking lines remain visible on aerial photos and on the ground. The vegetation in these areas is greatly simplified to creosote with some annual herbs. In certain site-specific areas, digging has occurred that appears to be shallow mines.

The drainages are impounded by Amargosa Farm Road and sand sediment has collected behind each crossing point from historic floods. Washes are commonly used for off-roading.

Compared to many areas of the Mojave, the occurrence of invasive, non-native herbaceous plants is relatively low. This is probably due to the site's isolation, low rainfall, and removal from major sources of nitrogen pollution (such as along Interstate [I]-15 and I-10) that tend to foster invasion by non-native plants (Brooks 2009). The Mediterranean/North African genus *Schismus* spp. is a small-statured grass posing problems through much of the Mojave Desert. It occurs in relatively low densities throughout the project area, especially beneath the creosote canopy. Other invasive plants were located mostly along roads and not in the interior habitat areas.

Finally, there is evidence of historic grazing on the property. All perennial bunch grasses that are expected to occur based on soils and the ecological site description (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] soil survey reports) are missing from the flora. This is most likely a result of historic and some recent grazing by feral horses and burros, as well as by domestic sheep.

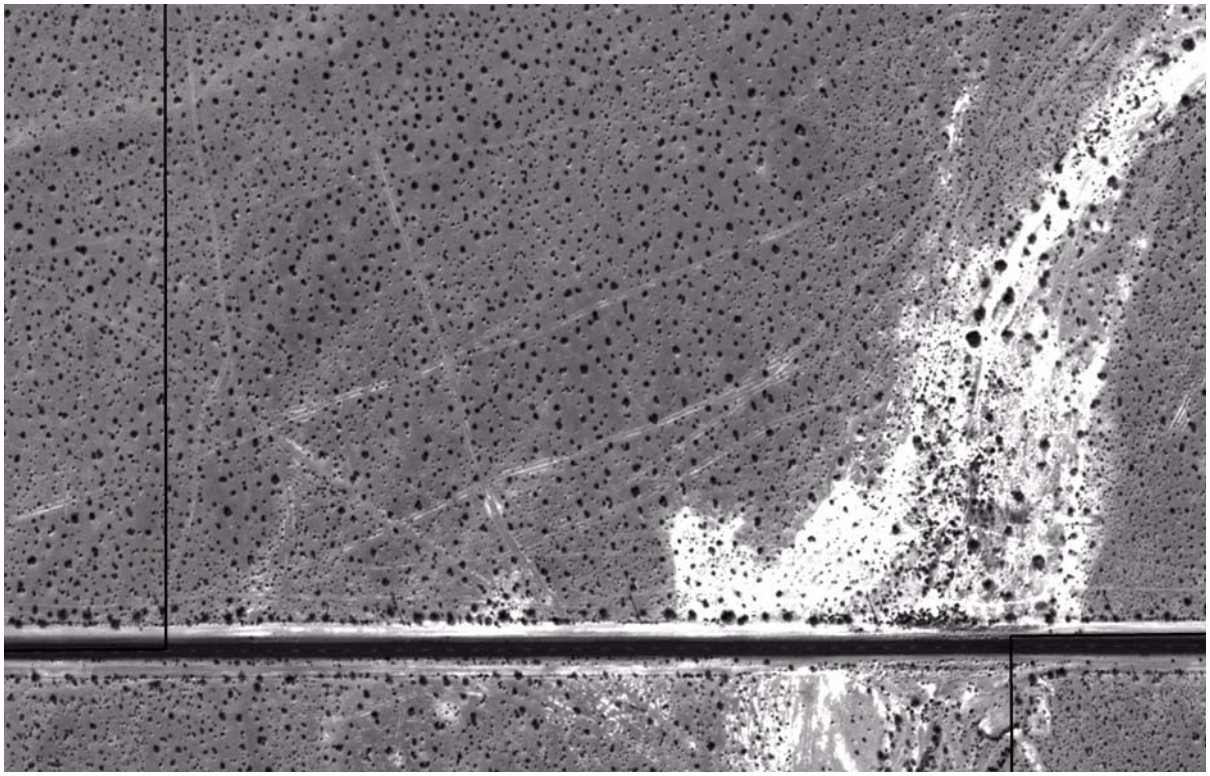


Photo 1-1. Off-road vehicle tracks and sand accumulation resulting from water impoundment against Amargosa Farm Road.

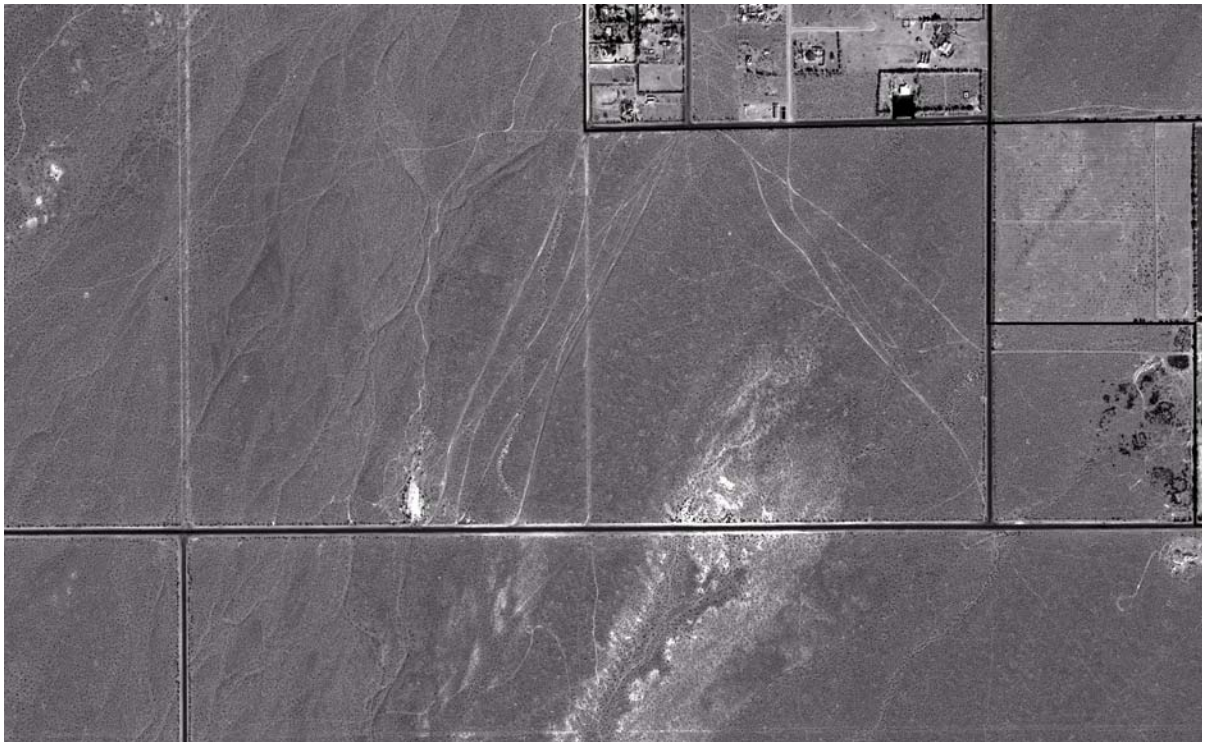


Photo 1-2. Site conditions near the intersection of Amargosa Farm Road and School Road, showing off-road vehicle tracks, road impoundment of drainage where sand has accumulated, and natural exposure of soil caliche rubble.

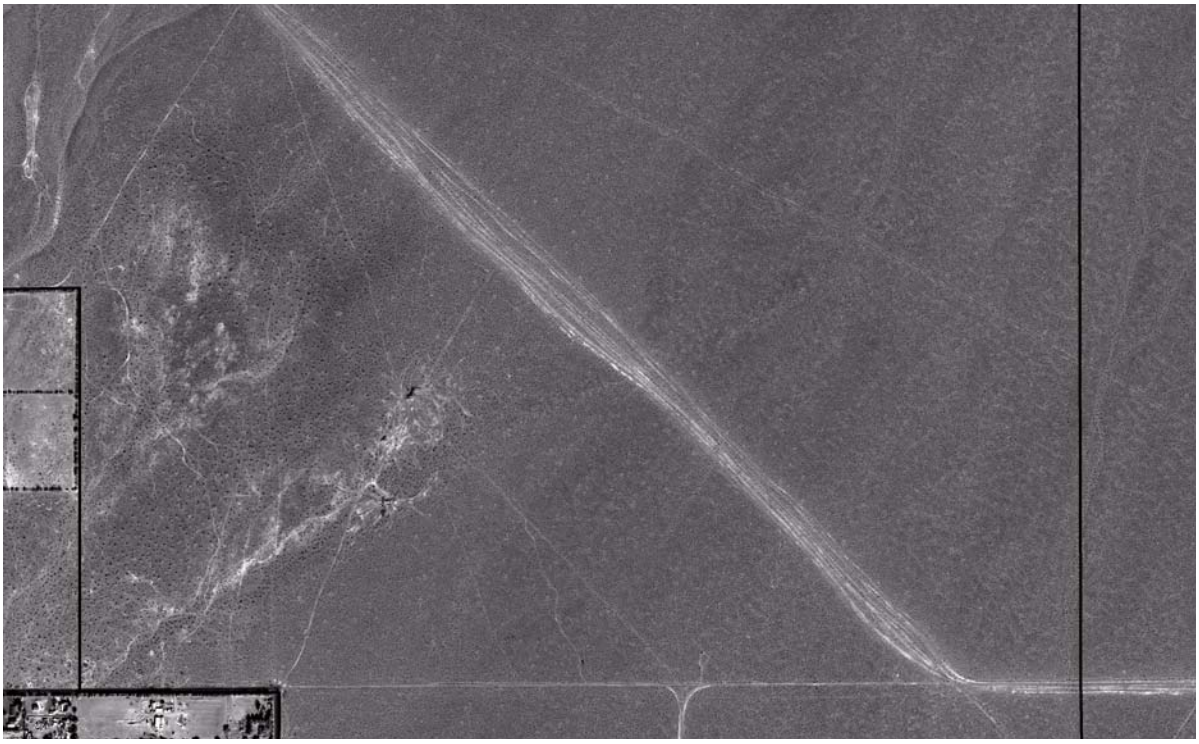


Photo 1-3. Northeast project area showing off-road raceway, trash dump, and off-road tracks.

Photo 1-4. Area near School Road showing evidence of past disking and off-road tracks.

2.0 Field Schedule and Focus Species List

2.1 Field Schedule

The following table (Table 2-1) describes field personnel, as well as dates and times of field work.

Table 2-1. Survey Dates, Personnel, Times, and Conditions.

Date	Survey	Surveyor	Time
3-19-09	Initial field visit/tour, rare plants	Liz Kellogg, Scott Snover, Bill Fisher	3 hrs
3-20-09	Tortoise Rare plant/Wetland	Scott Snover, Bill Fisher Liz Kellogg	8 hrs
3-21-09	Tortoise Rare plant/Wetland	Scott Snover, Bill Fisher Liz Kellogg	6 hrs
3-23-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	9 hrs
3-24-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	9 hrs
3-25-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	9 hrs
3-26-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	8 hrs
3-30-09	Tortoise Insects	Harry Smead, Scott Snover, Bill Fisher Harry Smead, Scott Snover	7 hrs 1 hr
3-31-09	Tortoise Insects	Harry Smead, Scott Snover, Bill Fisher Harry Smead, Scott Snover	7 hrs 1 hr
4-1-09	Tortoise Insects	Harry Smead, Scott Snover, Bill Fisher Harry Smead, Scott Snover	7 hrs 1 hr
4-2-09	Tortoise Insects	Harry Smead, Scott Snover, Bill Fisher Harry Smead, Scott Snover	7 hrs 1 hr
4-3-09	Tortoise	Harry Smead, Scott Snover, Bill Fisher	6 hrs
4-4-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	8 hrs
4-5-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	8 hrs
4-6-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	8 hrs
4-7-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	8 hrs
4-8-09	Tortoise	Joseph Kean, Harry Smead, Bill Fisher	7.5 hrs
4-08-09	Nocturnal Avian	Kevin Clark	1 hr
4-09-09	Avian	Kevin Clark	6.5 hrs
4-10-09	Avian	Kevin Clark	2 hrs
4-19-09	Tortoise	Michael Moss, Bill Fisher, Harry Smead	8 hrs
4-20-09	Tortoise	Michael Moss, Bill Fisher, Harry Smead	8 hrs
4-21-09	Tortoise	Michael Moss, Bill Fisher, Harry Smead	8 hrs
4-22-09	Tortoise	Michael Moss, Bill Fisher, Harry Smead	8 hrs
4-24-09	Rare Plants Tortoise	Joseph Kean, Liz Kellogg Harry, Scott, Bill	8.5 hrs
4-25-09	Rare Plants Tortoise	Joseph Kean, Liz Kellogg Harry, Scott, Bill	8 hrs

Table 2-1. Survey Dates, Personnel, Times, and Conditions.

Date	Survey	Surveyor	Time
4-26-09	Rare Plant Survey Tortoise	Joseph Kean, Liz Kellogg Harry, Scott, Bill	6.5 hrs
4-29-09	Invertebrate Survey	Joseph Kean, Scott Snover	1.5 hrs
4-30-09	Invertebrate Survey Vegetation Mapping, Rare plants	Joseph Kean, Scott Snover	8 hrs
5-1-09	Invertebrate Survey Vegetation Mapping	Joseph Kean, Scott Snover	3 hrs
5-4-08	Tortoise	Harry Smead, Bill Fisher, Mike Moss	8 hrs
5-5-09	Tortoise	Harry Smead, Bill Fisher, Mike Moss	8 hrs
5-6-09	Tortoise	Harry Smead, Bill Fisher, Mike Moss	8 hrs
5-6-09	Nocturnal Avian	Kevin Clark	1 hr
5-7-09	Avian	Kevin Clark	5.25 hrs
5-7-09	Tortoise	Harry Smead, Bill Fisher, Jason Crandall, Kevin Clark	8 hrs
5-8-09	Tortoise, Rare Plants, Mammal Survey	Harry Smead, Jason Crandall, Bill Fisher, Shawn Smallwood, Liz Kellogg	8 hrs
5-8-09	Avian	Kevin Clark	5.25 hrs
5-9-09	Tortoise Mammal Surveys	Harry Smead, Jason Crandall, Bill Fisher, Shawn Smallwood	8 hrs 7 hrs
5-9-09	Avian	Kevin Clark	4 hrs
5-10-09	Tortoise Mammal Survey	Harry Smead, Bill Fisher, Shawn Smallwood	8 hrs 7 hrs
5-11-09	Tortoise Mammal Survey	Erica Cunningham, Harry Smead, Bill Fisher Shawn Smallwood	8 hrs 9 hrs
5-12-09	Tortoise Mammal Survey	Erica Cunningham, Harry Smead, Bill Fisher Shawn Smallwood	8 hrs 9 hrs
5-13-09	Tortoise Mammal Survey	Erica Cunningham, Harry Smead, Bill Fisher Shawn Smallwood	5 hrs 5.5 hrs
5-20-09	Tortoise, Veg Mapping, Rare Plant	Jason Crandall, Scott Snover, Bill Fisher	7 hrs
5-21-09	Tortoise, Veg Mapping	Jason Crandall, Scott Snover, Bill Fisher	7 hrs
5-22-09	Tortoise, Veg Mapping	Jason Crandall, Scott Snover, Bill Fisher	7 hrs
5-27-09	Nocturnal Avian	Kevin Clark	1 hr
5-28-09	Night-time Herpetological Survey	Joseph Kean, Harry Smead	2 hrs
5-28-09	Avian	Kevin Clark	4 hrs
5-29-09	Waterline Desert Tortoise Survey	Joseph Kean, Harry Smead	6.5 hrs
5-29-09	Avian	Kevin Clark	3.25 hrs
5-29-09	Night-time Herpetological Survey	Joseph Kean, Harry Smead	2.75 hrs
5-29-09	Night-time Road Survey	Joseph Kean, Harry Smead	.5 hrs
5-30-09	Focused Rare Plant Surveys	Joseph Kean, Harry Smead	7.5 hrs
5-30-09	Avian	Kevin Clark	3.5 hrs
5-31-09	Focused Rare Plant Surveys	Joseph Kean, Harry Smead	6.5 hrs
5-31-09	Night-time Herpetological Survey	Joseph Kean, Harry Smead	3 hrs
6-1-09	Focused Rare Plant Survey	Joseph Kean, Harry Smead	3.75 hrs
6/09/09	Rare Plant Surveys	Liz Kellogg, Jason Crandall	5 hrs
6/10/09	Rare Plant Surveys	Liz Kellogg, Jason Crandall	7 hrs
6/11/09	Rare Plant Surveys	Liz Kellogg, Jason Crandall	2 hrs
6/19/09	Rare Plants, Herpetological Survey, Insects	Joseph Kean, Harry Smead	1.5 hrs
6/20/09	Rare Plants, Herpetological Survey, Insects	Joseph Kean, Harry Smead	8 hrs
6/21/09	Rare Plants, Herpetological Survey, Insects	Joseph Kean, Harry Smead	7.5 hrs
6/22/09	Rare Plants, Herpetological Survey, Insects	Joseph Kean, Harry Smead	7.5 hrs
6/23/09	Rare Plants, Herpetological Survey, Insects	Joseph Kean, Harry Smead	5 hrs

Table 2-1. Survey Dates, Personnel, Times, and Conditions.

Date	Survey	Surveyor	Time
7/1/09	Bats	Jim Kellogg	4 hrs
7/2/09	Bats	Jim Kellogg	4 hrs
7/3/09	Bats	Jim Kellogg	4 hrs
7/4/09	Bats	Jim Kellogg	4 hrs
7/5/09	Bats	Jim Kellogg	4 hrs

2.2 Focus Species

Generally wildlife inventory methods and focused surveys for all species of concern are developed based on the project's objective to develop a successful EIS including mitigation measures, and using BLM listed species (their Resource Conservation Plan and their list of designated sensitive species), National Park Service special status species, national conservation plans for avian species and associated lists, and lists from any regional or local habitat conservation plans (including the Nye County Species-At-Risk list). See Table 2-2 for the focus species list for the Amargosa Farm Road Solar Project. Map 2-1 shows some known locations of special status species.

Presence/absence surveys were conducted for all special status species and species of special concern within the habitat proposed for disturbance on the Amargosa Farm Road Solar Project. Established or reasonable (if there were no established methods) survey methods were used.

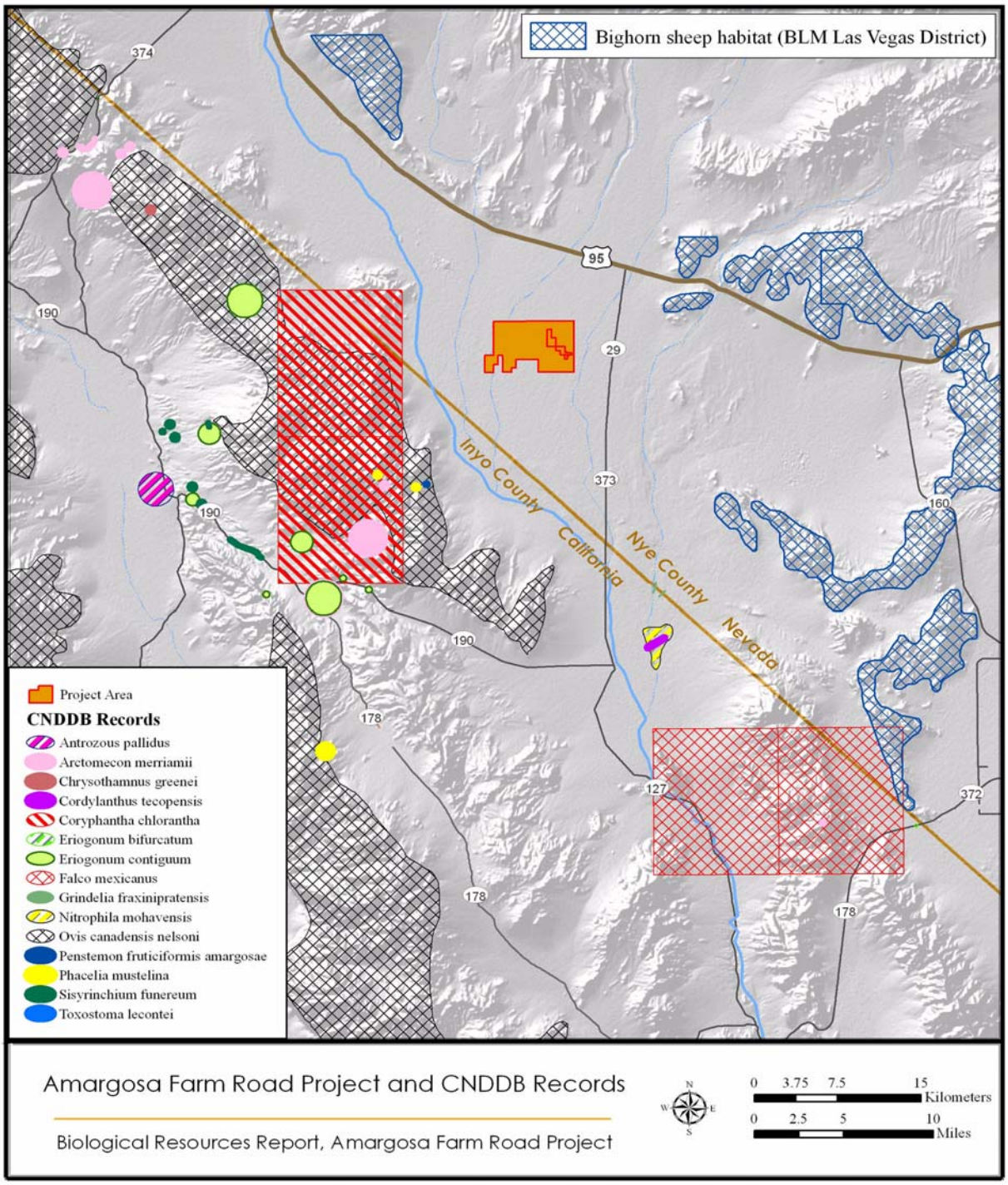
The level of effort (routes walked, time in field, and qualifications of the observer) is documented in each individual section of this report enabling an outside reviewer to understand the confidence with which presence/absence of a species was estimated.

Table 2-2. Focus ('special status') species targeted for presence/absence surveys at the Amargosa Farm Road Solar Project site.

Group	Species Name	Common Name
BLM SENSITIVE SPECIES		
Amphibians	*Bufo microscaphus microscaphus*	Arizona toad
Reptiles	*Sauromalus obesus*	Chuckwalla
Reptiles	*Gopherus agassizii*	Desert tortoise Mojave Desert pop.
Birds	*Phainopepla nitens*	Phainopepla
Birds	*Empidonax traillii extimus*	Southwestern Willow Flycatcher
Birds	*Falco peregrinus*	Peregrine Falcon
NEVADA NATURAL HERITAGE DIVISION SPECIES-AT-RISK (SOUTHERN NYE COUNTY)		
Plants - Monocots	*Sisyrinchium funereum*	Death Valley blue-eyed grass
Plants - Monocots	*Sisyrinchium radicatum*	St. George blue-eyed grass
Plants - Monocots	*Spiranthes infernalis*	Ash Meadows lady's tresses
Plants - Dicots	*Arctomecon merriamii*	White bearpoppy
Plants - Dicots	*Astragalus mohavensis var. hemigyrus*	Halfring milkvetch
Plants - Dicots	*Astragalus nyensis*	Nye milkvetch
Plants - Dicots	*Atriplex argentea var. longitrichoma*	Pahrump silverscale
Plants - Dicots	*Camissonia megalantha*	Cane Spring suncup
Plants - Dicots	*Centaurium namophilum*	Spring-loving centaury
Plants - Dicots	*Cordylanthus tecopensi*	Tecopa birdbeak
Plants - Dicots	*Enceliopsis nudicaulis var. corrugata*	Ash Meadows sunray

Table 2-2. Focus ('special status') species targeted for presence/absence surveys at the Amargosa Farm Road Solar Project site.

Group	Species Name	Common Name
Plants - Dicots	*Eriogonum bifurcatum*	Pahrump Valley buckwheat
Plants - Dicots	*Eriogonum heermannii var. clokeyi*	Clokey buckwheat
Plants - Dicots	*Grindelia fraxinopratensis*	Ash Meadows gumplant
Plants - Dicots	*Lathyrus hitchcockianus*	Bullfrog Hills sweetpea
Plants - Dicots	*Lesquerella pendula*	Hanging bladderpod
Plants - Dicots	*Lupinus holmgrenianus*	Holmgren lupine
Plants - Dicots	*Nitrophila mohavensis*	Amargosa niterwort
Plants - Dicots	*Penstemon bicolor ssp. roseus*	Rosy twotone beardtongue
Plants - Dicots	*Penstemon fruticiformis ssp. amargosae*	Death Valley beardtongue
Plants - Dicots	*Phacelia beatleyae*	Beatley scorpionflower
Plants - Dicots	*Phacelia filiae*	Clarke phacelia
Plants - Dicots	*Phacelia mustelina*	Weasel phacelia
Amphibians	*Bufo nelsoni*	Amargosa toad
Reptiles	*Heloderma suspectum cinctum*	Banded Gila monster
Birds	*Athene cunicularia hypugaea*	Western Burrowing Owl
Birds	*Buteo regalis*	Ferruginous Hawk
Birds	*Buteo swainson*	Swainson's Hawk
Birds	*Toxostoma lecontei*	LeConte's thrasher
Birds	*Toxostoma bendirei*	Bendire's thrasher
Birds	*Plegadis chihi*	White-faced Ibis
FROM CNDDB RECORDS		
Plants - Dicots	*Chrysothamnus greenei*	Greene's rabbitbrush
Plants - Dicots	*Eriogonum contiguum*	Reveal's buckwheat
Plants - Dicots	*Escobaria vivipara var. rosea*	Bee-hive cactus
Plants - Dicots	*Petalonyx thurberi ssp. Gilmanii*	Death Valley sandpaper-plant



Map 2-1. CNDDB records for focus species potentially occurring on Amargosa Farm Road Solar Project site, plus bighorn sheep habitat locations from the BLM (Las Vegas District).

3.0 Vegetation Mapping

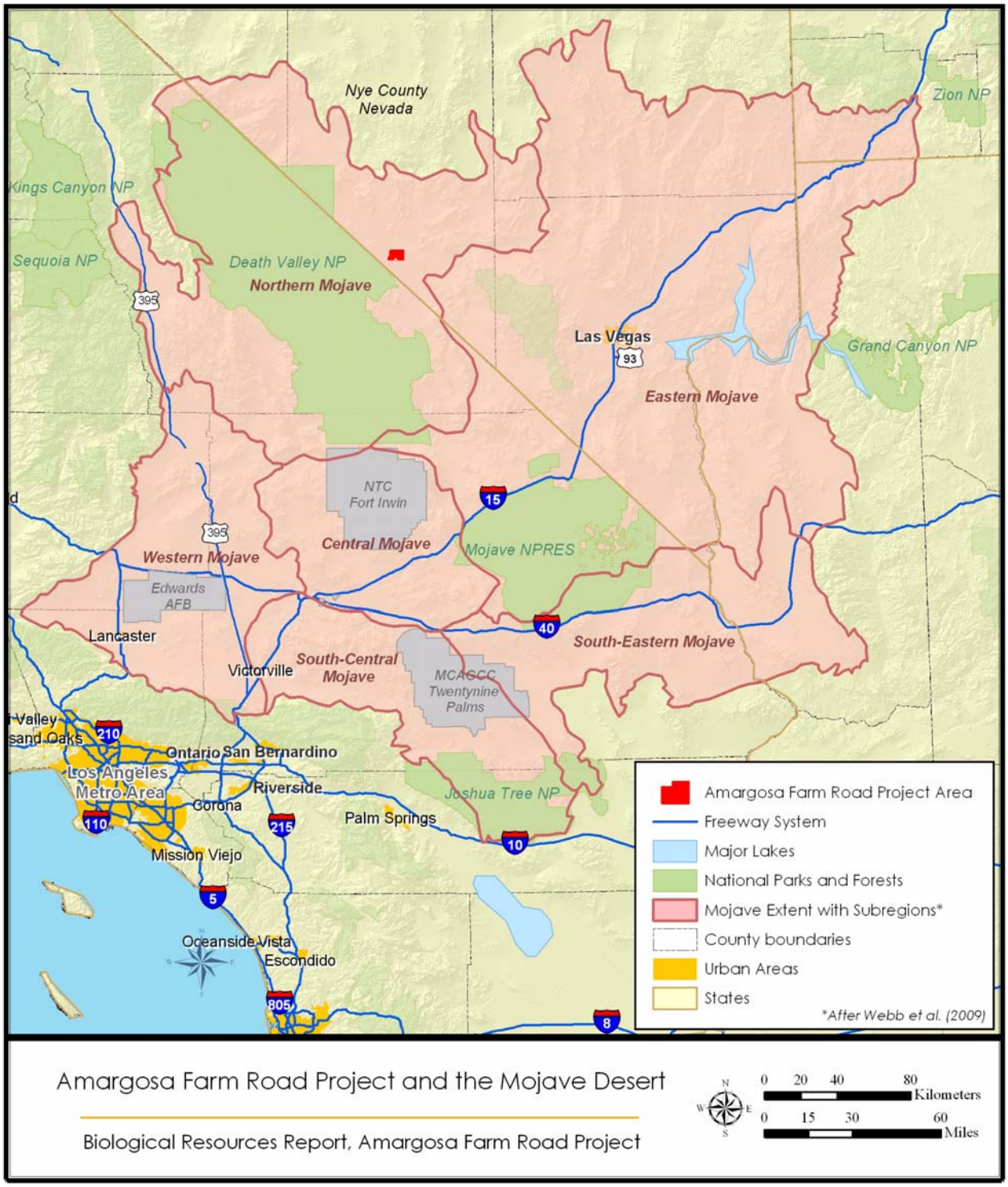
3.1 Introduction

3.1.1 Floristic Context of the Project Area

The Amargosa Farm Road Solar Project site is located in the Northern Mojave Desert Ecoregion which encompasses the southern tip of Nevada (Map 3-1) and extends into Arizona, California, and Utah. This ecoregion is a transitional region between the higher and cooler Great Basin Desert to the north and the warmer Sonoran Desert to the south (Webb *et al.* 2009), featuring basin and range topography, with broad valleys separated by rugged mountain ranges. The ecoregion is dominated by Mojave Desert scrub, which is intermediate between the Great Basin Desert scrub and the Sonoran Desert scrub habitats. Upper and lower Sonoran habitat types are found along the southwestern border of the ecoregion. Five other habitat types typically associated with mountain ranges and higher elevation basins are found in the ecoregion. The primary mountains are the Virgin, Black, Cerbat, and Mojave. Elevation ranges from about 450 to more than 8,000 feet, averaging 2,770 feet. Precipitation ranges from about 5 to 11 inches per year, with slightly more winter than summer precipitation.

3.2 Methods

For vegetation mapping, the International Vegetation Classification (IVC) was used. This system combines both physiognomic and floristic approaches. The system has won broad acceptance, including from the Federal Geographic Data Committee, which accepted it as the standard approach to be used by all U.S. federal agencies (http://biology.usgs.gov/fgdc.veg/standards/vegstd. htm). In North America, the IVC consists of the U.S. National Vegetation Classification System (USNVC) and the Canadian Vegetation Classification System. The most current units of the USNVC are now maintained on the NatureServe Explorer website. The USNVC is strictly a jurisdictional subset of the IVC. The USNVC is being developed by NatureServe and its natural heritage member programs in partnership with the Federal Geographic Data Committee Vegetation Subcommittee (FGDC), the Ecological Society of America Vegetation Classification Panel (see Jennings *et al.* 2003) and federal partners.



Map 3-1. The location of the Amargosa Farm Road Solar Project in relation to the Northern Mojave Ecoregion.

3.2.1 Aerial Photography Interpretation

A set of high resolution aerial photographs (2006) of the project area was acquired from the National Agricultural Imagery Program data files, housed at the University of Nevada-Reno's W.M. Keck Earth Sciences and Mining Research Information Center. Since the images were in the geographic projection Universal Transverse Mercator (UTM) North American Datum 1983 (NAD83), Zone 11, the vegetation map data was also created in the same projection. Using Environmental Systems Research Institute (ESRI) ArcView/ ArcMap, the aerial photos were used to delineate vegetation boundaries into a GIS data layer, as well as unique ecosites and topographic features such as washes.

The minimum mapping unit (the smallest area to be delineated) was 2 acres. Some smaller polygons were created in special cases, such as those where unique plant species/topography assemblages occur that differ markedly from the surrounding creosote scrub. Also roads in the area may sub-divide a larger polygon into two or more smaller polygons which individually might consist of less than two acres. Whenever discernible, interpreters assigned a vegetation type directly to each polygon from the aerial photo. Other land cover types, such as disturbed areas, developed areas, and paved roads, were also demarcated (unpaved roads in the area were too narrow to warrant being separated out from the surrounding vegetation).

3.2.2 Ground Truthing

Since exact identification of plant species assemblages can usually not be discerned on aerial photos, extensive ground-truthing was required to identify the vegetation composition of given polygons. Using a set of printed, high-resolution maps with the project boundaries overlaid on the aerial photo, field crews either verified that boundary lines drawn in the lab matched with a visible shift in vegetation on the ground, crossed-out lines that were not visible on the ground, or drew new lines as needed directly onto the field maps. The many dirt and paved roads provided ready access to much of the site for visual verification of the vegetation mapping. Field crews walked out from the roads in order to assess polygons that could not be seen from the road. Global Positioning System (GPS) waypoints were taken to identify boundaries between vegetation types that were not clearly visible on the aerial photos when needed.

3.2.3 GIS Data Development

As the mapping efforts progressed, a GIS data layer was developed to track the progress of the effort and identify areas that needed to be ground-truthed. Hand drawn lines on the field maps were digitized into the computer (because the individual shrubs are clearly discernible on the aerial photos, they provided excellent guidance in reproducing the lines from the maps to the computer screen). The collected GPS waypoints were overlaid onto the working vegetation map data to show where additional vegetation boundaries lay. The attribute table for the GIS data layer included a column for species composition and ecosite type for each polygon. Vegetation types are named according to the dominant species present, with any given type including from one to three plant names. Ecosite types delineated were desert flats, alkali flats, and desert washes.

3.3 Results

3.3.1 General Vegetation Conditions

The vegetation within the project boundaries is generally very sparse and dominated by creosote and burrobush (Photo 3-1), with very little herbaceous growth most of which is confined to the shrub canopies or just a short distance beyond. Between shrubs the surface is mostly barren, desert pavement with a widely scattered growth of a few forb and grass species, primarily Cryptantha (*Cryptantha* spp.), Mediterranean grass (*Schismus barbatus*), goldfields (*Lasthenia californica*), and devil's spineflower (*Chorizanthe rigida*). The relative proportions of these annuals tended to shift from mostly *Cryptantha* and *Schismus* in areas of creosote-burrobush to more *Chorizanthe* in areas dominated solely by creosote. Other forb species common on site were various annual buckwheat species (e.g. flat-topped buckwheat [*Eriogonum deflexum*], Thomas' buckwheat [*Eriogonum thomasii*]), several species of the primrose (Onagraceae) family (e.g. devil's lantern [*Oenothera deltoides*], Booth's evening primrose [*Camissonia boothii*]), and annual mustard species (none could be identified this year since the only evidence observed was the remnants of previous years' growth, which lacked the identifiable structures necessary to identify the species). Other annual species documented in the species list compiled for this project were scarce, occurring mostly as widely scattered individual plants. Few of these annuals produced any flowers this year, and many did not produce any herbaceous growth (aside from the *Schismus*, none of the species mentioned above were identified from new growth, but rather from remnants of previous years' growth). Desert puffballs (*Podaxis pistillaris*) (Photo 3-2), while not numerous, were fairly common on much of the project site occurring individually or in loose groupings.

Photo 3-1. Creosote-burrobush vegetation on the Amargosa Farm Road Solar Project site, looking west.

*Photo 3-2. Desert puffball (*Podaxis pistillaris*) at the Amargosa Farm Road solar project site.*

Cacti found on site represented just two species; golden cholla (*Cylindropuntia echinocarpa*), and beavertail pricklypear (*Opuntia basilaris* var. *basilaris*). Only seven cholla and two beavertail were found. All cacti, with the exception of two, were located in a small area in the northwestern quadrant of the Amargosa Farm Road Solar Project site.

3.3.2 Vegetation Communities

Almost the entire project site is characterized as desert flats with Mojave creosote scrub (Holland code 34100; Hartman 2002) as the sole dominant community type (Map 3-2). This community type is dominated by creosote, either as the sole dominant or co-dominant with one or more other shrub species. Burrobush (*Ambrosia dumosa*) is the most typical co-dominant, followed by saltbush (*Atriplex* spp.) in more alkaline soils. The shrubs range anywhere from 0.5-3m tall, are widely spaced, and generally the ground between shrubs is essentially barren or contains very sparse forbs and grasses (Hartman 2002). Growth occurs during spring (rarely in summer or fall) if rainfall is sufficient. Cold winters and droughts in other seasons can limit plant growth. Many herbaceous ephemeral species may flower in late March and April if winter rains are sufficient. Summer thundershowers can also trigger growth.

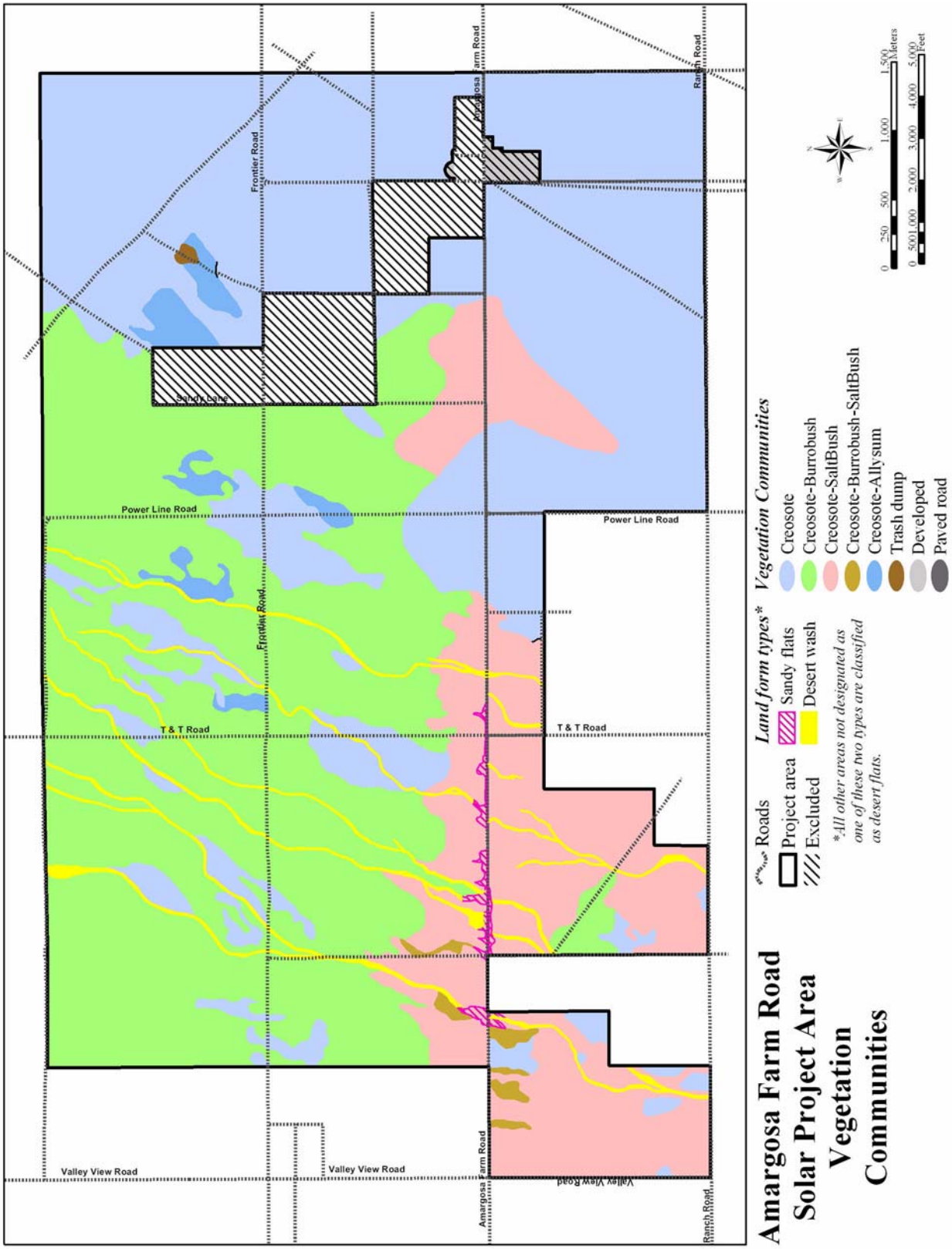
The soils where creosote scrub occurs are characterized as well-drained secondary soils with very low available water holding capacity (Hartman 2002). They occur on slopes, alluvial fans, and valleys. Winter temperatures are often below freezing in these areas.

This vegetation community is extensive and characteristic of the Mojave Desert, extending from the Death Valley region southward and across the Mojave Desert to the San Bernardino Mountains, and eastward to northwestern Arizona and southern Nevada (Hartman 2002).

Although practically the entire project area is defined as belonging to the Hartman vegetation type of Mojave creosote scrub, several distinct species assemblages encompassed within that type were delineated by this mapping effort (Table 3-1).

Table 3-1. Vegetation communities of the Amargosa Farm Road Solar Project site in 2009.

Vegetation Community	Acres	percent of Total
Desert Flats	7488.8	97.6
Creosote	3038.7	39.6
Creosote-Burrobush	2946.1	38.4
Creosote-SaltBush	1337.3	17.4
Creosote-Allysum	130.7	1.7
Creosote-Burrobush-SaltBush	36.0	0.5
Sandy Flats	22.3	0.3
Creosote-SaltBush	22.3	0.3
Washes	95.6	1.2
Sparsely vegetated desert washes, wash	95.6	1.2
Other	62.6	0.8
Disturbed creosote, trash dump	4.7	0.1
Developed	25.8	0.3
Paved road	32.1	0.4
Total Acreage	7669.3	



Map 3-2. Vegetation communities of the Amargosa Farm Road Solar Project site in 2009.

3.3.3 Desert Flats

3.3.3.1 Creosote (*Larrea tridentata*) Sole Dominant

Nearly 40 percent of the project site is dominated solely by creosote (Photo 3-3), and while some other shrubs such as burrobush or saltbush do occur they are very minor components. Other than shrubs, there is very little vegetation cover. What little there is consists primarily of very sparse Mediterranean grass and goldfield, confined almost exclusively under shrub canopies. In the ground space between shrubs there is little to no herbaceous growth aside from Cryptantha and spineflower (Photo 3-4), which in some areas is present in relatively high numbers (although in well-dispersed patches of perhaps 10+ plants/m^2). Also notable are scattered dense patches of flat-topped buckwheat, which primarily occur in this vegetation type. Observable wildlife was also scarce in the creosote, where sightings of lizards, numerous elsewhere on the project site, were very rare.

Photo 3-3. Creosote vegetation type at Amargosa Farm Road Solar Project site. Note the lack of plant growth between shrubs.

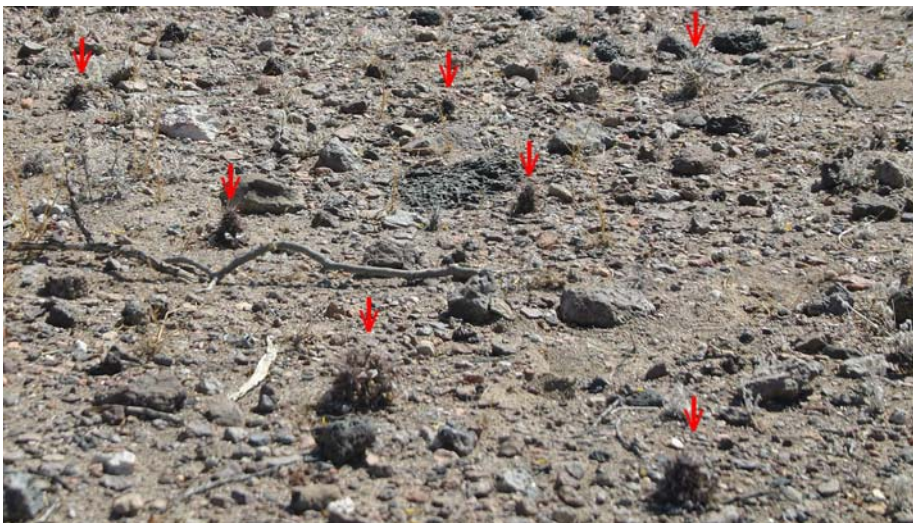


Photo 3-4. Characteristic ground cover in creosote-dominated areas. The red arrows indicate some of the spineflower plants visible in the interstitial areas away from the shrub canopies.

3.3.3.2 Creosote-Burrobush (*Larrea tridentata-Ambrosia dumosa*) Co-Dominant

Present on just over 38 percent of the project site, this vegetation type is nearly as widespread as the creosote-only type. Creosote and burrobush are more-or-less equally co-dominant is these areas (Photo 3-5) in the mostly flat, gravelly desert pavement. In these areas the most common herbaceous species are Mediterranean grass and *Chaenactis fremontii*, with lower frequencies of spine-flower and *Cryptantha*. Most of the herbaceous growth is limited to beneath the shrub canopies or in close proximity. Primroses and *Brassica spp.* are occasionally seen as well, as are desert puffballs, which were limited to this vegetation type. Wildlife sightings are more numerous in these areas than in the creosote-only areas, including all lizard species observed on site, jackrabbits, rodent activity, and signs of feral burro activity (including numerous tracks and occasional dung). Also, the four desert tortoise (*Gopherus agassizii*) burrows found exclusively on site were located in this vegetation type.

Photo 3-5. Creosote-burrobush vegetation at the Amargosa Farm Road Solar Project site.

3.3.3.3 Creosote-Salt bush (*Larrea tridentata-Atriplex polycarpa*) Co-Dominant

Primarily in the southern area of the Amargosa Farm Road Solar Project site, salt-bush (*Atriplex* species, primarily *A. polycarpa*) becomes co-dominant with creosote (Photo 3-6). This vegetation type, creosote-salt bush co-dominant, occurs on approximately 17 percent of the site. Burrobush may still be present but is reduced to sub-dominant status including a few, intermittent, widely separated plants. The herbaceous component tends to be similar to that of the creosote-burrobush type, only somewhat more sparse. Wildlife activity occurs more in this creosote-salt-bush co-dominant vegetation community than in creosote-only vegetation; however, wildlife is more active in the creosote-burrobush areas than it is here.

Photo 3-6. Creosote-saltbush vegetation at the Amargosa Farm Road Solar Project site.

3.3.3.4 Creosote-Desert Allysum (*Larrea tridentata-Lepidium fremontii*) Co-Dominant

In creosote-desert alyssum co-dominant vegetation, desert alyssum (*Lepidium fremontii*) is co-dominant with creosote (Photo 3-7). This type occurs in isolated small polygons found primarily in the northeast quadrant of the Amargosa Farm Road Solar Project site. The overall shrub canopy is much lower than in any of the other vegetation types, and there is sparse herbaceous growth outside of the shrub canopies.

Photo 3-7. Creosote-desert allysum vegetation at the Amargosa Farm Road Solar Project. The yellowish shrubs are desert allysum.

3.3.3.5 Creosote-Burrobush-Saltbush *(Larrea tridentata-Ambrosia dumosa-Atriplex polycarpa)* Co-Dominant

A few small polygons of the creosote-burrobush-saltbush co-dominant vegetation type were mapped on either side of the west end of Amargosa Farm Road. However there are numerous small pockets throughout the western half of the Amargosa Farm Road Solar Project site where all three primary shrub species occur as co-dominants.

3.3.4 Sandy Flats

Sandy flats occur solely along the edges of Amargosa Farm Road and are areas where run-off from the small washes is backed up against the road structure (Photo 3-8). The gravelly surface that characterizes the rest of the site is absent here, replaced by sandy and finer sediments. Standing water may be present here after rains, as evidenced by surface clay cracks in depressions. The vegetation is dominated by creosote and saltbush, plus other chenopod shrubs such as spiny hopsage (*Grayia spinosa*). Herbaceous growth is much more abundant in these areas, primarily grasses (*Schismus* and one or two others that could not be identified) and mustards (none of which could be identified due to the lack of recognizable structures).

3.3.5 Ephemeral Washes

A number of shallow ephemeral washes cross the western half of the project area from north to south (Map 3-2); however, none have any of the desert riparian trees typical of desert washes in more mesic regions, such as desert willows (*Chilopsis linearis*) or catclaw acacia (*Acacia greggii*). For the most part, the washes on the Amargosa Farm Road Solar Project site are unvegetated, or hold only a sparse shrub assemblage composed primarily of the same shrubs as the surrounding desert flats. A few individuals of cheesebush (*Hymonoclea salsola*), a shrub species typical of desert washes elsewhere, do occur, yet they are sparse. In some places the washes have well-developed banks, especially the Fortymile Wash on the west side of the site (Photo 3-8, top). On the banks it is more common to see *Atriplex polycarpa* than away from the banks. However, most of the project-site washes are little more than shallow swales (Photo 3-9, bottom), especially southward and eastward. Although there were somewhat more annuals observed germinating along the washes in 2009, these were scarce.

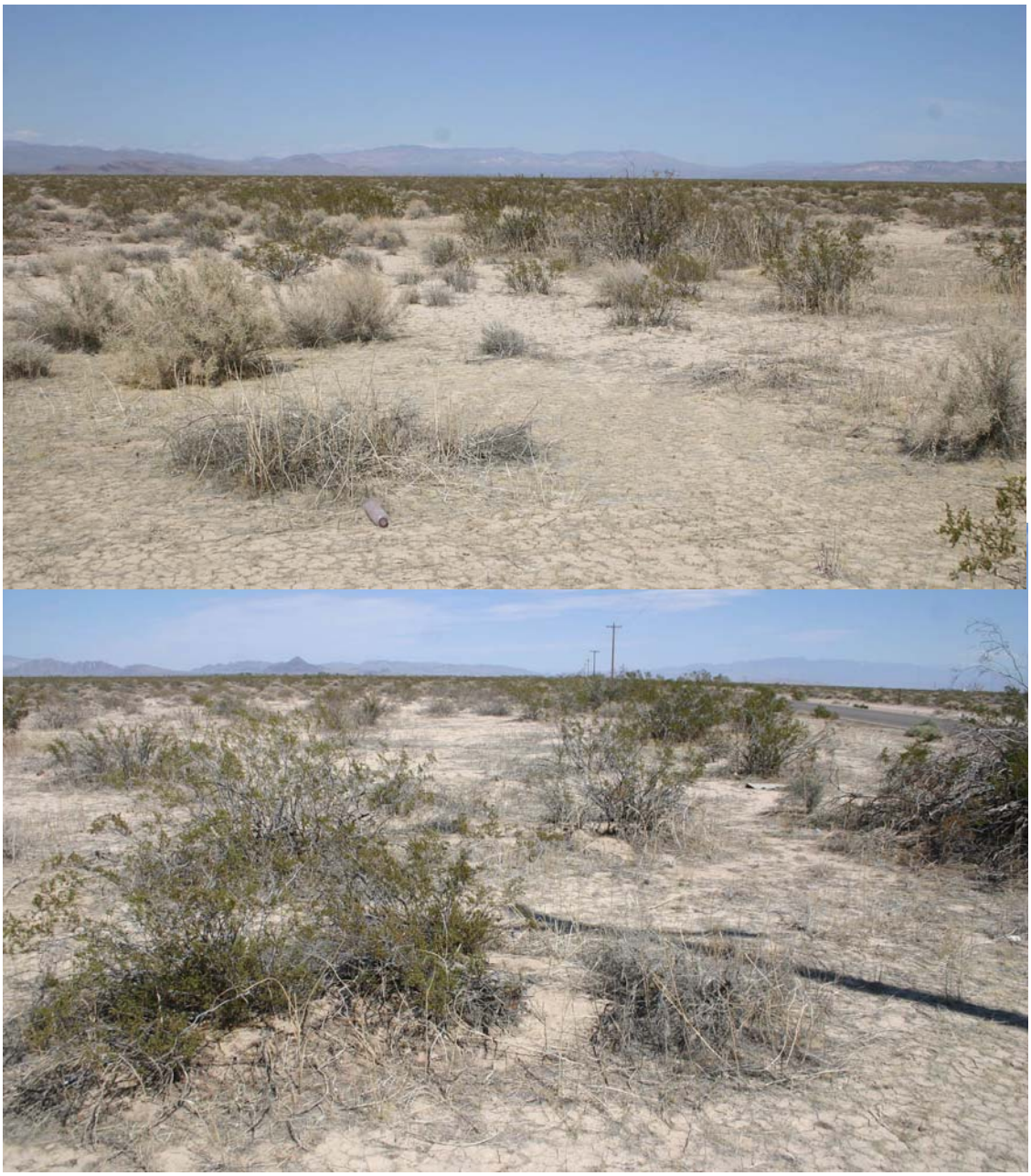


Photo 3-8. Two views of the sandy flat areas along Amargosa Farm Road. Note the more abundant annual growth, most of which is Schismus *and mustard species (all of the annuals depicted here are previous years' growth, no live growth was observed on these sites in 2009 except a few Schismus plants and Russian thistle* [Salsola tragus]).

Photo 3-9. Representative photos of ephemeral washes at Amargosa Farm Road Solar Project site. The beds of the washes are generally very sparsely vegetated. Some wash features have well-formed banks such as in the Fortymile Wash (top), others are more shallow with an exposed caliche layer (bottom).

3.4 Discussion

The extremely dry conditions within the project area limited the amount of observable plant growth this year. A large proportion of the species listed in the plant species list were observed from the dried remnants of the previous years' growth, especially spineflowers, primroses, *Cryptantha* spp., and various asters. The abundance of dried remnants provides a hint as to how the area might appear

in a wet year, especially considering the size of some primrose skeletons (Photo 3-10). Taking into account the climatic conditions in the region such blooming events likely occur at intervals of several years (the last above-average annual rainfall totals occurred in 2004 and 2005, and previous to that, 1998).

Photo 3-10. Examples of skeletal remains of primrose species found throughout much of the project area.

4.0 Special Status Plant Surveys

4.1 Methods

For this report, the terms "special status plant" and "rare plant" refer to all vascular plant taxa that are federally listed or recognized as listed by the Nevada Natural Heritage Program, Nye County Species-At-Risk list, or a BLM Sensitive species. BLM Sensitive species are taxa that are not already included as BLM Special Status Species under Federally listed, proposed, or candidate species; or State of Nevada listed species. The California Native Plant Society (CNPS) plants with a "CNPS 1B" status or better were considered and placed on the target list. The 1B list is comprised of plants that are rare throughout their range, most of which have declined significantly over the last century.

Rare plants of concern that are not federally listed do not have formally approved survey protocols. Therefore, reasonable survey methods, carried out by a competent biologist, and documented are considered acceptable.

Surveys were conducted by field observations during a time frame when the targeted species were expected to be found. Lead botanist Elizabeth Kellogg is on the BLM Las Vegas District list of approved botanists.

A records, literature, and document search of library research materials, databases, internet research materials on applicable species, previous surveys and studies, aerial photo documentation, EAs, and EIS(s) was conducted to develop a rare plant target list. This list included rare plants known from the general region for which suitable habitat was expected to occur or at least had a reasonable potential to occur. The area included in the proposed construction site as well as adjacent lands and counties was researched to create a comprehensive list of plants that have a possibility of occuring within the project site (including but not necessarily limited to an area encompassing the 7.5 minute USGS quadrangle maps of the project and the first ring of quadrangle maps immediately surrounding the project area). A generous range was applied to the known and possible locations of special status species; all rare plant species that occur within 25 miles of the Amargosa Farm Road Solar Project property site were included on the focus list.

The list of rare plant taxa having potential to occur within the Amargosa Farm Road Solar Project site is presented in Table 4-1.

After development of the focus species list and prior to the commencement of surveys, field personnel developed search images for the focus plant species based on visits to known plant locations where there had been sufficient rainfall for growth this year, herbarium specimens, photographs, and descriptions from the Jepson Manual (Hickman 1993). Local plant populations along roadsides were referenced for fully developed plants; road-runoff provides enhanced water loads which typically leads to increased growth and maturity ideal for identification. The Mojave National Preserve and Death Valley National Park were visited for the development of search images. Rhyolite, Nevada was also visited for plant observations and was considered the best representation of plants with potential to occur on site.

Table 4-1. Target special status species and their listings/ranks under government and private agencies

Scientific Name	Common Name	Family	Federal Listing	G Rank	CNPS Listing	Nevada Heritage
Sisyrinchium funereum	Funeral Mountain blue-eyed grass	Iridaceae	None	G2G3	1B.3	NA
Penstemon bicolor ssp. *roseus*	Rosy two-toned beardtongue	Scrophulariaceae	None	G3?T3Q	2.3	S
Phacelia mustelina	Weasel phacelia	Hydrophyllaceae	None	G2	1B.3	S
Cordylanthus tecopensis	Tecopa bird's beak	Scrophulariaceae	None	G2	1B.2	S
Enceliopsis nudicaulis var. *corrugata*	Ash meadows daisy	Asteraceae	Threatened	G5T2	3.3	S
Arctomecon merriamii	White bear poppy	Papaveraceae	None	G3	2.2	S
Astragalus mohavensis var. *hemigyrus*	Curved-pod milk-vetch	Fabaceae	None	G3G4T2T3	1A	S
Penstemon fruticiformis ssp. *amargosae*	Amargosa beardtongue	Scrophulariaceae	None	G4T3	1B.3	S
Astragalus nyensis	Nye milkvetch	Fabaceae	None	G3	NA	S
Lathyrus hitchcockianus	Bullfrog Mountain pea	Fabaceae	None	G2	1B.3	S
Phacelia filiae	Clarke phacelia	Hydrophyllaceae	None	G2	NA	NA
Eriogonum bifurcatum	Forked buckwheat	Polygonaceae	None	G2	1B.2	S
Lupinus holmgrenianus	Holmgren's lupine	Fabaceae	None	G2G3	2.3	NA
Eriogonum contiguum	Reveal's buckwheat	Polygonaceae	None	G2	2.3	W
Escobaria vivipara var. rosea	Viviparous foxtail cactus	Cactaceae	None	G5T3	2.2	
Lesquerella pendula	Snake range bladderpod	Brassicaceae				
Phacelia beatleyae	Beatley scorpion plant	Hydrophyllaceae	Sp. of Concern	G3	NA	S
Sisyrinchium radicatum						
Petalonyx thurberi ssp. gilmanii	Death Valley sandpaper-plant		None	G5T2	1B.3	
Camissonia megalantha	Cane Spring suncup	Onagraceae	Sp. of Concern	G3Q	NA	S
Spiranthes infernalis	Ash Meadows lady's tresses	Orchidaceae	Sp. of Concern	G1	NA	S
Eriogonum heermannii var. *clokeyi*	Clokey buckwheat	Polygonaceae	None	G5	NA	S
Centaurium namophilum	Spring-loving centaury	Gentianaceae	Threatened	G2Q	Considered but rejected	S
Grindelia fraxinopratensis	Ash Meadows gumplant	Asteraceae	Threatened	G2	1B.2	S
Nitrophila mohavensis	Amargosa nitrophila	Chenopodiaceae	Endangered	G1	1B.1	S
Atriplex argentea var. *longitrichoma*	Long-hair silverscale	Chenopodiaceae				
Chrysothamnus greenei	Greene's rabbitbrush	Asteracea	None	G5	2.3	NA

Surveys were timed to coincide with the blooming periods of the targeted species (Table 4-2), since many require flowers and/or fruits for positive identification. Most of the species included in the surveys bloom from May through June; therefore, that time period was the focus of the surveys.

4.1.1 Daily Survey Areas and Plant Lists

The project area was subdivided into quarter-sections estimated as the area that could be surveyed in a single day by a two-person crew (approximately between 100 to 500 acres per subarea, depending upon the vegetation and walking about two miles per hour). Given the total area of the property and the uniformity of habitats at hand, it was determined that surveying by grid would be suitable. Surveyors walked approximately 30-50 feet apart depending on the vegetation cover and uniformity, to reach approximately 100% coverage of the property. Wider spacing was adopted as surveys progressed and it became apparent that there was almost no growth of annual plants this season. Spacing was closer in washes, sand flats, any unusual substrates encountered, and other areas believed to be of higher potential for rare plants.

Table 4-2. Blooming periods of species to be surveyed (according to CNPS On-Line Rare Plant Inventory information). Note that the indicated periods are general in nature and may differ in any given year due to variations in rainfall patterns and local site-specific conditions.

Rare plant surveys	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Sisyrinchium funereum												
Penstemon bicolor ssp. *roseus*												
Phacelia mustelina												
Cordylanthus tecopensis												
Enceliopsis nudicaulis var. *corrugata*												
Arctomecon merriamii												
Astragalus mohavensis var. *hemigyrus*												
Penstemon fruticiformis ssp. *amargosae*												
Astragalus nyensis												
Lathyrus hitchcockianus												
Phacelia filiae												
Eriogonum bifurcatum												
Lupinus holmgrenianus												
Eriogonum contiguum												
Escobaria vivipara var. *rosea*												
Lesquerella pendula												
Phacelia beatleyae												
Sisyrinchium radicatum												
Petalonyx thurberi ssp. *gilmanii*												
Camissonia megalantha												
Spiranthes infernalis												
Eriogonum heermannii var. *clokeyi*												
Centaurium namophilum												
Grindelia fraxinopratensis												
Nitrophila mohavensis												
Atriplex argentea var. *longitrichoma*												
Chrysothamnus greenei												

Given the large project area, the special status plant surveys were targeted for those sites most likely to contain the focus species. Areas that were likely to contain greater species diversity; for instance drainages, knolls, and sandy substrate areas, were targeted within each of the assessment polygons. Many areas of the property were determined unlikely to contain any rare plants, generally consisting of only a few different species.

Field surveys commenced at the end of March, 2009 and continued throughout the end of June 2009. Field crews consisted of two to three people daily, with each member conducting 30-foot visual sweeps along walking transects. Team members walked parallel routes, plotting a route that would ensure that all portions of the day's area was visited. Maps with high resolution color aerial photographs and elevation contours were referred to in order to facilitate planning of the daily survey routes, and to seek out habitat patches most likely to contain targeted, special status plants.

In addition to searching for special status species, field crews compiled a complete list of the plant species observed within each survey area for the day. When team members encountered a plant species not immediately recognizable, pictures were taken and a sample was collected for later identification. Occasionally specimens remained as 'unknown', when determined too young or

from a previous year and did not exhibit diagnostic characters. Most collected specimens of species with non-special status were preserved and tagged upon identification. The rare plant surveys were supplemented by incidental observations made while conducting vegetation mapping efforts and other surveys. Anecdotal notations of wildlife species and other practical observations were recorded each day as well, to support the wildlife survey work. Surveys for rate plants and waters of the U.S. were conducted simultaneously by the same plant team, and proceeded more slowly than rare plant surveys conducted alone.

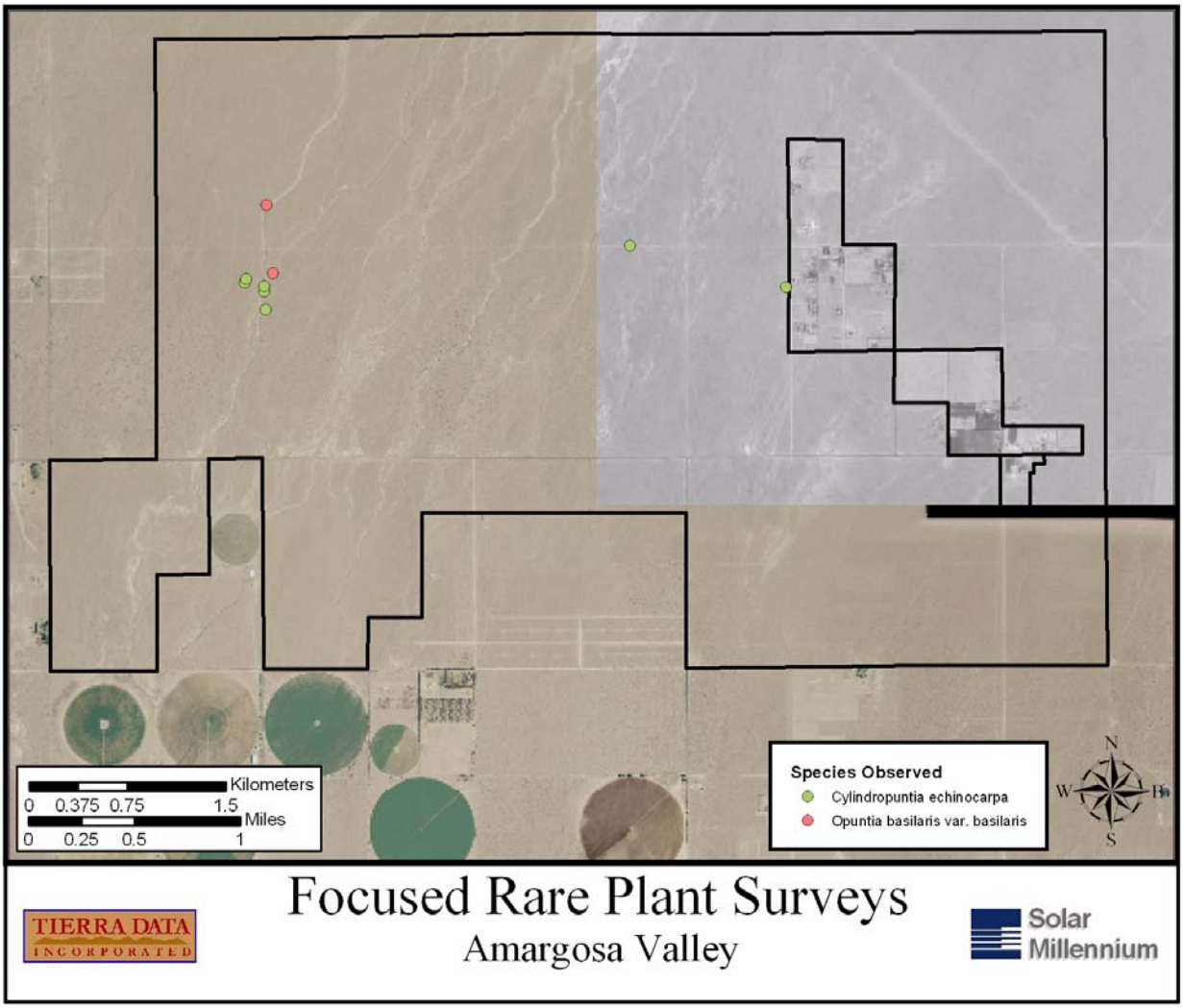
4.2 Results

A total of 20 days of field surveys were conducted from March through June plus additional visits to nearby locations consisting of a greater diversity of flora and fully developed specimens for reference purposes.

A total of 61plants (identified to species, sub-species, or variety) were found during the course of the plant surveys and one fungus species. Many recorded species were seen on a daily basis, with certain species recorded each survey date. Expansive areas that consisted solely of burrobush (*Ambrosia dumosa*) and creosote (*Larrea tridentata*) were encountered. On average, 26 species were recorded each day, ranging from 23 to 33 species on any given day. The complete plant species list compiled during the course of the survey is provided in Appendix A.

There were no special status plant species found over the course of the surveys.

All cactus species observed were identified and documented for salvage purposes by mapping. There were two cactus species that were observed and mapped according to the GIS data collection methods previously described. Neither of the species have a special status; however, they were mapped to provide a better understanding of the flora that was encountered over the course of the surveys. Cacti locations are indicated on the map below (Map 4-1). See Photo 4-1 and Photo 4-2 for their appearance.



Map 4-1. Cacti identification and locations mapped during rare plant surveys at Amargosa Farm Road Solar Project, 2009. No cacti were rare.

Photo 4-1. A Cylindropuntia echinocarpa *cactus found during the focused rare plant surveys.*

Photo 4-2. An Opuntia basilaris *individual found during the focused rare plant surveys.*

4.3 Discussion

Washes, knolls, and impoundments were considered most likely to contain live plants being that water was concentrated there and rainfall infiltration is unimpeded compared to the pavement characteristic of the upland areas. The majority of the property consisted of a group of co-dominant shrub species, under which non-native grasses were observed with sparsely distributed buckwheat and spineflower individuals. Rarely was an entire living specimen available with all plant parts for easy identification due to low rainfall. Remnants of previous year's vegetation were often collected and used for classification of species present within the project site.

The introduction of non-native species within this region is not extensive within the project site compared to other local areas; however, their presence is surely negative. Generally speaking, the flora composition is natural for this site except for the probable loss of historic understory bunch grasses and other preferred forage to grazing.

In addition to the non-native species, the annual rainfall for this region has recently been below average. This would also generate undesirable conditions for germination of the predominantly ephemeral flora.

Given these reasons and concerns it is not surprising that the survey area contained very few annuals from the current year, only a small number of cactus, and no special status species. Most of the herbaceous plants that were identified were from a previous year's growing season.

5.0 Invasive Plant Species

Those plants on the Nevada Noxious Weed List were mapped coincident with vegetation mapping and rare plant surveys. Table 5-1 shows pest plants with potential to occur within the project site. The entire survey area was subject to this mapping effort. The presence of non-native pest plant species was observed throughout field reconnaissance surveys, primarily by conducting windshield surveys along roads.

5.1 Methods

Likely habitats (roadsides and watercourses were prioritized) and areas were surveyed on foot or by car as needed to document occurrences of non-native pest plants. Weed locations were mapped either by using a GPS unit to record locations with sub-meter accuracy, or when larger populations are found, the locations were mapped directly onto high-resolution aerial photo maps carried at all times by field crews. The hand-drawn polygons were digitized into a GIS layer for production of summary maps. Non-native pest plant species were characterized into polygons of low, medium, and high densities.

Table 5-1. Pest plants known to occur within Nye County or adjacent counties that have the potential to occur within the project site.

Family	Scientific Name	Common Name	Weed Status Reference	Habitat
Asteraceae	Acroptilon repens	Russian knapweed	NDA-B	Roadsides and cultivated ground
Brassicaceae	Cardaria draba	Hoary cress	NDA-C	Disturbed soils, saline soils, roadsides
Asteraceae	Centaurea solstitialis	Yellow starthistle	NDA-A	Disturbed soils, roadsides, pastures
Asteraceae	Grindelia spp.	Gumweed	WoW	Disturbed soils
Chenopodiaceae	Halogeton glomeratus	Halogeton	WoW	Alkaline soils, open flats, scrub
Brassicaceae	Lepidium latifolium	Perennial pepperweed	NDA-C	Disturbed soils
Chenopodiaceae	Salsola spp.	Russian thistle	WoW	Disturbed and cultivated areas, roadsides
Tamaricaceae	Tamarix ramosissima	Salt cedar	NDA-C	Washes, streambeds, ditches
Zygophyllaceae	Tribulus terrestris	Puncture vine	NDA-C	Roadsides, disturbed areas

NDA-A: Weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; actively eradicated from nursery stock dealer premises; control required by the state in all infestations.

NDA-B: Weeds established in scattered populations in some counties of the state; actively excluded where possible, actively eradicated from nursery stock dealer premises; control required by the state in areas where populations are not well established or previously unknown to occur.

NDA-C: Weeds currently established and generally widespread in many counties of the state; actively eradicated from nursery stock dealer premises; abatement at the discretion of the state quarantine officer.

WoW: Weeds of the West (Whitson et al. 2006).

5.2 Results

A preliminary habitat assessment in March identified no special habitat conditions for rare plants on the target species list. Only two pest plants were found on the project property, Russian thistle (*Salsola tragus)* and athel tamarisk (*Tama-*

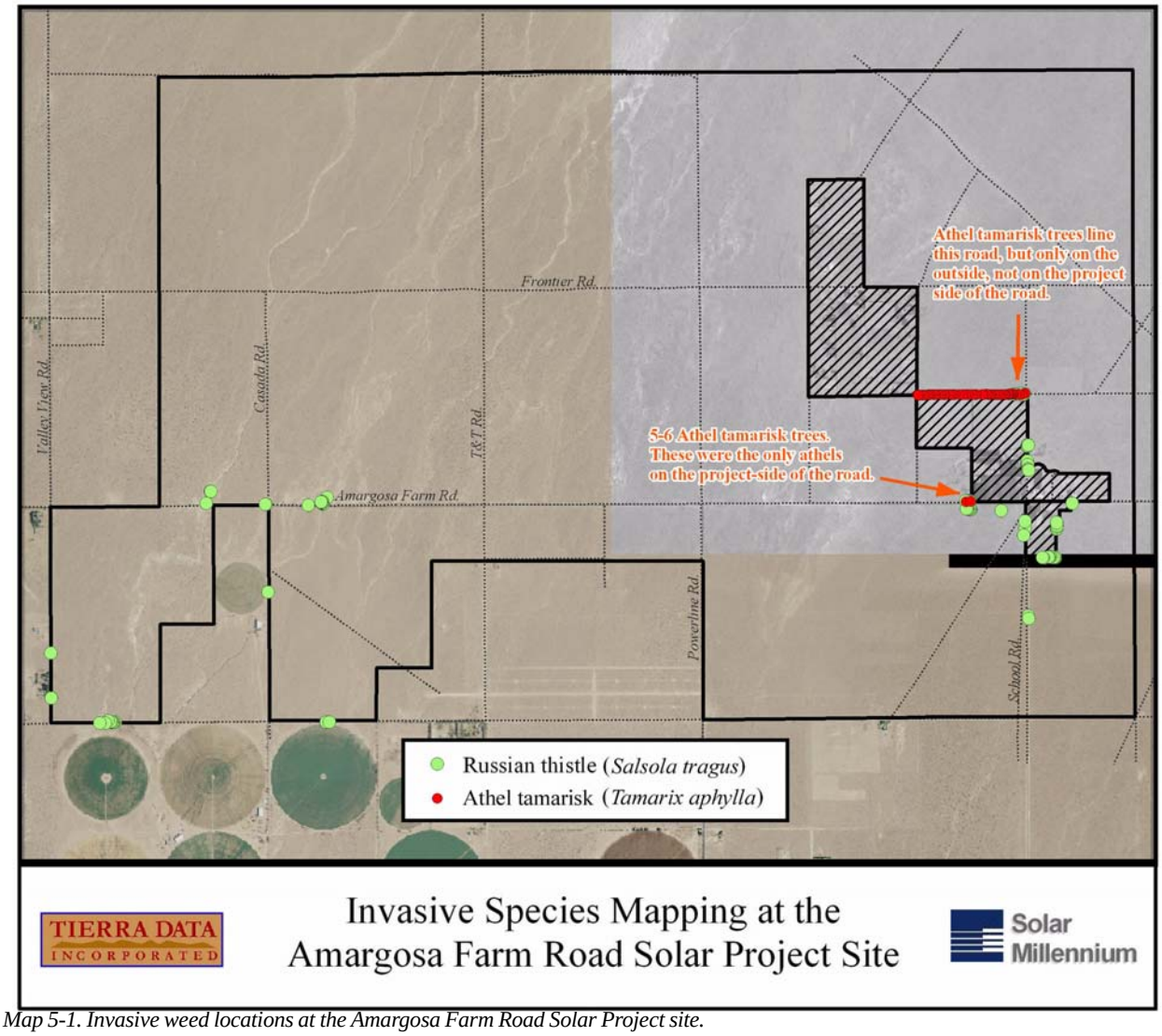
rix aphylla) (Photos 5-1 and 5-2). Although neither of these species are currently listed by the Nevada noxious weed list, both are considered aggressive and opportunistic, and often portray weed-like trends.

There were a few patches of Russian thistle encountered, some of which consisted of numerous individuals and seedlings (Map 5-1). The populations ranged from a few plants to greater than 20 plants. All of the Russian thistle individuals that were found during the survey efforts were located near roads, generally no more than 60 feet from the road edges.

Athel tamarisk was also found near roads (Map 5-1) where it had been planted in several locations around residential structures on neighboring lands. Although most of the trees lie outside the project site, being planted on the side of the road opposite the site, there are a few on the roadsides within the site. Below are species accounts of these two species that will provide a brief description of their natural history.

*Photo 5-1. Russian thistle (*Salsola tragus*).*

*Photo 5-2. Athel tamarisk (*Tamarix aphylla*).*



Map 5-1. Invasive weed locations at the Amargosa Farm Road Solar Project site.

5.3 Discussion

Generally speaking, there were few infestations observed over the course of the survey effort; all populations are indicated on the map developed from the findings. The species that were found have unique characteristics in terms of invasiveness and significance, which are described below. In both cases, it appeared that the invasions were restricted to favorable habitats. The habitats influenced by Russian thistle were along roadways and it is likely that the roads were the vector for this species' introduction. The tamarix that were observed were most likely offspring from nearby plantings in developed areas. This species is often utilized for wind belts because it is easy to grow and once established can provide good protection from detrimental weather conditions, as well as much-wanted shade in a desert environment.

Russian thistle (*Salsola tragus*)

Russian thistle, also known as tumbleweed, was likely introduced into the United States from Russia in flaxseed around 1875. This summer annual can grow brushy, to more than one meter in height. The stem generally branches multiple times giving the mature plants a roundish appearance. The leaves are thread-like and leathery with a sharp tip. This species is native to Eurasia and is generally found in disturbed areas below 2700 m (Hickman 1993). It is widespread in many parts of western United States and is strongly competitive in semi-arid regions. The seeds are primarily dispersed by wind, and thousands can grow on a single plant. Adult plants are often uprooted at the end of the growing season during periods of high winds. Seeds are dispersed over great distances as these plants tumble across the countryside. It is typically found abundantly around roadsides, ditches, fencerows, and waste areas.

Biological controls, a leaf-boring moth and a stem-boring moth, were employed during the 1970's with very little success. The plant is currently found in nearly all of the United States and throughout much of Canada. Beyond the direct negative impacts Russian thistle tends to have in various natural communities, this plant is the preferred host of a leafhopper species that is believed to transmit curly top virus to many vegetable crops.

Athel tamarisk (*Tamarix aphylla*)

Athel tamarisk is native to northern Africa, the Middle East and India. This species grows as a shrub as well as rather large trees if given the opportunity, sufficient water, and soil resources. The leaves consist of tiny scale-like or awl-like segments that differ greatly among species within this genus. The plant was originally introduced into the United States as an ornamental for landscaping purposes. Given the aesthetically pleasing purple to pink inflorescence, ease of growing, and extensive network of roots, it was planted for appearance and commercially as a bank stabilizer.

Control of this species is often quite difficult especially within densely infested areas. Given the plant’s ability to resprout, resistance to herbicide as well as its general resilience, the prevention of proliferation is the most efficient way to manage this pest. *Tamarix aphylla*, is typically less aggressive compared to other Tamarix species.

6.0 Wildlife Surveys

General wildlife inventory methods and focused surveys for all species of concern were designed based on the project's objective to support a successful EIS that meets BLM requirements including avoidance and minimization measures, as well as to detect any special status species.

As a standard practice, presence/absence surveys are expected for all special status species and species of special concern that may be within the habitat that is proposed for disturbance, if potential habitat is observed. For species of concern that do not have formally approved survey methods, reasonable survey methods are used, carried out by a qualified biologist. This can only be done by field observations completed during a time frame when the targeted species can expect to be found. The level of effort (routes walked, time in field, and qualifications of the observer) must be documented so an outside reviewer understands the confidence with which the presence/absence of a species was estimated.

6.1 General Invertebrate Surveys

6.1.1 Introduction

Invertebrates form an integral part of the food web for any region, and yet are often overlooked in favor of the more visible vertebrate species. Insects occupy a number of niches in any ecosystem, including;

- detritivores that help in the breaking down or organic matter and recycling of nutrients,
- herbivores feeding on the foliage, flowers, seeds, and sap of the plants,
- carnivores preying on other insects, and
- parasites living off of a wide array of plant and vertebrate species, or even other insects.

An effort to document the biodiversity of an area that does not include insects would be overlooking a significant proportion of the total species present.

6.1.2 Methods

Sampling Design

For any special status invertebrates, host plant and other habitat elements are evaluated to determine potential, then specific methods are developed as needed if any special status species are potentially present.

For general insects, the survey effort focused on capturing a representative cross-section of the insect fauna by sampling a limited number of locations distributed throughout the project area and covering a variety of habitats and vegetation communities. A total of eight sampling locations were chosen (Map 6-1). In order to capture the greatest diversity of invertebrates possible at each site, several different sampling methods were utilized: pan traps, sweep netting, blacklight traps,

sticky traps, and Pollard walks (Pollard 1977; Royer *et al.* 1998). These methods are adapted from previous survey methodology developed for sites that covered similarly large areas (Tierra Data 2007; Tierra Data 2008).

In addition to the sampling methods described below, incidental records from the various surveyors working on other projects in the area were also included in the final invertebrate species list.

Insect Sampling Methods

Pan trap and cage.

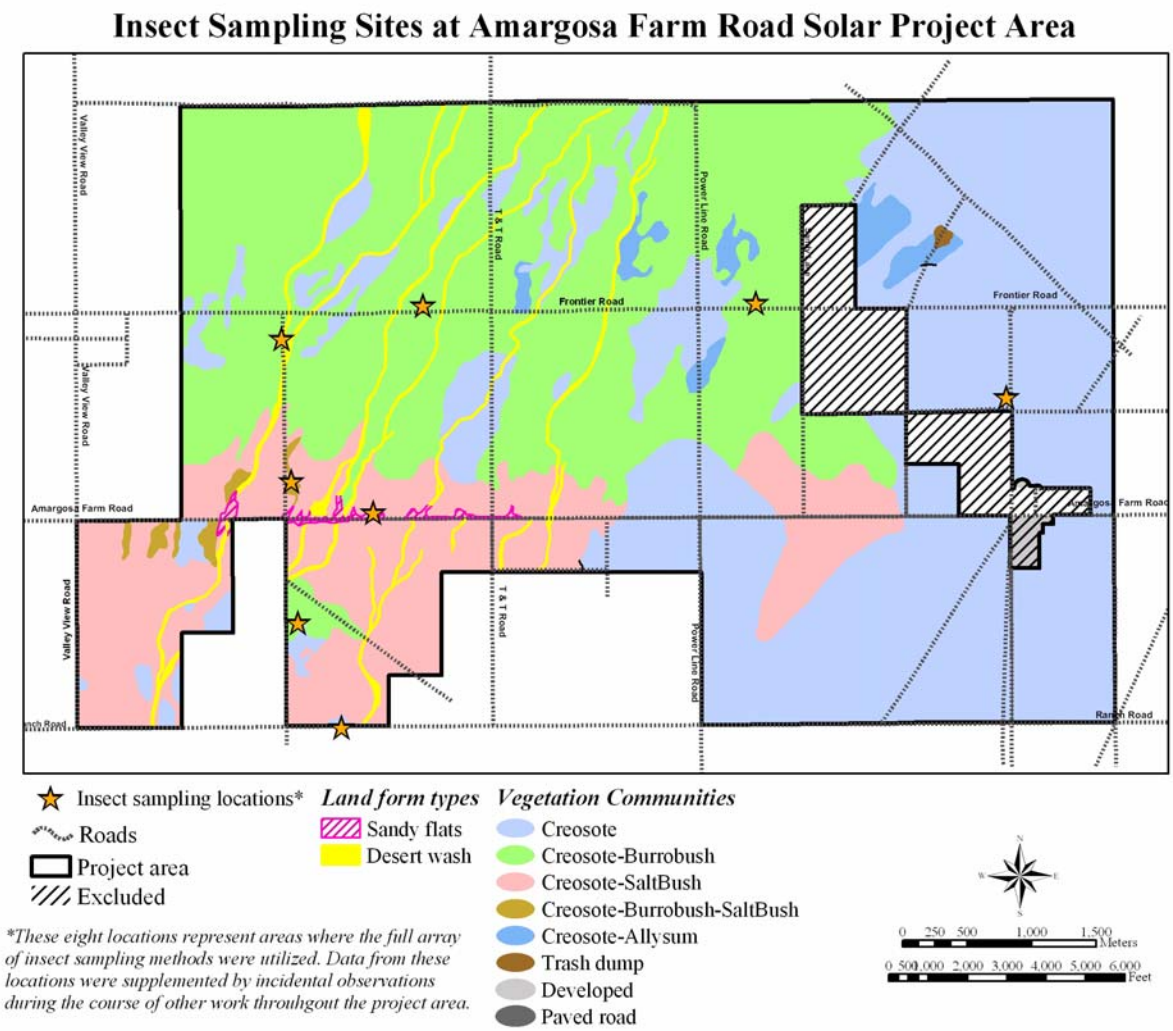
Pan Traps: For the collection of both ground-dwelling insects and flying insects, three pitfall traps were installed at each site for a 24-hour duration. The pitfall traps consisted of a square (~7 in^2) plastic container set into the ground so that the top of the container was set flush with the surrounding soil surface. Approximately one inch of killing fluid/attractant (mixture of water, salt, dish soap and yellow food coloring) was placed in each container and a wire cage was placed over the trap to prevent accidental capture of non-target taxa. A general location for each pan trap was selected randomly within a radius of approximately 30-50 feet. At least one of the three pans was always placed under the edge of a shrub canopy, with one or both of the other two placed in the open among the annual forbs and grasses between the shrubs.

The traps were picked up the next day, the containers sealed with a tight-fitting lid and the sample was transported to the lab for species identification. Samples were preserved in a 70 percent solution of isopropyl alcohol. All pan traps were removed from the field at the end of the sampling.

Sweep netting.

Sweep Netting: Sweep netting of the vegetation at each site was conducted for the collection of diurnally active invertebrates, many of which are not typically attracted to pan traps. One or two sets of twenty-five sweeps were taken in the area surrounding the pitfall trap array. Whenever possible one 'High' set and one 'Low' set of sweeps was collected, where the 'High' sweeps included the larger shrubs while the 'Low' sweeps were done within the forb/grass layer and smaller shrubs. Sweeps were collected while wandering the vicinity swiping the net through the chosen vegetation layer 25 times. Care was taken not to overlap the areas swept by each surveyor, since the activity of sweeping one layer can disturb the other layer and affect the sampling. Due to the lack of vertical structure in many areas of the project site, in some locations only one set of sweeps was collected, particularly in the areas where creosote was the lone dominant species.

The contents of the sweep nets were transferred to brown paper bags which were stapled shut and labeled with the survey site, date, and 'High' or 'Low.' In addition, the occasional insect that escaped from the net during the transfer process was noted (e.g. +1 fly). The bags were frozen to kill and preserve the collected insects until they could be sorted and identified.



Map 6-1. Insect survey sites at the Solar Millennium project site.

Blacklight trap.

Blacklight Traps: For the capture of nocturnal flying insects, blacklight traps were used (John W. Hock Co., Trap Model 1212). These traps consisted of a 4-watt blacklight, electric fan, hood, collection net and killing jar, and battery pack of four, D-size, batteries. At each site a light trap was hung from a metal rod placed in the ground in the vicinity of the pan trap array. The light sensitive switch on the trap turned on the light and the fan at dusk which would then run through the night. At dawn the light would be switched off but the fan would continue to run until the trap was collected and the batteries disconnected. Insects that flew into the trap were captured in a killing jar containing approximately one inch of killing fluid (see pan trap description for ingredients). The trap, and the enclosed insects, were brought back to the lab and preserved in alcohol for identification.

Sticky trap.

Sticky Traps: For additional collection of flying insects, three yellow sticky traps (3 x 5" Stiky Strips™ (Disposable) Insect Traps; Medina, Ohio) were placed at each site. One sticky trap was placed near each pan trap, either hung from a shrub or stuck in the ground with a metal skewer. The cards were collected the next day, placed in ziploc bags, and brought back to the laboratory for identification (after freezing to kill the collected insects). No traps were left in the field.

Pollard Walks: In order to record diurnally active lepidopterans and orthopterans, and other larger taxa not typically captured by the above methods, a meandering route was covered on foot and all larger butterflies and other insects seen were recorded. The walks typically lasted about 15-20 minutes each, walking a more-or-less circular route out and back from the pan trap array. The route utilized at each site depended upon the local terrain and, although they were not formally documented, essentially the same route was walked on each survey date. The actual elapsed time differed somewhat each event depending upon the level of insect activity (at times many butterflies or grasshoppers were active; at other times almost nothing was seen flying around the area). The routes walked were generally around 75 to 100m each.

Whenever possible butterflies seen were identified by sight, but some smaller butterflies were collected in sweep nets and brought back to the lab for preservation and identification. Grasshoppers and other large insects were also collected as needed in order to identify them accurately. Use of sweep-netting and active pursuit of individual insects was minimized since these activities are generally not part of the standard Pollard walk methodology (since they could lead to a biased data set). Insects seen before or after the Pollard walks were also recorded, but kept separate from the Pollard data.

6.1.3 Identification of Distinct Taxa

TDI biologist, Scott Snover, conducted all insect identifications. While no attempt was made to identify most of the insects collected by the above methods to genus and species, every reasonable effort was made to distinguish distinct types within each order and family. For example, if two flies identified as belonging to the same Dipteran family showed clear morphological differences from one another, they were entered into the insect database as varieties ‘A’ and ‘B’ for that family (e.g. flies from the family Muscidae would be designated as ‘Muscid fly A’, ‘Muscid fly B’). In many cases these general types may include two or more species, but keys, reference books, or web sites of sufficient detail are few to identify most insect groups to species, and often depend upon very minute and difficult to distinguish features. Occasionally a species name was assigned to some showy or well-known species specifically illustrated by a reliable reference source. Some groups, however, can be identified to species with a reasonable effort, such as butterflies, grasshoppers, and ants.

Reference sources used included the following:

General insects: Peterson Field Guide to the Insects (Borror and White 1970), California Insects (Powell and Hogue1979), Field Guide to Insects of North America (Eaton and Kaufman 2007), Bug Guide web site (http//www.bugguide.net).

Insect Orders- Books: Peterson Field Guides: Beetles (White 1983), An Introduction to Southern California Butterflies (Heath 2004), Field Guide to Grasshoppers, Katydids, and Crickets of the United States (Capinera *et al* 2004), Dragonflies and Damselflies of California (Manolis 2003), Plant Galls of California and Other Western States (Russo 2006).

Insect Orders- Web sites: Ant Web (http://www.antweb.org), Singing Insects of North America (http://buzz.ifas.ufl.edu), Ants of North America (http://www.cs.unc.edu/~hedlund/ants), Field Guide to Common Western Grasshoppers (http://www.sdvc.uwyo.edu/grasshopper), California Insect Survey (http://essig.berkeley.edu/pages/cispubs.htm), Butterflies & Moths of North America (http://www.butterfliesandmoths.org).

Voucher specimens of most of the taxa collected were preserved, pinned, labeled and organized in collection boxes to use as reference while processing the collected samples. Also, brief verbal descriptions or simple drawings were made to help track the various types collected, especially within the Diptera (flies), Homoptera (leaf hoppers), and Hemiptera (true bugs) Orders. In this way it was possible to determine if a particular insect was the same as one collected earlier or was, in fact, a new type.

6.1.4 Results

The insect surveys carried out at the Solar Millennium site, augmented by incidental records from other surveys, yielded a total of 207 distinct insect (and related fauna) taxa plus approximately 18 types of spiders. A total of five non-insect groups are represented, primarily spiders but also including scorpions, wind-scorpions (a.k.a. sun spiders), mites and ticks, and terrestrial isopods (pill bugs). The spiders were the most diverse group among these, with at least 18 distinctive taxa collected (this is a visual estimate only).

Among the insects, 14 Orders are represented, including at least 105 Families and approximately 199 distinct taxa. Three Orders dominate the overall diversity of the insect fauna; Hymenoptera (bees & wasps) with 29 Families represented, Diptera (flies) with 26 Families, and Coleoptera (beetles) with 20 Families. These three groups alone account for 71% of the insect Families and Species found. Figure 6-1 illustrates some of the insect species found.

No listed or special status insects were detected at any of the sampling sites. A complete listing of all invertebrate taxa recorded is provided in Appendix A.

Table 6-1. Summary of insects (and other arthropods) taxa by taxonomic classification.

Classification (Phylum: Arthropoda)	number of families	number of taxa
Non-Insect Arthropods		
Class Crustacea	1	1
Order Isopoda (Pillbugs)	1	1
Arachnids (Class Arachnida)	4+	24+
Wind-scorpions (Order Solpulgida)	1	1
Scorpions (Order Scorpionida)	1-2	2
Mites and Ticks (Order Ixodida)	2	4
Spiders (Order Araneida)	unk	17+
Insects (Class Insecta)		
Springtails (Order Collembola)	2	2
Beetles (Order Coleoptera)	20	39
Cockroaches and Mantids (Order Dictyoptera)	2	3
Flies (Order Diptera)	26	44
True Bugs (Order Hemiptera)	8	17
Hoppers, Aphids, and Scales (Order Homoptera)	5	11
Wasps and Bees (Order Hymenoptera)	29	56
Moths and Butterflies (Order Lepidoptera)	5	14
Lacewings and Antlions (Order Neuroptera)	3	3
Damselflies and Dragonflies (Order Odonata)	unk	at least 3
Crickets and Grasshoppers (Order Orthoptera)	2	3
Barklice (Order Psocoptera)	1	1
Thrips (Order Thysanoptera)	1	2
Bristletails (Order Thysanura)	1	1
Grand total	109+	224

6.1.5 Discussion

No listed or special status insects were detected anywhere within the project area. Many of the known special status insects in Nevada are restricted to dune habitats, and while the Big Dune Area of Critical Environmental Concern is located near the project site, there are no dune substrates in the project area itself. As for other special status invertebrates in Nevada, such as cave arthropods or aquatic snails, there are no suitable habitats within the project area.

The overall diversity of insects on the site was somewhat surprising, given the lack of diversity of plants and vegetation communities seen. It is quite likely that additional species would be seen in wetter years when there is more annual growth than was seen this year.

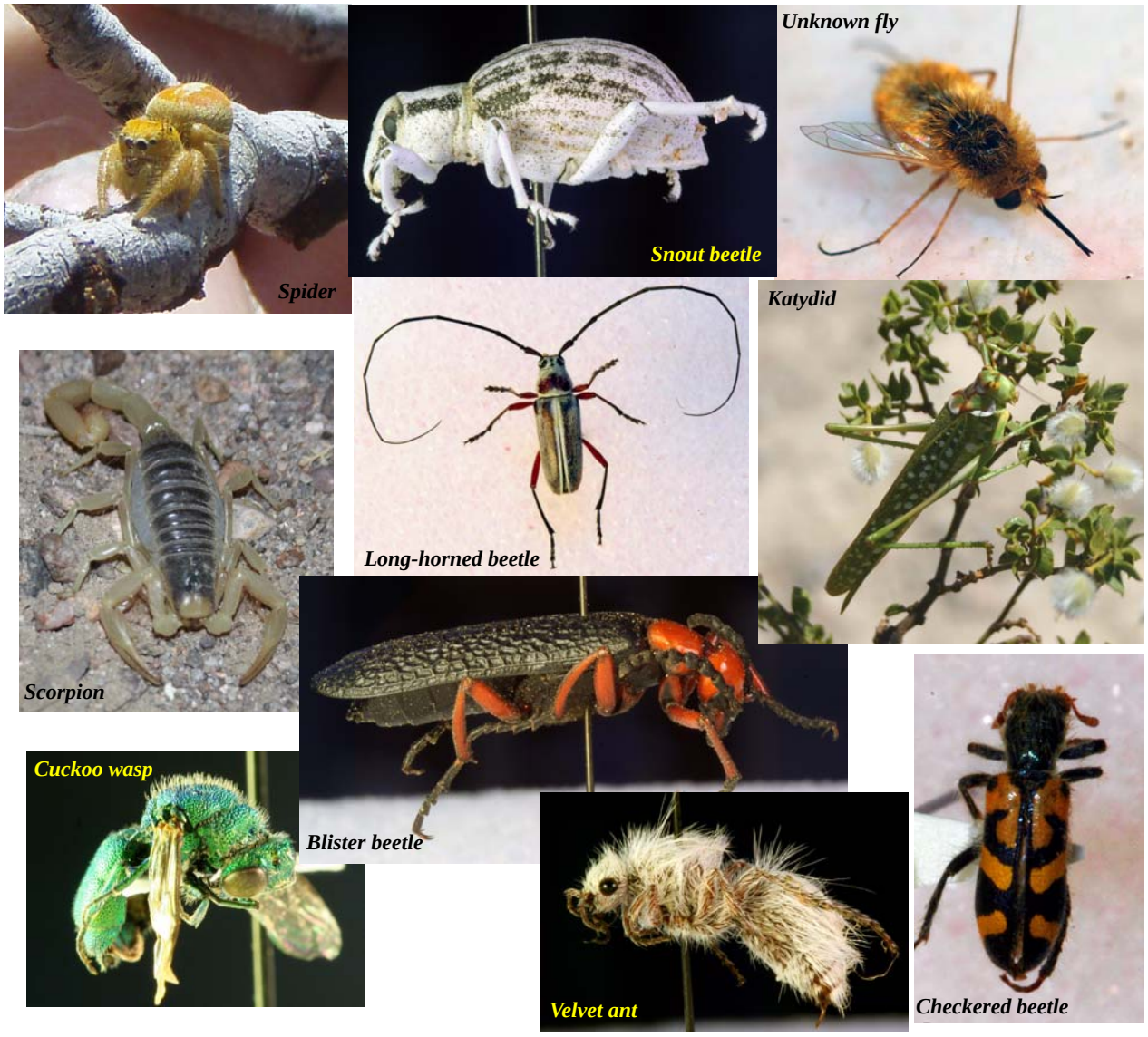


Figure 6-1. Some examples of insects found at the Amargosa Farm Road Solar Project site.(The 'Unknown fly' in the upper right is probably a Bee fly, but its wing vein patterns, an important taxonomic character in flies, does not match any reference material on that or any other taxon).

6.2 General Herpetological Surveys

6.2.1 Introduction

The Mojave Desert in Nevada is home to many species of reptiles and amphibians, including nine special status species. These special status species include five frogs, three lizards, and the desert tortoise, which is covered in Section 6.3.

6.2.2 Methods

To survey for reptiles, focused surveys were conducted throughout the project site. Surveys were conducted during the day and during the night. Surveys began early, approximately by 7:00 am and were completed by approximately 2:00 pm. On most survey days a series of three walks by one surveyor were made in various locations in order to cover a variety of habitats. All habitat types within the project site were represented in the survey effort, while concentrating on the washes. The surveyors walked a chosen path and observed reptiles for about 60 feet on either side (Map 6-2). During other biological resources surveys (i.e. bird and mammal surveys, vegetation mapping, and rare plants) herpetofauna observed were also recorded, supplementing the focused herpetological surveys. Available shelters such as lumber, trash, logs and rocks were removed and replaced, to search for reptiles hiding beneath.

For the focused herpetological surveys, all individuals located were identified as male or female as well as adult, juvenile, larvae, etc. Surveys were not conducted under weather conditions that could bias the survey effort by altering species-specific behavior patterns. These weather conditions include, but are not limited to, temperature extremes, precipitation, and winds greater than 4 on the Beaufort Scale. The route of each survey was clearly marked on a topographic map or on a hand-held GPS unit. Survey start and ending times as well as locations of target species sightings were recorded. On night surveys two surveyors with headlights made one walk through various habitats. Each surveyor walked and observed reptiles for about 30 feet on either side. Dates, times, and weather conditions for all herpetological surveys are shown in Table 6-2.

Table 6-2. Dates, times, and weather conditions for herpetological surveys at the Amargosa Farm Road Solar Project area .

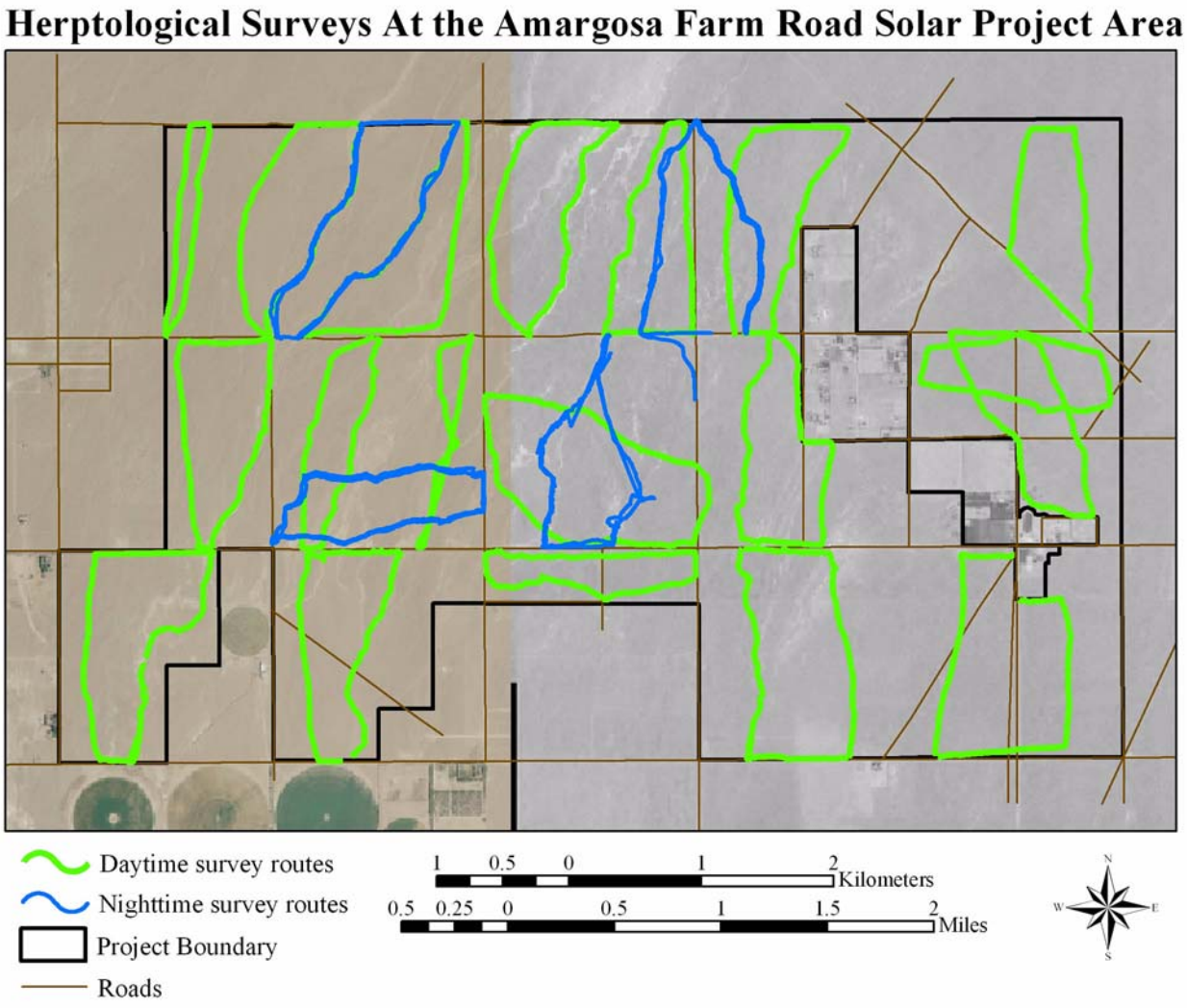
Date	Hour of Day	Wind (mph)		Air Temp (F°)	Relative Humidity (%)	Distance Covered (m)
		Average	Gust			
Daytime Surveys						
5/30/09	7:00	4.6	11.7	75.5	29.0	9570
	10:00	1.5	8.6	78.6	26.0	
	12:00	3.4	16.4	84.0	20.0	
	14:00	5.1	15.0	87.0	16.0	
	average	3.2	11.9	80.3	24.0	
5/31/09	7:00	3.6	10.5	74.6	32.0	13168
	9:00	2.0	5.6	83.2	22.0	
	13:00	6.0	15.4	90.0	14.0	
	17:00	4.2	11.9	91.5	13.0	
	average	3.9	11.4	85.0	20.0	
6/1/09	7:00	3.9	9.3	75.9	32.0	8508
	14:00	13.9	26.3	92.1	11.0	
	average	7.0	16.2	85.4	21.4	
6/20/09	7:00	20.0	28.4	78.9	27.0	12460
	9:00	18.3	29.6	83.3	24.0	
	14:00	7.8	21.7	91.6	8.0	
	average	14.5	26.2	86.1	16.6	
6/21/09	7:00	13.4	21.5	67.2	35.0	12210
	8:00	14.1	21.5	70.2	30.0	
	12:00	8.1	17.4	80.0	17.0	
	14:00	10.7	20.6	84.8	14.0	
	average	11.1	19.9	76.4	22.5	
6/22/09	7:00	1.4	8.9	71.7	21.0	13176
	14:00	7.4	16.8	90.5	9.0	
	average	4.7	13.0	83.3	12.4	
6/23/09	7:00	2.8	7.2	75.6	13.0	11786
	9:00	1.8	7.4	86.9	10.0	
	12:00	8.7	22.4	93.7	9.0	
	13:00	13.9	25.7	96.0	8.0	
	14:00	13.7	25.6	97.1	7.0	
	average	7.1	15.8	88.8	9.9	
Nighttime Surveys						
5/12/09	18:00	6.8	17.6	92.2	8.0	8283
	23:00	2.1	7.0	76.6	11.0	
	average	4.9	12.7	83.5	9.8	
5/28/09	19:00	4.0	9.9	92.1	10.0	8510
	23:00	2.3	16.1	86.6	13.0	
	average	5.5	18.6	88.8	11.6	
5/29/09	19:00	3.3	5.6	87.0	13.0	9795
	23:00	0.9	6.5	78.5	26.0	
	average	4.1	10.2	81.4	21.8	
5/31/09	19:00	3.7	10.2	87.6	16.0	9379
	23:00	3.1	8.6	77.4	29.0	
	average	3.7	10.9	81.8	23.4	

6.2.3 Results

During our focused day and night surveys six species of snakes and six species of lizards were found. Species of snakes observed include Mojave sidewinders (*Crotalus cerastes*), red racers (*Masticophis flagellum*), long-nosed snake (*Rhinocheilus lecontei*), spotted leaf-nosed snake (*Phyllorhynchus decutatus*), Nevada shovel-nosed snake (*Chionactis occipitalis talpina*), and glossy snake (*Arizona elegans eburnata*). A description of each follows. Lizard species observed include desert horned lizards (*Phyrnosoma platyrhinos*), desert iguanas (*Dipsosaurus dorsalis*), long-nosed leopard lizards (*Gambelia wislizenii*), zebra-tailed lizards (*Callisaurus draconoides*), side blotched lizards (*Uta stansburiana*), and Great Basin whiptails (*Aspidocelis tigris*). During the tortoise surveys, three species of snakes and six species of lizard were observed. The snakes included five Mojave sidewinders, four red racers, and one long-nosed snake. Results for the herpetological surveys are shown in Table 6-3.

Table 6-3. Herpetological survey results.

Date	Time	Findings										
		Zebra-tailed Lizard	Desert Horned Lizard	Desert Iguana	Western Whiptail	Leopard Lizard	Western side-blotched Lizard	Leaf-nosed Snake	Long-nosed Snake	Shovel-nose Snake	Sidewinder	Glossy Snake
5-28-09	20:25-22:35.	-	-	-	-	-	-	1	-	-	-	-
5-29-09	20:30-23:07	-	-	-	-	-	-	-	1	1	-	-
	23:15 - 23:45	-	-	-	-	-	-	-	-	-	-	-
5-31-09	10:30 - 12:27	5	-	3	4	-	1	-	-	-	-	-
	12:55-14:11	1	-	2	-	-	-	-	-	-	-	-
	9:00-11:40	-	-	-	-	-	-	-	-	-	1	1
6-20-09	10:00-11:30 A.M.	3	1	-	-	-	-	-	-	-	-	-
	11:35-12:40	5	-	-	2	-	-	-	-	-	-	-
	13:10-14:50	2	3	-	-	-	-	-	-	-	-	-
6-21-09	7:30-9:20 A.M.	8	1		4	-	-	-	-	-	-	-
	10:00-11:10 A.M.	2	3	-	-	-	-	-	-	-	-	-
6-22-09	7:30-9:30	5	-	-	5	1	-	-	-	-	-	-
	9:40-10:50	12	-	1	8	-	-	-	-	-	-	-
	11:35-1:10 A.M.	8	-	1	1	-	-	-	-	-	-	-
6-23-09	9:30-10:45	2	-	2	3	-	-	-	-	-	-	-
	11:10-12:17.	4	-	1	-	-	-	-		-	-	-



Map 6-2. Herpetological surveys conducted at the Amargosa Farm Road Solar Project site.

Desert Horned Lizard *(Phyrnosoma platyrhinos)*

The desert horned lizard is very common in many areas of project site; however their distribution appeared somewhat patchy. The desert horned lizard is found all over the Mojave Desert. It is a medium sized lizard about 2½ to 3¾ inches snout to vent length. Habitat requirement include an ample supply of native ants and a sandy substrate (Stebbins 1985). When these conditions are met, horned lizards are often present at all life stages. Desert horned lizards usually prefer rather warm temperatures; however, in this area they were detected rather early in the survey effort in cooler weather. In one instance, mating horned lizards were discovered. In another incident a horned lizard was observed with its left front leg and shoulder in the jaw of a leopard lizard; this was a dire situation for the leopard lizard as the horned lizard was much to large and thorny to devour.

Photo 6-1. Desert horned lizard.

Desert Iguana (*Dipsosaurus dorsalis)*

Desert iguanas were observed only after the temperature was high enough to support activity. Photo 6-2 and Photo 6-3. Desert iguanas were often observed emerging from small holes between shrubs mid-morning as the temperature was beginning to climb. In the afternoon, when the temperature exceeds their comfort level, they would return to these holes. Desert iguanas eat insects, however a major part of their diets are the flowers of the abundant creosote shrubs in the area. Desert iguanas also were observed dropping out of other flowering shrubs. No creosote seeds were observed on the ground except in a few sheltered, topographic windbreaks. Most of the creosote bloomed by June. For this reason, desert iguanas were most abundant where robust creosote shrubs were most dense such as along Amargosa Farm Road. As a result the distribution of desert iguanas was somewhat patchy. Desert iguanas are common throughout the Mojave and Colorado deserts. They are a larger lizard ranging from 4 to 5¾ inches snout to vent length.

Photo 6-2. Desert iguana.

Photo 6-3. Desert iguana

Long-Nosed Leopard Lizard (*Gambelia wislizenii*)

Long-nosed leopard lizards (Photo 6-4 and Photo 6-5) primarily eat lizards and occasionally some insects. As a predator they are more widely distributed than desert iguanas or horned lizards. However, they prefer open areas and are found all over the Mojave and Colorado Desert. Leopard lizards are also large lizards from 3¼ to 5¾ inches snout to vent length. In one incident a leopard lizard ran away from the observer into a large creosote bush where it was attacked by a red racer intent on eating the lizard. The lizard defended itself by biting the neck of the racer and thus prevented the snake from readily comsuming the lizard.

Photo 6-4. Long-nosed leopard lizard.

Photo 6-5. Long-nosed leopard lizard.

Zebra-tailed lizard (*Callisaurus draconoides*)

Zebra-tailed lizards (Photo 6-6) were very common throughout the site when the temperature rose high enough. Zebra-tailed lizards are medium sized lizard about 2½ to 4 inches snout to vent length and they run very fast. Zebra-tailed lizards eat insects and some plant material (www.californiaherps.com/lizards).

Photo 6-6. Zebra-tailed lizard.

Desert Side-blotched Lizard (*Uta stansburiana*)

Desert side-blotched lizards (Photo 6-7). were observed in many locations. They occur throughout southern California and have been observed as far north as Fallon, Nevada. Side-blotched lizards are small 1½ to 2½ inches snout to vent length (Stebbins 1985). Because of their small size they warm up very quickly and were only seen in the cooler periods, such as early in the survey period and early in the morning. Side-blotched lizards eat small insects and spiders.

Photo 6-7. Desert side blotched lizard.

Great Basin Whiptail (*Aspidocelis tigris*)

Great Basin whiptails (Photo 6-8) are perhaps the most common lizard onsite. They were observed throughout the project especially in the morning. These fast moving lizards are 2 to 5 inches snout to vent length. Great Basin whiptails eat insects and spiders as well as small lizards (www.californiaherps.com/lizards). Whiptails, unlike the other lizards, actively search for prey and can be seen moving from shrub to shrub. Their nervous gait makes them easily identifiable.

Photo 6-8. Great Basin desert whiptail.

Mojave Sidewinder *(Crotalus cerastes)*

Mojave sidewinders (Photo 6-9 and Photo 6-10) were the most common snake found on the project site. Sidewinders are a species of rattlesnake and are very poisonous. Most were seen in the early morning. In one incident, a sidewinder was observed guarding a kangaroo rat it had likely killed in the night. In two other incidents, sidewinders were found curled up in the sand and barely visible. The young snakes are about seven inches and the adults can be as long as 33 inches. They occur all over the Mojave Desert. Most were observed in the southern portion of the survey area especially south of Amargosa Farm road. Sidewinders eat lizards and when they grow large enough eat rodents.

Photo 6-9. Mojave sidewinder.

Photo 6-10. Mojave sidewinder.

Red Racer (*Masticophis flagellum)*

Red racers were the second-most common snake observed. These large snakes (36-102 inches) are diurnal (Stebbins 1985). They eat rodents, lizards and other snakes. They are very fast moving and found throughout the project. Red racers range from the coast to all over the deserts of southern California into Nevada.

Long-nosed snake (*Rhinocheilus lecontei)*

The long-nosed snake (Photo 6-11) is a medium sized snake about 20 to 41 inches in length. They are nocturnal and crepuscular (active at dusk and dawn). These snakes are found throughout Nevada into southern California and Arizona. Long-nosed snakes chiefly eat lizards, reptile eggs, and sometimes small rodents (Stebbins 1985). The first one discovered was found early in the morning having just eaten a whiptail lizard.

Photo 6-11. Long-nosed snake.

Snakes Found During Night Surveys

Spotted Leaf-Nosed Snake (*Phyllorhynchus decutatus)*

Spotted leaf-nosed snakes (Photo 6-12) are small snakes about 12 to 20 inches in length. This snake burrows under the sand and is nocturnal; therefore rarely encountered (Stebbins 1985). The snake is found throughout the deserts of southern California into southern Nevada. This snake was found in the central portion of the project site.

Photo 6-12. Spotted leaf-nosed snake.

Nevada Shovel-Nosed Snake *(Chionactis occipitalis talpina*)

The Nevada shovel-nosed snake (Photo 6-13) is a small snake about 10 to 17 inches long (Stebbins 1985). These snakes burrow under the sand and are nocturnal. They are usually only found by driving roads at night, but two were found near the Fortymile Wash. The range of the Nevada shovel-nosed snake is rather small, occupying only a small part of southern Nevada and into a smaller part of the California Mojave Desert (Stebbins 1985) Shovel-nosed snakes eat insects, spiders, and scorpions.

Photo 6-13. Nevada shovel-nosed snake.

Desert Glossy Snake (*Arizona elegans eburnata)*

The desert glossy snake (Photo 6-14) is a medium sized snake about 27 to 56 inches long (Stebbins 1985). It also burrows under the sand and is nocturnal. The range of the desert glossy snake runs from southern Nevada through the California desert into Mexico. This snake was found along a wash in the south-east section north of Amargosa Farm Road. Glossy snakes eat lizards, small snakes, and small rodents (Stebbins 1985).

Photo 6-14. Desert glossy snake.

6.2.4 Discussion

All of these reptiles found on the Solar Millennium project site are unique and interesting; however most occur over a wide range. The side-blotched lizard and the western whiptail are found from the coast into Nevada. The Nevada shovel-nosed snake has a much smaller range that extends into the eastern Mojave Desert (Stebbins 1985). None of the animals found are considered rare.

Although fairly common, the desert iguana is on the Nevada Natural Heritage Program Plant and Animal Watch List (http://heritage.nv.gov/lists/watch0703.pdf). The Nevada state rank is listed as “S3” or vulnerable to decline by habitat loss. The U.S. Fish and Wildlife Service stated in the July 8, 1999 Federal Register that the desert iguana suffered from habitat loss and commercial harvesting especially in Nevada. However, the agency decided not to list the desert iguana, and the desert iguana has no federal status. This fact is exacerbated by the presence of several pitfall traps on the site (destroyed) and a complaint by a local resident that desert iguanas were being harvested on site.

A number of reptiles and amphibians that inhabit the county were not found on the Amargosa Farm Road project site. Some of these animals may have avoided detection by surveyors; others are not expected to occur due to the lack of habitat present.

6.2.4.1 Reptiles That May Occur But Were Not Found.

Desert Banded Gecko (*Coleoonyx variegates*)

The desert banded geckos is a nocturnal lizard found in rocky areas of the desert (Stebbins, 1985). Although the site was largely covered with gravel, there were few small rocks at this site and no banded geckos were found. Banded geckos eat insects, spiders, and scorpions.

Desert Night Lizard (*Xantusia vigilis*)

A desert night lizard was found in the town of Beatty but none were found on the project site. Although common, these diurnal lizards are difficult to find (Stebbins 1985). Desert night lizards are usually found under dead fallen branches of yucca or Joshua trees, and they can be found in rocky areas such as the hills around Beatty, Nevada (Stebbins 1985). No yucca species were found in the project site.

Western Brush Lizard (*Urosaurus graciosus*)

The Western brush lizard is another diurnal lizard whose range extends to the project area. These lizards are commonly found in the branches of creosote bushes, and when approached, brush lizards sometimes remain motionless. However no brush lizards were observed during day or night surveys.

Mojave Patch-Nosed Snakes *(Salvadora hexalepis)*

The Mojave patch-nosed snake is a fast moving diurnal snake of the desert scrub. The Mojave patch-nosed snake was not observed during any surveys.

Desert Nightsnakes *(Hypsiglena torquata)*

Desert nightsnakes are secretive nocturnal snakes of the southwest. They eat lizards and frogs and are usually found under debris or rocks (Stebbins, 1985). Nightsnakes are sometimes seen crossing roads at night, but none were found.

Great Basin Gopher Snakes *(Pituophis catenifer)*

Great Basin gopher snakes occur in a wide variety of habitats including the desert. Gopher snakes primarily eat rodents and cottontail rabbits, but they will also eat lizards and snakes. The project site would be considered suitable habitat. However, gopher snakes are large relatively slow moving snakes. During the summer, high temperatures and a lack of suitable cover could be a limiting factor in their abundance on this site except possibly near the agricultural fields.

Desert Blind Snake *(Leptotyphlopsis humilis)*

The desert blind snake is very seldom observed due to its subterranean lifestyle. These snakes burrow into loose sand near washes and on hillsides. They eat ants and termites. Sometimes they surface in the night. Desert blind snakes could occur on the project site.

Mojave Rattlesnake *(Crotalus scutulatus)*

The Mojave rattlesnake is found throughout the Mojave Desert. Theses snakes eat rodents and rabbits (Stebbins 1985). They are large and slow moving similar to the gopher snake. Mojave rattlesnakes were not observed on the project site, but they could be present.

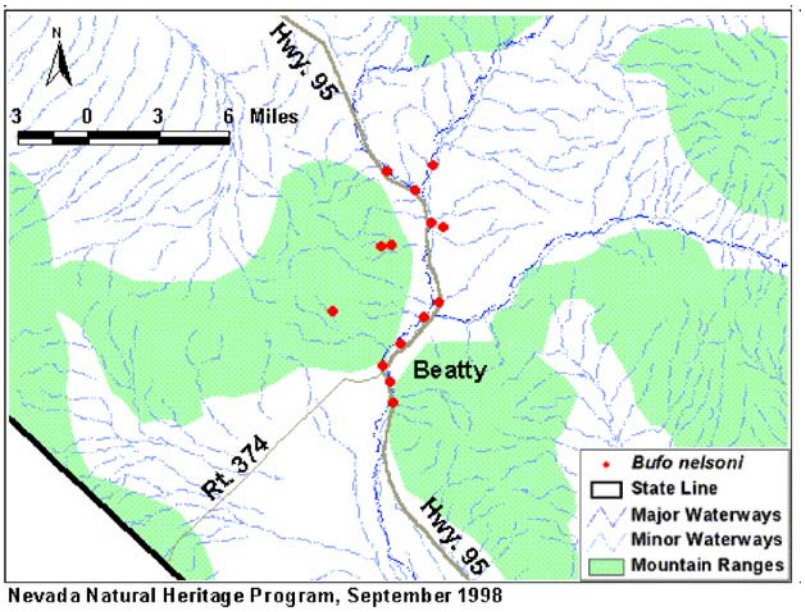
6.2.4.2 Animals Not Found and Not Expected On Site

Several animals occur in the county and on the nearby hills that prefer habitats not found on the Amargosa Farm Road Solar Project site. The chuckwalla (*Sauromalus ater*) is a large herbivorous lizard only found near very large boulders on nearby hillsides. The collared lizard (*Crotaphytus bicictores*) is a predatory lizard, and usually occupies very rocky habitats on nearby hillsides. The desert spiny lizard (*Sceloporus magister*) also prefers more rocky or shrubby habitat for cover. The sagebrush lizard (*Sceloporus graciosus*) prefers sagebrush habitats. The Great Basin fence lizard (*Sceloporus occidentalis*) is absent from the extreme desert. Gilbert's skink (*Plestiodon gilberti*) and the western skink (*P. skiltonianus*) usually prefer rocky habitats near streams. The desert striped whipsnake (*Masticophis taeniatus*) usually prefers a moister habitat, and the Western ground snake (*Sonora semiannulata*) prefers some subsurface moisture. The California kingsnake (*Lampropeltis getula*) is usually found near rock outcrops or clumps of vegetation, and the Sonora lyre snake (*Trimorphodon biscutatus*) usually prefers rockier habitat (Stebbins 1985).

The Banded Gila monster (*Heloderma suspectum cinctum*) is found in southwestern U.S., especially Arizona, and Mexico. They inhabit semi-arid rocky foothills near washes and arroyos with at least some moisture, and avoid open conditions and farmland (Smithsonian National Zoological Park 2008). They prefer scrubland or succulent desert and oak woodland (Stebbins 2003). It is the only species of lizard with special status that occurs in Nye County. Distribution maps and records show the Gila monster is only present as far north as Ash Meadows (Stebbins, 1985 /www.natureserve.org/publications/ NEscor2006.pdf.). Therefore, no banded Gila monsters were expected to be present on the project site.

6.2.5 Study of Impacts to Amargosa Toad *(Bufo nelsoni)*/ Columbia Spotted Frog (*Rana luteiventris*)

Generally speaking, two species of amphibians naturally occur in Nye County near the project location. The Amargosa toad (*Bufo nelsoni*) is largely restricted to the Amargosa River around the towns of Springdale and Beatty, Nevada (Stebbins 1985). Although it may be found in a few other subsidiary creeks, none of them run onto the project area (Map 6-3). An Amargosa toad literature review was conducted along with a species field search. A habitat values assessment and mapping for all life cycle stages included the assessment of food availability, shelter supply, and breeding sites. The Columbia spotted frog (*Rana luteiventris*) only occurs in and around permanent water sources and prefers moving water (Stebbins 1985). Due to the lack of any permanent water on the site (no potential habitat), neither of these species was expected to be present.



Map 6-3. Distribution of Amargosa toads, map by Nevada Natural Heritage Program. The project site is located well to the south of this map on Highway 373.

6.3 Desert Tortoise Surveys

The desert tortoise (*Gopherus agassizii*) (Photo 6-15) has a wide range throughout the southwestern deserts. Although the vegetation on the Amargosa Farm Road Solar Project site appears to be less than quality habitat for the tortoise, there was some potential for tortoise to occur. Surveys were conducted to more fully document the overall habitat potential, and an extensive search was conducted for existing signs or tortoises within the project area.

6.3.1 Species Account

The desert tortoise is a large, herbivorous reptile found in portions of California, Arizona, Nevada, and Utah. It also occurs in Sonora and Sinaloa, Mexico. The Mojave population of the desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Sonoran Desert in California. Desert tortoises reach 8 to 15 inches in carapace length. Adults have a domed carapace and relatively flat, unhinged plastron. Shell color is brownish, with yellow to tan scute centers. The forelimbs are flattened and adapted for digging and burrowing.

Photo 6-15. Desert tortoise (photographed near Barstow, CA, in 2008 by TDI).

Optimal habitat has been characterized as creosote bush scrub in which precipitation ranges from 2 to 8 inches, where a diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner 1982, Turner and Brown 1982). Soils must be friable enough for digging of burrows, but firm enough so that burrows do not collapse. Desert tortoises occur from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982). Maximum longevity in the wild is likely to be about 50 to 70 years, the norm being 25 to 35 years (Germano 1992, 1994, in Boarman 2002).

Tortoise activity patterns are primarily controlled by ambient temperature and precipitation (Nagy and Medica 1986, Zimmerman *et al.* 1994). In the East Mojave and Colorado Deserts, annual precipitation occurs in both summer and winter, providing food and water to tortoises throughout much of the summer and fall. Most precipitation occurs in winter in the West Mojave Desert, resulting in an abundance of annual spring vegetation, which dries up by late May or June. Tortoises in the West Mojave are primarily active in May and June, with a secondary activity period from September through October. Tortoises may also be active during periods of mild or rainy weather in summer and winter. During inactive periods, tortoises rest in subterranean burrows or caliche caves, and spend approximately 98 percent of the time in these shelter sites (Nagy and Medica 1986). During active periods, they usually spend nights and the hotter part of the day in their burrow; they may also rest under shrubs or in shallow burrows (Pallets). Tortoises may use an average of seven to 12 burrows at any given time (Barrett 1990, Bulova 1994, TRW Environmental Safety System Inc. 1997).

Walde *et al.* (2003) observed that desert tortoises retreated into burrows when air temperature reached 91.0 °F (32.8°C) + 3.55°F (1.97°C) and ground temperatures reached 94.6°F (34.8°C) 6.05°F + (3.36°C); 95 percent of desert tortoise observations above ground occurred in air temperature less than 91°F (33°C). The body temperature at which desert tortoises become incapacitated ranges from 101.5°F (38.6°C) to 113.2°F (45.1°C) (Naegle 1976, Zimmerman *et al.* 1994).

Desert tortoises are most commonly found within the desert scrub vegetation type, primarily in creosote bush scrub. In addition, they occur in succulent scrub, cheese bush scrub, blackbrush scrub, hopsage scrub, shad scale scrub, microphyll woodland, Mojave saltbush-allscale scrub and scrub-steppe vegetation types of the desert and semi desert grassland complex (USFWS 1994). Within these vegetation types, desert tortoises potentially can survive and reproduce where their basic habitat requirements are met. These requirements include a sufficient amount and quality of forage species; shelter site for protection from predators and environmental extremes; suitable substrates for burrowing, nesting, and over wintering; various plants for shelter; and adequate area for movement, dispersal, and gene flow. Throughout most of the Mojave Region, tortoises occur most commonly on gently sloping terrain with soils ranging from sandy-gravel and with scattered shrubs, and where there is abundant inter-shrub space for growth of herbaceous plants. Throughout their range, however, tortoises can be found in steeper, rockier areas.

Although desert tortoises eat alien plants, they generally prefer native forbs when available (Jennings 1993, Avery 1998). Consumption of alien plants may place them at a nitrogen and water deficit (Henen 1997). Droughts frequently occur in the desert, resulting in extended periods of low water availability. Periods of extended drought place tortoises at even greater water and nitrogen deficit than during moderate or high rainfall years (Peterson 1996, Henen 1997). During a drought, more nitrogen than normal is required to excrete nitrogenous wastes, thus more rapidly depleting nitrogen is stored in body tissues. Plants also play important roles in stabilizing soil and providing cover for protection from predators and heat.

Tortoise activities are concentrated in overlapping core areas, known as home ranges. Because tortoises do not defend a specific, exclusive area, they do not maintain territories. The size of desert tortoise home ranges varies with respect to location and year. Female home ranges are approximately half that of the average male, which range from 25 to 200 acres (Berry 1986). Over its lifetime, each desert tortoise may require more than 1.5 square miles of habitat and make forays of more than 7 miles at a time (Berry 1986). In drought years, the ability of tortoises to drink while surface water is available following rains may be crucial for tortoise survival. During droughts, tortoises forage over larger areas, increasing the likelihood of encounters with sources of injury or mortality including humans and other predators.

Changing ecological condition as a result of natural events or human-caused activities may stress individuals and result in more severe clinical expressions of Upper Respiratory Tract Disease(URTD) (Brown *et al.* 2002). For example, the proliferation of non-native plants within the range of the tortoise has had far-reaching impacts on tortoise populations. Tortoises have been found to prefer

native vegetation over non-native (Tracy *et al.* 2004). Non-native annual plants in desert tortoise critical habitat in the western Mojave Desert were found to compose over 60 percent of the annual biomass (Brooks 1998). The reduction in quantity and quality of forage may stress tortoises and make them more susceptible to drought-and disease-related mortality (Brown *et al.* 1994). What is currently known with certainty about disease in the desert tortoise relates entirely to individual tortoises and not populations; virtually nothing is known about the demographic consequences of disease (Tracy *et al.* 2004).

6.3.2 Status of the Species/Critical Habitat Rangewide

On August 4, 1989, the U. S. Fish and Wildlife Service published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 FR 42270). On April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened (55 FR 12178). Reasons for the determination included significant population declines, loss of habitat from construction projects such as roads, housing and energy developments, and conversion of native habitat to agriculture. Grazing and off-highway-vehicle (OHV) activity have degraded additional habitat. Also cited as threatening the desert tortoise's continuing existence were illegal collection by humans for pets or consumption, URTD, predation on juvenile desert tortoises by common ravens, coyotes *(Canis latrans)*, and kit foxes *(Vulpes macrotis)*, fire, and animals killed with vehicles on paved and unpaved roads.

On June 28, 1994, the Service approved the final Desert Tortoise (Mojave Population) Recovery Plan (Recovery Plan) (USFWS 1994). The Recovery Plan divides the range of the desert tortoise into six recovery units and recommends establishment of 14 Desert Wildlife Management Areas (DWMAs) throughout the recovery units.

Recovery Units

The Northeastern Mojave Recovery Unit occurs primarily in Nevada, but it also extends into California along the Ivanpah Valley and into extreme southwestern Utah and northwestern Arizona. Vegetation within this unit is characterized by creosote bush scrub, big galleta-scrub steppe, desert needle grass scrub-steppe, and blackbrush scrub (in higher elevations). Topography is varied, with flats, valleys, alluvial fans, washes, and rocky slopes, Much of the northern portion of the Northeastern Mojave Recovery Unit is characterized as basin and range, with elevations from 2,500 to 12,000 feet. Desert tortoises typically eat summer and winter annuals, cacti, and perennial grasses. Desert tortoises in this recovery unit, the northern portion of which represents the northernmost distribution of the species, are typically found in low densities (about 10 to 20 adults per square mile).

Map 6-4. Historic range and designated critical habitat of the desert tortoise.

The Eastern Mojave Recovery Unit is situated primarily in California, but also extends into Nevada in the Amargosa, Pahrump, and Piute valleys. In the Eastern Mojave Recovery Unit, desert tortoises are often active in late summer and early autumn in addition to spring because this region receives both winter and summer rains and supports two distinct annual floras on which they can feed. Desert tortoises in the Eastern Mojave Recovery Unit occupy a variety of vegetation types and feed on summer and winter annuals, cacti, perennial grasses,

and herbaceous perennials. They den singly in caliche caves, bajadas, and washes. This recovery unit is isolated from the Western Mojave Recovery Unit by the Baker Sink, a low-elevation, extremely hot and arid strip that extends from Death Valley to Bristol Dry Lake. The Baker Sink area is generally not considered suitable for desert tortoises. Desert tortoise densities in the Eastern Mojave Recovery Unit can vary dramatically, ranging from 5 to as much as 350 adults per square mile (USFWS 1994) (USFWS 2006).

6.3.3 Desert Tortoise Habitat in the Project Area

The project site is located in the desert tortoise Eastern Mojave Recovery Unit and close to border of the Northeastern Mojave Recovery Unit but is not designated as critical habitat. The project area vegetation and soils are discussed extensively in other sections of this report. As the reader can determine from these sections, habitat suitable for desert tortoise is extremely limited and must be considered marginal to unsuitable. During this survey period, March through May, very little annual vegetation was detected. Split-grass *(Schismus arabicus)* was the most predominant annual species. In most cases it was only found very close to creosote bushes and it grew and dried within about two weeks allowing the plants to obtain heights of less than one inch with almost none of the plants forming flowers. An extremely small amount of annual vegetation from past years' production was observed (Photo 6-16). The dry condition of Amargosa Valley appears to be caused by the "rain shadow" effect of the Sierra Nevada as well as the Funeral Mountains, located in California, and situated due west of the project site. Rainfall and climatological data can be found in Section 1.3.2.

Photo 6-16. At left is a photo of the Amargosa Farm Road project area. At right for comparison is a photo of higher quality habitat from near Barstow, CA (Both photo by TDI, April 2009). Note the abundant white flowers (Chaenactis spp.) and grasses in the photo on the right from Barstow, compared to lack of herbaceous growth on the Amargosa Farm Road site.

Without annual vegetation it is almost impossible for tortoises to survive long term in this environment. It has been reported (Jennings 1993) that the tortoise diet is made up of a multitude of vegetation but only a few species account for the majority of biomass consumed. Forage is typically made up annual forbs

and grasses, perennial grasses and succulent perennials as well as cacti. The almost complete lack of these forage plants as well as the lack of cured/dry plants indicates that only in the wettest of years may the desert tortoise be able to survive across the project area. The surveyed area was approximately 7000 acres. The landscape throughout most of the Amargosa Valley is of similar vegetation character as the project site. Traveling approximately 15 miles to the North toward Beatty, NV, the habitat does improve somewhat. Annual flowers and grasses were observed from the roadways. A "green-up" was observed on the alluvial fans extending into the Valley from mountains on both sides of the valley. This same condition was observed traveling approximately the same distance toward the southeast and Pahrump Valley, but it never occurred in 2009 on the project site.

The soils across the project area vary slightly with the eastern portion of the site being classified as a gravelly fine sandy loam. The western portion of the site is too coarsely mapped to report texture; however it appeared to be between a silty loam and a fine sandy loam, with a surface protection of rock similar to but less completely armored than a fully-developed desert pavement. This soil structure is suitable for burrow construction; this is supported by numerous coyote, kit fox and jack-rabbit dens. Many of the coyote and kit fox dens were extremely complex and supported numerous entrance/exit points. There were some caliche caves/holes in the vicinity of Forte-mile Wash. Many appear to be used by small mammals and reptiles.

The vegetation community, as described in Section 3.0, is primarily creosote bush scrub, with creosote bush being by far the most dominant species. Some of the areas within the project footprint are almost pure stands of creosote bush that consist of widely dispersed plants and cover several hundred acres. Some of these locations appear to have been previously farmed. Burrobush *(Ambrosia dumosa)* plays a lesser role in this community and in some areas is almost completely lacking. As was discussed earlier, with these stands of widely dispersed perennial plants, and the lack or non-existence of annual plants, much of the project area is unsuitable or poor desert tortoise habitat.

6.3.4 Methods

Desert tortoise surveys began on March 21, 2009 and were completed on June 1, 2009. Upon arrival at the project location, the first day was dedicated to determining the overall footprint of the project and attempting to delineate the best tortoise habitat. The project area is laid out by sections located in townships and ranges. The initial reconnaissance revealed that almost all sections had existing roads or improved trails located on section lines. Amargosa Farm Road is a paved, moderately used, road that traverses east and west through the south portion of the project area. Other main East/West roads are Frontier Road one mile north of Amargosa Road and Ranch Road one mile South. North/South roads are mostly improved dirt roads located on all section lines (Map 6-5). Only the Northern most edge of sections 4 and 5, Township (T)16S, Range(R) 49E does not have an improved road. Due to the physical layout of the project area it was initially determined the best survey method would be to use standard survey methods and to do one section at a time.

After the initial reconnaissance, the survey team determined that the best potential tortoise habitat is located in Section 1 and part of Section 2, T16S, R48E. This habitat also extends into the western portion of Section 6, T16S, R49E. These particular sections are within the vicinity of the Fortymile Wash. Although this normally dry wash flows from a generally north to south direction, Sections 7, 12,13,14, to the south of Sections 1, 2, and 6 consist of heavily degraded habitat. A description of habitat degradation will be further detailed in the following Discussion of this Section.

Section 1 was the first section surveyed. This survey began on March 21, 2009 with temperatures ranging from 48°F in the mornings to 82°F in the afternoons. Winds varied from calm to days with gusts up to 36 miles per hour. Humidity varied from lows of 5 percent in the afternoons to highs of 36 percent on one morning. Average humidity was in the 7-10 percent range.

Due to the plant community make-up of Section 1, standard 30-foot separation was maintained between surveyors. The entire section, as well as all the project area, displayed signs of human disturbance. Two and four wheeled vehicle tracks were observed crossing this section as well as all the project area. The area was littered with trash, although not nearly as much trash as is located on other sections. The area is heavily used by coyotes as well as kit fox. Numerous fox and coyote dens were observed along with scat and skeletal remains.

Standard protocol entails presence-or-absence surveys throughout the project area for 100 % coverage using parallel pedestrian transects spaced 30 feet apart. The USFWS allows this distance to vary if habitat conditions would exclude desert tortoise, such as in areas of desert pavement, previously disturbed habitat, abandoned agricultural fields, soil types that will not support burrows or food sources, or areas of heavy disturbance by ATV's. They allow some discretion by tortoise biologists. In accordance with the USFWS protocol, an appropriate survey pace is approximately 2 miles per hour. In this particular case the lack of habitat and inability to meet the minimum number of tortoise occurrences criterion in the 2009 Draft protocol made the difference between the 1992 and 2009 protocol negligible.

Discussion between tortoise specialist Bill Fisher and the USFWS resulted in both a decision to use the 1992 protocol and, later, in a modification to the 1992 protocol. It was requested that transect separation be widened from 10 meters to 20 meters at a minimum. It was mentioned that anything except possibly scat would be clearly visible with 20 meter separation. The 10 meter requirement was thought to be a waste of resources (labor) in this particular case. The request was found "reasonable" by the USFWS and the transect width modification was made in accordance with professional judgment to minimize effort where habitat was poor or where project impacts were expected to be less, while ensuring that 100-percent coverage was provided.

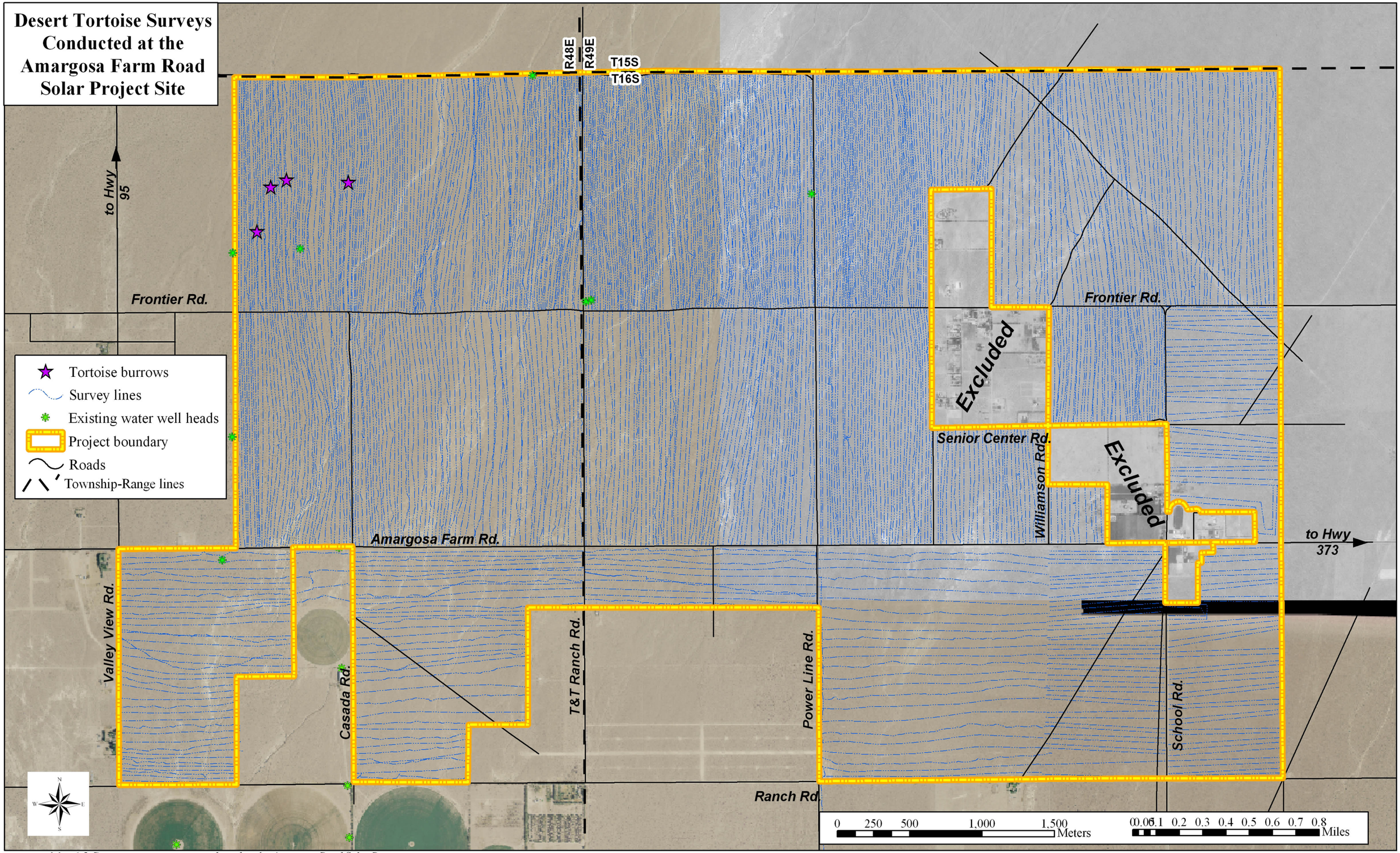
Survey teams consisted of between three and five biologists throughout the entire process. Normally, shells, scutes or bone segments of dead tortoise are moved into wash areas during high water events. For this reason, special emphasis was placed in the wash and bank areas. The survey team also looked very closely at manmade hills and banks created as part of past agricultural projects or possible mining exploration. In the experience of the lead biologist,

tortoise generally prefer to excavate burrows in previously disturbed soil, presumably because the digging process is much easier than in compacted natural soils. Each Section was surveyed beginning at one of the Section lines defined by an existing road. The first line was established by following an existing road and subsequent transects were conducted by using the track function of hand-held Garmin and Magellan GPS units to maintain distance between surveyors and create relatively straight transects. This same process was conducted across the entire survey area. As the survey proceeded into other sections, distance between surveyors was increased or decreased based upon the professional judgment of the lead surveyor. In much of the project area, vegetation was very sparse and consisted almost entirely of widely spaced creosote bushes separated by sandy-gravel soils that were almost completely devoid of any other vegetation. As was discussed earlier, very little ephemeral vegetation exists in the project area, with some widely spaced dry annual plants from previous years' production.

All surveys began in the morning hours after the sun reached a high enough point to avoid casting long shadows. Starting times changed as the season progressed from approximately 8:00 AM to 6:45 AM. Temperatures ranged from 48°F at starting time to 72°F as the season progressed. Ending time for daily surveys was determined by the amount of terrain covered each day. Each team member walked 8 to 10 miles per day. Ending times varied from 3:00 PM to 1:15 PM later in the survey period. Temperatures at ending time each day varied from 62°F to 97°F. Wind and humidity were variable as discussed earlier. The final transects were completed on June 1, 2009.

All tortoise signs were recorded using standard Desert Tortoise Survey Sheets and are attached in the Appendix B. Each burrow/shelter site that appeared to be created by desert tortoise was measured and recorded on the Form. A reflective light was shown into all burrows that generally had a shape that could be associated with tortoise. In most cases, these burrows showed interior signs such as narrowing or branching in various directions, which are not indicative of tortoise burrows and were not considered as tortoise shelter sites.

Each surveyor recorded other data such as vegetation, birds, reptiles and mammals that were found on the transect lines or in observable limits. These field observations included live or dead animals and plants, identifiable skeletal remains, burrows and sheltering sites, scat, nests, antlers, horns, feathers, fur and skin. These field observations are presented in the species lists located within this document.



Map 6-5. Desert tortoise surveys conducted at the Amargosa Road Solar Project site.

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6.3.5 Results

Upon completion of over two months of desert tortoise surveys, conducted during the months of late March and all of April and May, only four Class 4 burrows were observed. These months are considered the months of highest tortoise activities. No dead or live tortoises were observed. As was previously discussed, no shells, scutes or bone segments of dead tortoise were detected in wash areas or where water ponds during high water events. Generally, if no other tortoise sign is detected during survey activities, tortoise remains can be found in washes.

Three of the burrows detected are located in the eastern quarter section of Section 2, T16S, R48E (Map 6-5). The burrows varied in depth from 24 inches to 36 inches the width of all burrows was approximately 8 inches. All shelters had debris located in the burrow and spider webs covered all the entrances. There is no indication the soil in the apron at the front of the burrow was freshly dug. No scat, tracks or any other sign indicate the burrows had been used in the past year. The burrows located in this area are fairly close to each other and appear to have been excavated by the same animal or animal of nearly the same physical proportions.No other tortoise sign was detected during the duration of this survey.

6.3.6 Discussion

A small desert tortoise population is known to exist to the North of the project site around Beatty, NV. Desert tortoise surveys conducted in 2006 (Knight and Leavitt 2006) and in 2007 (Converse Consultants 2008) for proposed mining operations, indicate population densities of 0-9.99 tortoise per square mile. It should also be noted that the lead tortoise biologist for this project was the BLM Manager for public lands surrounding Beatty, NV and has extensive knowledge of this tortoise population. This experience can confirm the low density of this population.

To the northeast of the project site, lies the Department of Energy, Nevada Test Site. This area has been extensively surveyed for tortoise over many years (Rautenstrauch and O'Farrell, 1991). These surveys also indicate a low to very low density of tortoise.

To the South and East of the project site, in the Pahrump Valley and area known as Johnny, surveys have been conducted over years that also indicate a low density of tortoise (personnel communication with USFWS, Las Vegas Field Office).

The above cited surveys/studies indicate very low to non-existent populations on the flat valley floors with population increases on the alluvial fans and lower foothills. Perennial and ephemeral plant density and variation greatly increase in the foothill and alluvial fan areas due to increased localized moisture. This moisture not only allows plant development but also provides needed water for the desert tortoise. As has been discussed in this report, this project is located on the valley floor of the Amargosa Valley. Annual/ephemeral plant production was extremely low during this survey period and all indications, based on cured/dried plants indicate that annual plant production is normally very low to non-existent. Very large areas of the project have no dried vegetation with the

only dominant vegetative species being creosote bush. Given these environmental conditions it will be extremely difficult for desert tortoise to survive within the project site.

In addition to these harsh environmental conditions, the project shows heavy anthropological disturbance. As was previously discussed, almost the entire project is encompassed by roads. The roads transect the site from North to South and East to West on almost all section lines. In addition, several roads cross the area at various angles. The Northeast corner of the project has a road/trail system that is used for competitive off-road racing events. This off-road racing event course has been widened over years of racing to well over 200 feet in some areas.

On the East, West, and South boundaries of the proposed project area are dwellings, agricultural fields, and county buildings including a school, library, fire department and county road department. Heavy disturbance, including trash and green waste from yards and gardens have been dumped on the focused land. The field surveys also revealed wide spread litter of trash and trash dumps consisting of household appliances, clothing, cans, bottles, car parts and other trash associated with humans and their pets. Domestic dog tracks crisscrossed the project site and several dogs were observed. We also found widespread livestock carcasses; sheep, cattle, ostrich, chickens and domestic dogs and cats that appear to have died from natural causes or disease, and are simply drug into the desert and left to decay. In most cases, these carcasses were dismembered and widely scattered presumably by canids or carrion-feeding birds. The study also revealed numerous empty rifle, pistol and shotgun cartridges, some widespread, indicating rounds expanded during hunting; others closely grouped indicating target practice. There is also light to heavy use of the entire project site by off-road recreationists. Motorcycle, ATV, and four-wheel drive truck tracks were observed throughout the area. Several water wells were found scattered throughout the site (see Map 6-5). These wells have either been plugged or have welded covers on the casing. It is assumed these wells are associated with past agricultural fields and desert land entrees that have been filed with BLM. Prior to the Federal Land Policy and Management Act, trespass cotton fields were established throughout the Amargosa Valley. Over the years, these fallow agricultural fields have reverted back to desert scrub communities. All of these conditions are extremely detrimental to desert tortoise.

6.4 Bird Surveys

This report summarizes the results of the avian species surveys conducted from April 8, 2009 through May 30, 2009 on the Amargosa Farm Road project area in Amargosa Valley, Nye County, Nevada. The project area consists of approximately 7,800 acres of mostly natural desert habitats centered roughly on Amargosa Farm Road and Power Line Road (Map 6-6). The surveys were conducted throughout the study area, and consisted of point counts, walking surveys, driving surveys, and nocturnal surveys.

The majority of the habitat onsite consists of Mojave desert scrub. This habitat is dominated by creosote bush (*Larrea tridentata*) and smaller shrub species such as burrobush (*Ambrosia dumosa*). The habitat is generally very open, with limited vegetative cover (Photo 6-19 and Photo 6-20). Several dry washes flow from north to south through the study area, though these do not support any vegetation distinct from the upland communities. Residential areas adjacent to the project site support planted vegetation, including tamarisk (*Tamarix* sp.), cottonwood (*Populus* sp.), and oleander (*Oleander* sp.). Several large agricultural fields border the study area as well. These were planted with alfalfa or were idle during the time of the surveys.

6.4.1 Methods

General bird surveys were conducted to produce a baseline of the species present within the project area, emphasizing obtaining as long a documented species list as possible. Special attention was given to detecting federal, state, and county special status birds. Surveys were conducted throughout the period of work in spring and early summer to maximize the detection of species. For two to three consecutive days a month for the duration of field effort, regular routes were walked at each location, covering habitat types determined most likely to yield the greatest variety of species. Locations were also chosen to augment the chances of sighting special status species. Visual identification of avian species was made with binoculars/spotting scopes and by song recognition.

LeConte's thrasher *(Toxostoma lecontei)* is a rare and declining species that is secretive and difficult to find, so must be searched for in a focused manner. It prefers breeding in saltbush/shadscale vegetation or cholla cacti in sandy substrate. It needs vegetative litter for cover and for obtaining prey. Bendire's thrasher *(Toxostoma bendirei)* is a rare species that could occur anywhere in the project area (found in creosote scrub in southern Nevada desert with relatively open grassland, shrubland or woodland with scattered shrubs or trees). It occurs in low densities and is easily confused with similar species, so must also be searched for in a focused manner. Avoidance and minimization measures for this species would be expected to be the same as for all migratory birds. No construction can take place during the breeding season unless surveys are completed and a report submitted to the BLM just prior to construction activities.

Focused surveys were conducted for LeConte's thrasher (*Toxostoma lecontei*), Bendire's thrasher (*Toxostoma bendirei*), burrowing owl (*Athene cunicularia hypugaea*), and loggerhead shrike (*Lanius ludovicianus*). Burrowing owl surveys were conducted using standard road survey methods. This requires driving existing roads and trails and searching the area for perching owls. Some areas were hiked to scan for owls using binoculars. In order to ensure thorough coverage throughout the site for LeConte's thrasher, a series of point count stations were established at 500 meter intervals along all drivable roadways. This 500 meter point count interval has been utilized in other large study areas to survey for uncommon species such as LeConte's thrasher (Center for Conservation Biology 2005). Additional point count stations were established at 500 meters and one km within interior sections of the site, requiring hiking into the points. A total of 81 point count stations were established. Each of these stations was sampled two or three times, during visits separated by several weeks.

At each point count station, taped songs of each of the four focal species were broadcast. Each song was broadcast for approximately 30 seconds, followed by 30 seconds of quiet. The point count lasted approximately 5 minutes. All avian species detected were recorded. In addition to the point counts, agricultural fields, and residential areas in and adjacent to the project area were also surveyed from public roads in order to document the species using the area. Three nocturnal surveys were conducted on the project site (April 8, May 6, and May 27, 2009). These surveys consisted of driving roadways at night and periodically listening for calling owls and nightjars.

Habitat was assessed for the federally endangered southwestern willow flycatcher to determine if a focused survey by a permitted biologist was necessary.

Survey Schedule

Survey one:

April 9, 2009: 6:55 AM - 1:30 PM; start weather: clear, calm, 46°;

End: clear, south breeze, 72°F

April 10, 2009: 6:50 AM - 9:00 AM; start weather: overcast, south wind 10 mph, 45°;

End: overcast, windy, 60°, storm approaching.

Survey two:

May 7, 2009: 6:35 AM -11:46 AM; start weather: clear, north wind 5 mph, 69°;

End: clear, north wind 12 mph, 93°.

May 8, 2009: 6:50 AM - 12:10 PM; start weather: clear, north wind 5 mph, 70°;

End: clear, north wind 5 mph, 92°.

May 9, 2009: 6:35 AM - 10:30 AM; start weather: clear, north wind 3 mph, 67°;

End: clear, north wind 2 mph, 89°.

Survey three:

May 28, 2009: 6:05 AM - 12:05 PM; start weather: clear, north breeze 5-10 mph, 70°;

End: partly cloudy, southeast breeze 10 mph, 102°

May 29, 2009: 6:00 AM - 11:10 AM; start weather: overcast, calm, 80°;

End: partly cloudy, west wind 5 mph, 94°.

May 30, 2009: 6:15 AM - 9:45 AM; start weather: overcast, west wind 5-10 mph, 78°;

End: overcast, north wind, 15-20 mph, 76°.

6.4.2 Results

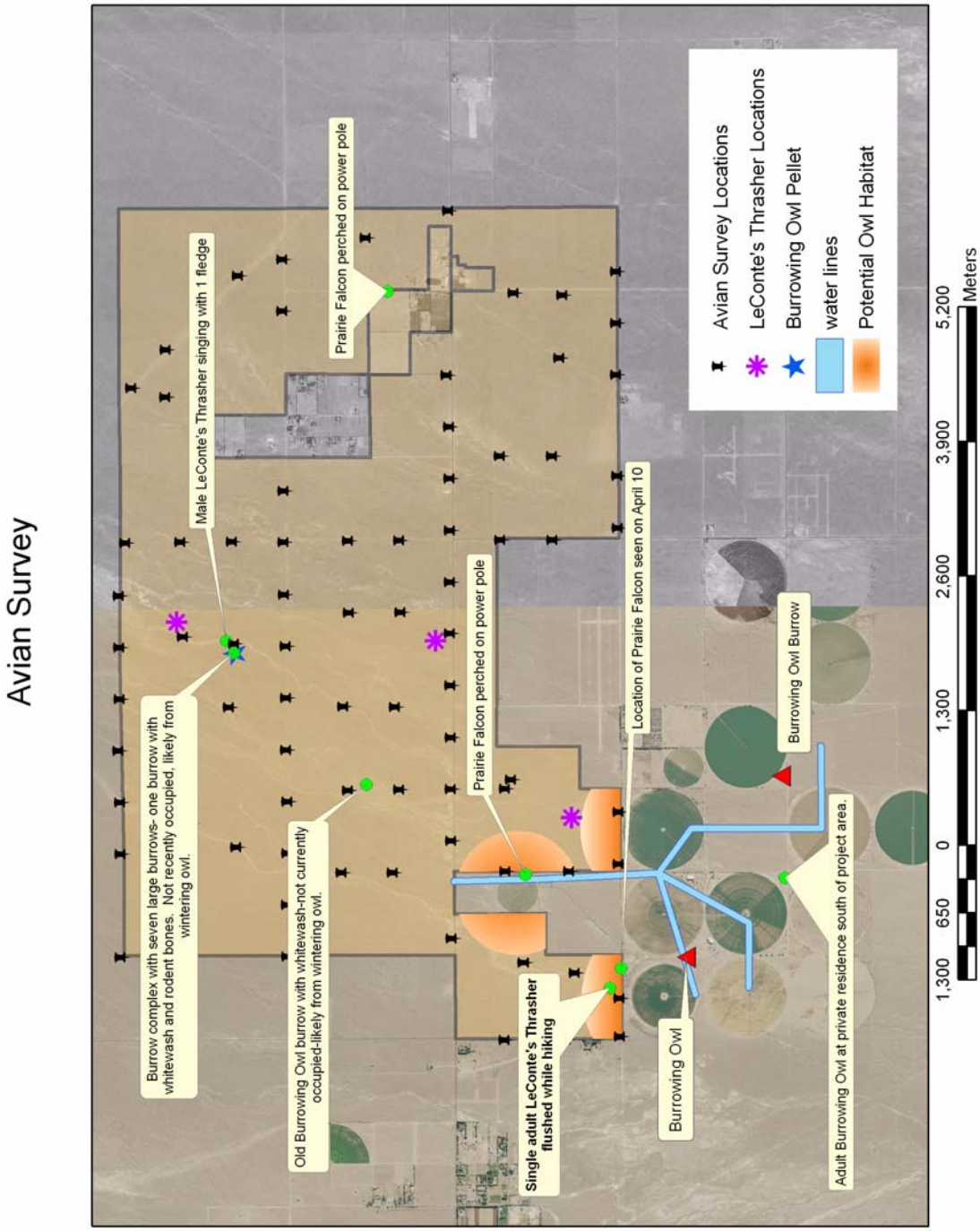
General avian nesting potential is low to moderate on the site. Active and potential nesting sites were mapped. Raptors and other birds of interest were observed and recorded as part of other surveys, but some focused effort was expended. Avoidance or other protection measures may be needed in these areas during the nesting season under the Migratory Bird Treaty Act.

We mapped habitat values for burrowing owls and surveyed for owls. Burrowing owls, a BLM sensitive species and a Nevada animal species considered to be "at risk" in all counties in Nevada and tracked by the NNHP, could utilize burrows made by canids, squirrels, or other species. Habitat for burrowing owls is present throughout the site.

A total of 27 species were detected from April 8 through May 30, 2009 (Table 6-4).

Table 6-4. Avian Species List for Amargosa Farm Road Solar Project, April 8-May 30, 2009.

Common Name	Species	Habitat
Great Egret	*Ardea Alba*	A
White-faced Ibis	*Plegadis chihi*	A
Turkey Vulture	*Cathartes aura*	ALL
Cooper's Hawk	*Accipiter cooperii*	R
Swainson's Hawk	*Buteo swainsoni*	A
Red-tailed Hawk	*Buteo jamaicensis*	ALL
American Kestrel	*Falco sparverius*	ALL
Prairie Falcon	*Falco mexicanus*	A
Eurasian Collared Dove	*Streptopelia decaocto*	R
Mourning Dove	*Zenaida macroura*	ALL
Greater Roadrunner	*Geococcyx californianus*	ALL
Burrowing Owl	*Athene cunicularia*	A
Lesser Nighthawk	*Chordeiles acutipennis*	D
Ash-throated Flycatcher	*Myiarchus cinerascens*	ALL
Western Kingbird	*Tyrannus verticalis*	R
Common Raven	*Corvus corax*	ALL
Horned Lark	*Eremophila alpestris*	D
LeConte's Thrasher	*Toxostoma lecontei*	D
Phainopepla	*Phainopepla nitens*	R
Wilson's Warbler	*Wilsonia pusilla*	D
Chipping Sparrow	*Spizella passerina*	D
Black-throated Sparrow	*Amphispiza bilineata*	D
Lincoln's Sparrow	*Melospiza lincolnii*	D
Black-headed Grosbeak	*Pheucticus melanocephalus*	R
Great-tailed Grackle	*Quiscalus mexicanus*	R
House Finch	*Carpodacus mexicanus*	ALL
House Sparrow	*Passer domesticus*	R
Habitats: D = Desert; R = Residential; A = Agricultural; ALL = all habitats		



Map 6-6. Locations of avian surveys, LeConte's thrasher locations, and potential burrowing owl habitat.

No habitat for southwestern willow flycatcher was found that would have prompted a survey for southwestern willow flycatcher, since no riparian vegetation exists on site.

6.4.2.1 Point Count Results

The natural desert habitats of the study area supported a very low density of birds, and resulted in most point counts detecting no birds (Table 6-5). Two species, the horned lark (*Eremophila alpestris*) and the black-throated sparrow (*Amphispiza bilineata*), made up the bulk of the bird detections on the remaining points. An additional ten species were detected during the point counts, most consisting of single individuals. An additional fifteen species were detected during driving surveys, mostly adjacent to residential and agricultural areas.

Table 6-5. Point count data.

Date	Survey Point	Species Found	Date	Survey Point	Species Found
April 9, 2009	Point 1	BTSP	May 7, 2009	Point 21	0
April 9, 2009	Point 2	BTSP	May 7, 2009	Point 22	0
April 9, 2009	Point 3	0	May 7, 2009	Point 23	0
April 9, 2009	Point 4	0	May 7, 2009	Point 24	0
April 9, 2009	Point 5	0	May 7, 2009	Point 25	0
April 9, 2009	Point 6	0	May 7, 2009	Point 26	0
April 9, 2009	Point 7	0	May 7, 2009	Point 27	0
April 9, 2009	Point 8	0	May 7, 2009	Point 28	0
April 9, 2009	Point 9	0	May 7, 2009	Point 29	0
April 9, 2009	Point 10	0	May 7, 2009	Point 30	0
April 9, 2009	Point 11	0	May 7, 2009	Point 31	HOLA
April 9, 2009	Point 12	0	May 7, 2009	Point 32	0
April 9, 2009	Point 13	HOLA	May 7, 2009	Point 33	0
April 9, 2009	Point 14	0	May 8, 2009	Point 34	EUCD, WIWA
April 9, 2009	Point 15	0	May 8, 2009	Point 35	0
April 9, 2009	Point 16	HOLA	May 8, 2009	Point 36	0
April 9, 2009	Point 17	0	May 8, 2009	Point 37	RTHA
April 9, 2009	Point 18	BTSP	May 8, 2009	Point 38	0
April 9, 2009	Point 19	0	May 8, 2009	Point 39	0
April 9, 2009	Point 20	BTSP	May 8, 2009	Point 40	0
April 9, 2009	Point 21	0	May 8, 2009	Point 41	0
April 9, 2009	Point 22	0	May 8, 2009	Point 42	BTSP
April 9, 2009	Point 23	0	May 8, 2009	Point 43	0
April 9, 2009	Point 24	0	May 8, 2009	Point 44	0
April 9, 2009	Point 25	BTSP	May 8, 2009	Point 45	0
April 9, 2009	Point 26	0	May 8, 2009	Point 46	0
April 9, 2009	Point 27	0	May 8, 2009	Point 47	0
April 9, 2009	Point 28	0	May 8, 2009	Point 48	EUCD
April 9, 2009	Point 29	0	May 8, 2009	Point 49	EUCD
April 10, 2009*	Point 30	0	May 8, 2009	Point 50	EUCD
April 10, 2009	Point 31	0	May 8, 2009	Point 51	BTSP
April 10, 2009	Point 32	0	May 8, 2009	Point 52	0
April 10, 2009	Point 33	0	May 8, 2009	Point 53	0
May 7, 2009	Point 1	0	May 8, 2009	Point 54	0
May 7, 2009	Point 2	0	May 8, 2009	Point 55	0
May 7, 2009	Point 3	0	May 8, 2009	Point 56	0
May 7, 2009	Point 4	HOLA	May 8, 2009	Point 57	0
May 7, 2009	Point 5	HOLA	May 8, 2009	Point 58	0
May 7, 2009	Point 6	0	May 8, 2009	Point 59	0

Table 6-5. Point count data.

Date	Survey Point	Species Found	Date	Survey Point	Species Found
May 7, 2009	Point 7	0	May 8, 2009	Point 60	0
May 7, 2009	Point 8	0	May 8, 2009	Point 61	0
May 7, 2009	Point 9	RTHA, HOLA	May 8, 2009	Point 62	0
May 7, 2009	Point 10	0	May 8, 2009	Point 63	0
May 7, 2009	Point 11	0	May 8, 2009	Point 64	0
May 7, 2009	Point 12	0	May 9, 2009	Point 65	BTSP
May 7, 2009	Point 13	0	May 9, 2009	Point 66	BTSP
May 7, 2009	Point 14	HOLA	May 9, 2009	Point 67	WFIB, EUCD
May 7, 2009	Point 15	0	May 9, 2009	Point 68	EUCD
May 7, 2009	Point 16	0	May 9, 2009	Point 69	LETH, BTSP
May 7, 2009	Point 17	0	May 9, 2009	Point 70	0
May 7, 2009	Point 18	0	May 9, 2009	Point 71	0
May 7, 2009	Point 19	0	May 9, 2009	Point 72	0
May 7, 2009	Point 20	0	May 9, 2009	Point 73	0
May 9, 2009	Point 74	0	May 29, 2009	Point 45	0
May 9, 2009	Point 75	0	May 29, 2009	Point 46	0
May 9, 2009	Point 76	0	May 29, 2009	Point 47	0
May 9, 2009	Point 77	0	May 29, 2009	Point 48	EUCD, HOSP
May 9, 2009	Point 78	0	May 29, 2009	Point 49	EUCD
May 9, 2009	Point 79	0	May 29, 2009	Point 50	GTGR, EUCD, HOLA
May 9, 2009	Point 80	0	May 29, 2009	Point 51	0
May 9, 2009	Point 81	0	May 29, 2009	Point 52	HOSP
May 28, 2009	Point 1	0	May 29, 2009	Point 53	WEKI, EUCD
May 28, 2009	Point 2	HOLA	May 29, 2009	Point 54	EUCD
May 28, 2009	Point 3	BTSP	May 29, 2009	Point 68	EUCD
May 28, 2009	Point 4	0	May 29, 2009	Point 67	TUVU
May 28, 2009	Point 5	HOLA	May 29, 2009	Point 74	0
May 28, 2009	Point 6	BTSP	May 29, 2009	Point 75	0
May 28, 2009	Point 7	0	May 29, 2009	Point 55	0
May 28, 2009	Point 8	0	May 29, 2009	Point 56	0
May 28, 2009	Point 9	BTSP	May 29, 2009	Point 57	0
May 28, 2009	Point 10	0	May 29, 2009	Point 58	HOLA
May 28, 2009	Point 11	0	May 29, 2009	Point 59	0
May 28, 2009	Point 12	0	May 29, 2009	Point 60	CORA
May 28, 2009	Point 13	HOLA	May 29, 2009	Point 61	0
May 28, 2009	Point 14	0	May 29, 2009	Point 62	HOLA
May 28, 2009	Point 15	0	May 30, 2009	Point 30	0
May 28, 2009	Point 16	0	May 30, 2009	Point 31	0
May 28, 2009	Point 17	0	May 30, 2009	Point 32	0
May 28, 2009	Point 18	0	May 30, 2009	Point 33	0
May 28, 2009	Point 19	0	May 30, 2009	Point 41	0
May 28, 2009	Point 20	0	May 30, 2009	Point 40	0
May 28, 2009	Point 21	0	May 30, 2009	Point 39	0
May 28, 2009	Point 22	0	May 30, 2009	Point 72	0
May 28, 2009	Point 23	0	May 30, 2009	Point 73	0
May 28, 2009	Point 24	0	May 30, 2009	Point 38	EUCD
May 28, 2009	Point 25	0	May 30, 2009	Point 37	0
May 28, 2009	Point 26	0	May 30, 2009	Point 63	0
May 28, 2009	Point 27	0	May 30, 2009	Point 64	HOLA
May 28, 2009	Point 28	0	May 30, 2009	Point 76	0
May 28, 2009	Point 29	0	May 30, 2009	Point 77	BTSP
May 29, 2009	Point 65	BTSP, LENH	May 30, 2009	Point 78	0
May 29, 2009	Point 66	BTSP	May 30, 2009	Point 79	0
May 29, 2009	Point 44	0	May 30, 2009	Point 36	0
May 29, 2009	Point 43	BTSP, EUCD	May 30, 2009	Point 35	0

Table 6-5. Point count data.

Date	Survey Point	Species Found	Date	Survey Point	Species Found
May 29, 2009	Point 69	0	May 30, 2009	Point 81	0
May 29, 2009	Point 70	HOLA	May 30, 2009	Point 34	0
May 29, 2009	Point 71	0	May 30, 2009	Point 80	0
May 29, 2009	Point 42	BTSP			

*Surveys suspended on April 10 due to high winds and approaching storm.
Codes: CORA = common raven; BTSP = black-throated sparrow; EUCD = Eurasian collared-dove; GTGR = great-tailed grackle; HOLA = horned lark; HOSP = house sparrow; LENH = lesser nighthawk; LETH = LeConte's thrasher; RTHA = red-tailed hawk; TUVU = turkey vulture; WEKI = Western kingbird; WFIB = white-faced ibis; WIWA = Wilson's warbler

6.4.2.2 Special Status Species

White-faced ibis (*Plegadis chihi*) is a proposed sensitive species by the BLM Nevada office and is a protected species under Nevada state law. A flock of approximately fifty White-faced ibis was recorded on May 9, 2009 on the alfalfa field just south of Amargosa Farm Road, and west of Casada Road.

Swainson's hawk (*Buteo swainsoni*) is considered a sensitive species by the BLM Nevada office and is a protected species under Nevada state law. Five Swainson's hawks were detected on the April 10, 2009 survey at the southwestern corner of the project area perched in and adjacent to the alfalfa field located just offsite to the south. These hawks were apparently feeding on large insects such as grasshoppers available in the field. This species is strongly migratory, and was not seen again on the project site.

Prairie falcon (*Falco mexicanus*) is considered a sensitive species by the BLM Nevada office and is a protected species under Nevada state law. Prairie falcons were detected three times during the surveys, always perched adjacent to agricultural fields. The first observation was on April 10, 2009, where one was perched on a telephone pole at the southwestern corner of the project area among the five Swainson's hawks mentioned above (Map 6-6). The second observation was on May 29, 2009, where one individual was also perched on a telephone pole adjacent to an alfalfa field just south of Amargosa Farm Road and west of Casada Road in the south central portion of the project area (Map 6-6). The third observation on May 30, 2009, was one perched on a telephone pole north of Amargosa Farm Road on the eastern portion of the site. It is likely that these agricultural fields regularly attract local prairie falcons due to the increased number of prey items such as insects and small birds available there. The adjacent desert habitats support relatively low numbers of prey items and would be utilized for hunting much less frequently.

Burrowing owl is considered a sensitive species by the BLM Nevada office and is a protected species under Nevada state law. Two burrows previously occupied by owls were located during the surveys. The first was May 28, 2009, where a complex of seven large kangaroo rat burrows was found in a small area. One of the burrows showed whitewash at the entrance, and a rodent bone was found as well as old pellets (Photo 6-17). The second burrow was found on May 29, 2009, in the southeastern portion of the site. This burrow had old whitewash next to it (Photo 6-18). Both of these burrow complexes had not been occupied in some time, as there were spider webs in the entrances, very old whitewash, and bleached rodent bones and old pellets. No fresh pellets or feathers or prey remains were found, which suggests occupancy by wintering owls. It would be expected that the majority of owls using this area would be wintering owls, and

a minority would remain to breed. Given the low productivity of the desert at this site, in terms of the very sparse vegetation and low insect and rodent populations, the only areas that are suitable for supporting breeding owls are those adjacent to the irrigated alfalfa fields.

Photo 6-17. Burrow with whitewash among complex of seven kangaroo rat burrows. An old rodent bone and old pellets were also found here. Photo taken by Kevin B. Clark on May 28, 2009.

Photo 6-18. Burrow with faded whitewash found in the southeastern portion of the study site on May 29, 2009. Photo by Kevin B. Clark

A local resident identified an occupied burrowing owl burrow one mile south of the project area along Casada Road in a residential lot adjacent to an alfalfa field on May 29, 2009. One owl was observed during the visit, though the resident said that a pair of owls had fledged several young earlier in the year.

In general, a low density of wintering owls could potentially occur throughout the property where there are suitable burrows. Breeding burrowing owls would be located adjacent to the alfalfa fields, where the prey base is significantly more abundant than the surrounding desert. The regular sightings of prairie falcons perched over those fields likely serve to limit the population of burrowing owls in the area.

LeConte's thrasher is considered a sensitive species by the BLM Nevada office and is a protected species under Nevada state law. LeConte's thrashers were detected on three occasions during the surveys. The first detection was on May 9, 2009 when three individuals were seen from a point count (Map 6-6, Photo 6-19). This likely represented a family group of adults and recently fledged young. The second detection was of a singing male with one fledgling on May 28, 2009 in the central portion of the site (Map 6-6, Photo 6-20). On May 29, 2009 a single adult thrasher was flushed while hiking back from a point count near the southwestern boundary of the site (Map 6-6). LeConte's thrasher naturally occurs at low densities, and since the entire site is potential habitat, it is likely that a small number of pairs are resident throughout the site.

Photo 6-19. Location of family group of three LeConte's Thrashers detected on May 9, 2009. Photo by Kevin B. Clark.

Photo 6-20. Site of singing LeConte's Thrasher with one fledgling on May 28, 2009. Photo by Kevin B. Clark.

Phainopepla (*Phainopepla nitens*) is considered a sensitive species by the BLM Nevada office and is a protected species under Nevada state law. A single Phainopepla was detected perched on a tamarisk tree in a residential portion of the project area on May 29, 2009.

No loggerhead shrikes or Bendire's thrasher were detected during the surveys. The only avian species detected during nocturnal surveys was lesser nighthawk (*Chordeiles acutipennis*).

6.5 General Mammal Surveys

Large mammal activity was searched for on foot and surveys were based on burrows, prints, scat, and other sign identified by certified wildlife tracking biologist, Shawn Smallwood. Foot searches were performed in late spring and small mammal trapping in early summer, 2009. In addition, documented distributions, counts and movement corridors were gathered from GIS data from the Nevada Department of Wildlife.

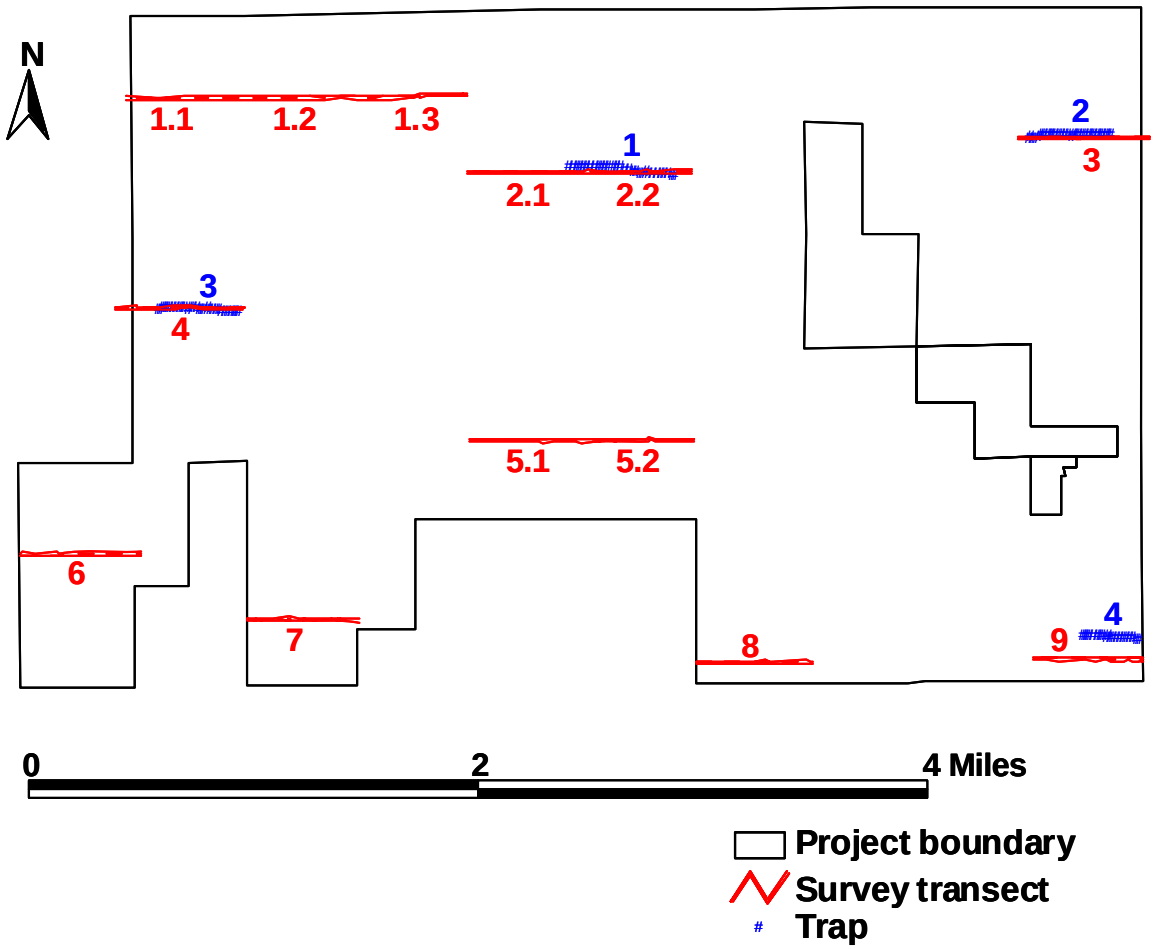
All wildlife species observed, including all mammals, amphibians, reptiles, and birds were noted during the general mammal surveys to aid in species list compilation. The presence and distribution of harvester ant colonies were also noted, as these are keystone species in desert communities.

6.5.1 Methods

Sections (or half-sections, if entire sections were cut off by residential areas of project boundaries) were systematically selected within the project area to sample the east-west and north-south extents of the project area. Within each section, ran-

domly selected numbers one through nine were used to represent transect starting points at tenth-mile segments from the southern to northern boundaries of the section. Thus, in the most southeastern half-section, the number 1 was chosen, so foot searches began 0.1 tenths of a mile from Ranch Road, the southern boundary of the half-section. Foot searches were along four parallel east-west transect segments separated by 15 meters for a total survey strip width of 60 meters extending between 0.5 and 1.5 km across the half-section, section, or parcel larger than a section that was selected. Along these survey strips (Map 6-7), a Trimble Geo-XT GPS was used to record locations of burrow systems constructed by kangaroo rats, pocket mice, ground squirrels, and carnivores, and locations of animal observations were also recorded. Other types of sign was recorded as well, such as tracks, scats, and carcasses, but some sign was omitted due to its ubiquity across the project area. For example, tracks or scats of coyote was not recorded, as individual coyote home ranges could cover the entire project area and these types of sign occurred in all survey areas.

Four sites for mammal live-trapping (Map 6-7) were selected. Because of time constraints to trap in four locations, arbitrarily selected sites were used to represent the east-west and north-south extents of the project area and to overlap with foot searches along surveyed strips. In the interests of representing the east-west distributions of small mammals, an unusually long inter-trap distance of about 20 m was used. The aim was for 60 trap nights per site. Twelve-inch Sherman live traps designed for kangaroo rats were used. In each trap ample bait was provided, consisting of bird seed mixed with peanut butter. All traps were provisioned with four clean cotton balls for thermal protection, and traps were placed to the westward side of creosote bushes to minimize exposure to morning sun. Traps were set each evening and checking them began at about 05:30 hours. Captured animals were identified to species and released immediately afterwards.



Map 6-7. Study design for mammal surveys in the Amargosa Farm Road Solar Project site, Nye County, Nevada. Blue numbers denote trapping sites and red numbers denote segments of foot survey transect segments.

6.5.2 Results

Evidence for the presence of 12 mammal species (Table 6-6) was found. No mammal species were detected that were unexpected or exceptionally rare. After 240 trap nights (238.5 effective trap nights), 87 small mammals were captured representing five species (Table 6-6 and Table 6-7). Trap results did not indicate any strong east-west or north-south gradients in small mammal species abundance (Figure 6-2).

In addition to those listed below, a bighorn sheep skull was found in Fortymile Wash. See Map 2-1 for known bighorn sheep areas in the region. Feral burro tracks were common; a map of recognized herd management areas is shown on Map 6-8, below.

Table 6-6. Mammals (other than bats) observed in the Amargosa Farm Road Solar Project site during spring 2009.

Common Name	Species Name	Evidence	Location(s)
Mammals			
Deer mouse	*Peromyscus maniculatus*	captured	widespread
Little pocket mouse	*Perognathus longimembris*	captured	widespread
Long-tailed pocket mouse	*Perognathus formosus*	captured	northwest
Merriam's kangaroo rat	*Dipodomys merriami*	captured	widespread
White-tailed antelope squirrel	*Ammospermophilus leucurus*	captured	northwest
Desert cottontail	*Sylvilagus audubonii*	seen	widespread
Black-tailed jackrabbit	*Lepus americanus*	seen	widespread
Domestic dog	*Canis familiaris*	tracks	north
Coyote	*Canis latrans*	tracks, scat, burrows	widespread
Kit fox	*Vulpes velox*	Seen	widespread
Burro	*Equus asinus*	tracks, scat	widespread
Sheep sp.	*Ovis* sp.	tracks	west side

Table 6-7. Trapping results at Site 1 at 0.7 miles north of Frontier Road and between Powerline and T&T Roads, Site 2 at 0.6 miles north of Frontier Road and east of OCR track, Site 3 at north of Amargosa Farm Road west of Casada Road, and Site 4 at 0.2 miles north of Ranch Road and between the eastern project boundary and School Road.

		Site			
Results	Species	1	2	3	4
Trap nights		60	60	60	60
Open traps		49	32	37	35
Closed but empty		0	2	0	1
Effective trap nights		60	59	60	59.5
Deer mouse	*Peromyscus maniculatus*	0	1	1	0
Merriam's kangaroo rat	*Dipodomys merriami*	11	25	18	20
Little pocket mouse	*Perognathus longimembris*	2	0	3	4
Long-tailed pocket mouse	*Perognathus formosus*	1	0	0	0
White-tailed antelope squirrel	*Ammospermophilus leucurus*	0	0	1	0
Total captures		14	26	23	24
Captures/trap nightx100 percent		23 percent	44 percent	38 percent	40 percent
Trap deaths		0	0	0	0

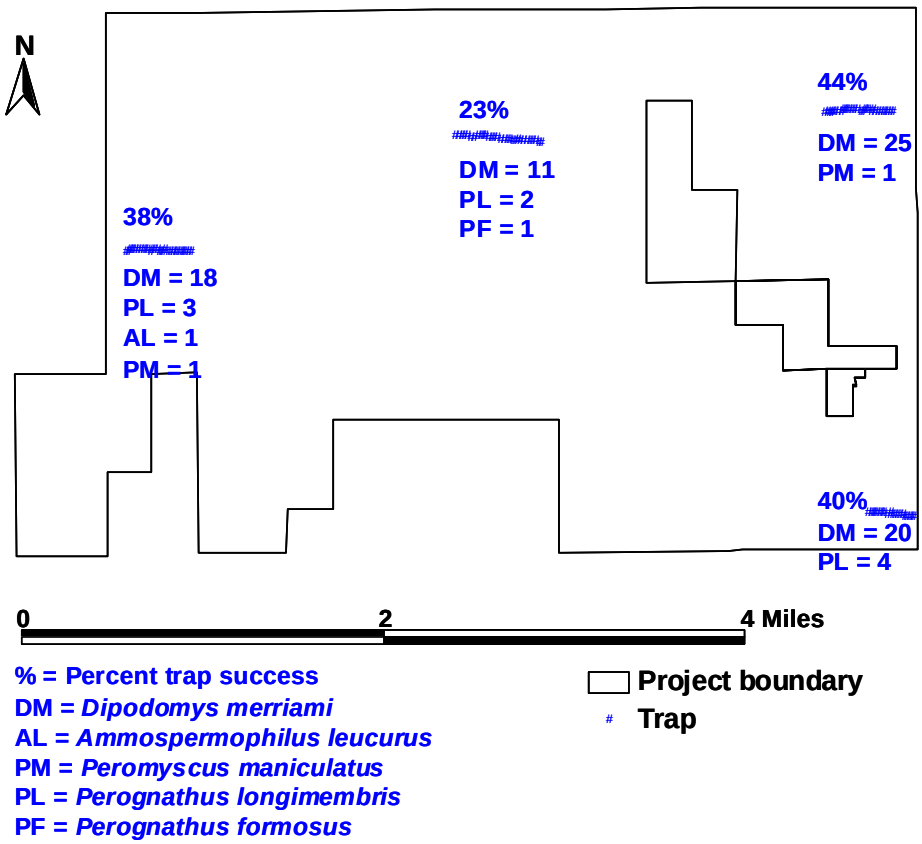


Figure 6-2. Small mammal trapping results in the Amargosa Farm Road Solar Project site, 2009.

The spatial pattern of Merriam's kangaroo rat burrow systems appeared to be uniform among survey strips (no significant correlations were found grading east-west or north-south), though burrows were strongly clustered within survey strips (Figure 6-3). Pocket mouse burrow systems did not grade north-south, but they did decline from west to east ($r^2 = 0.67$, SE = 0.41, $P < 0.001$):

$$Y = 1.797 * e^{-0.158(X+1)},$$

where Y = burrow systems per ha, and X = distance (m) from western boundary (Figure 6-4 and Figure 6-5). The highest densities of pocket mouse burrow systems were along the western edge of the project area.

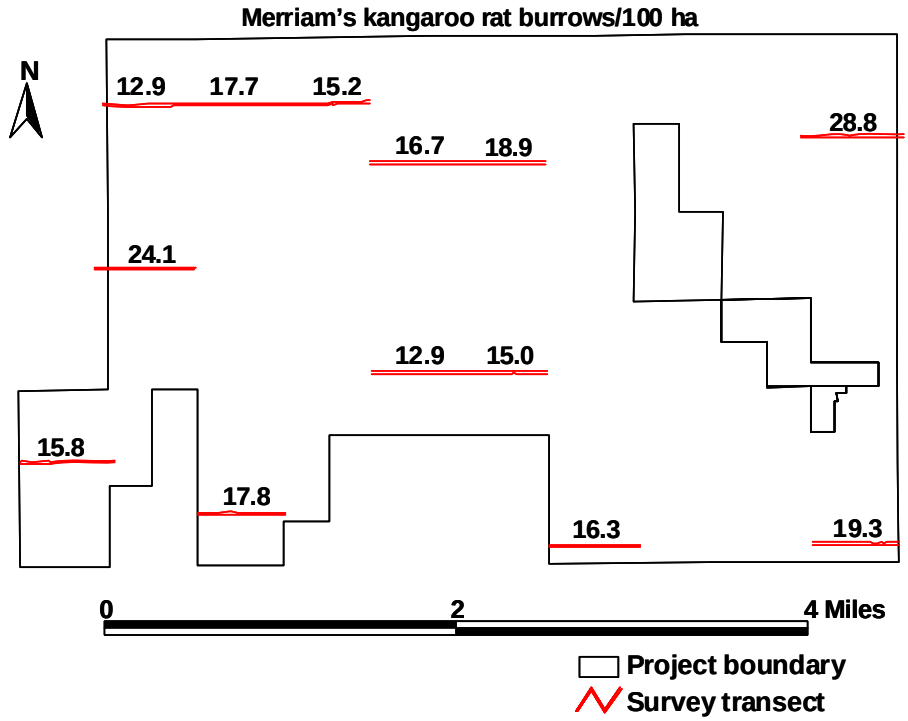


Figure 6-3. Merriam's kangaroo rat burrow systems per 100 ha along survey transect segments in the Amargosa Solar Power Project area, 2009.

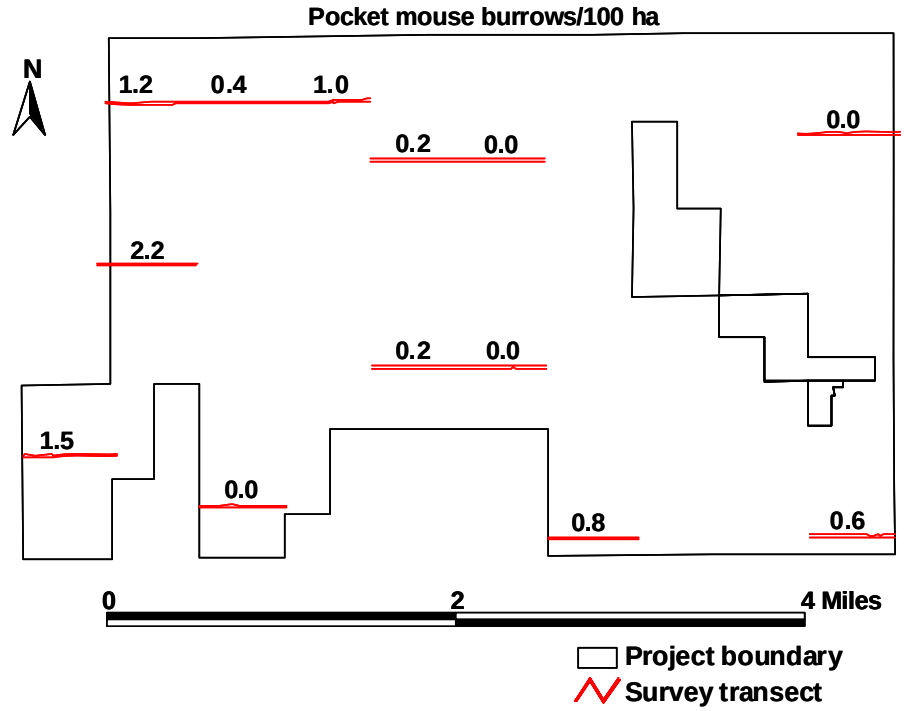


Figure 6-4. Pocket mouse burrow systems per 100 ha along survey transect segments in the Amargosa Farm Road Solar Project site, 2009.

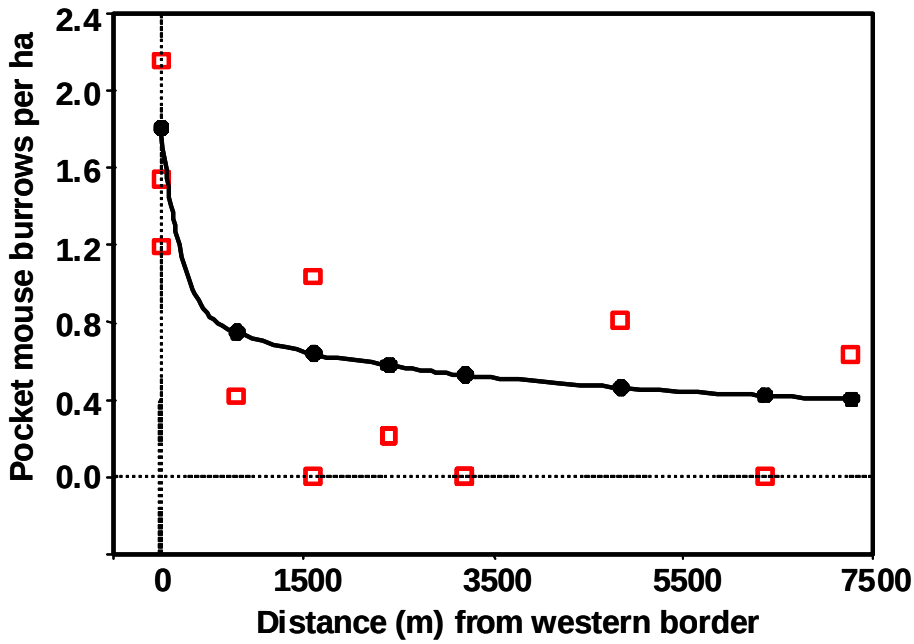


Figure 6-5. Pocket mouse burrow systems per 100 ha along survey transect segments in the Amargosa Farm Road Solar Project site, 2009.

Lizard density did not grade north-south, but it declined from west to east (r^2 = 0.43, SE = 47.18, $P < 0.05$):

$$Y = 176.385 - 0.017X$$

where Y = lizards per 100 ha, and X = distance (m) from western boundary of project area (Figure 6-6 and Figure 6-7). Harvester ant colonies did not grade significantly from north to south or east to west (Figure 6-8). Bird species and individual reptile species were observed too sporadically to justify tests of significant spatial gradients within the study area.

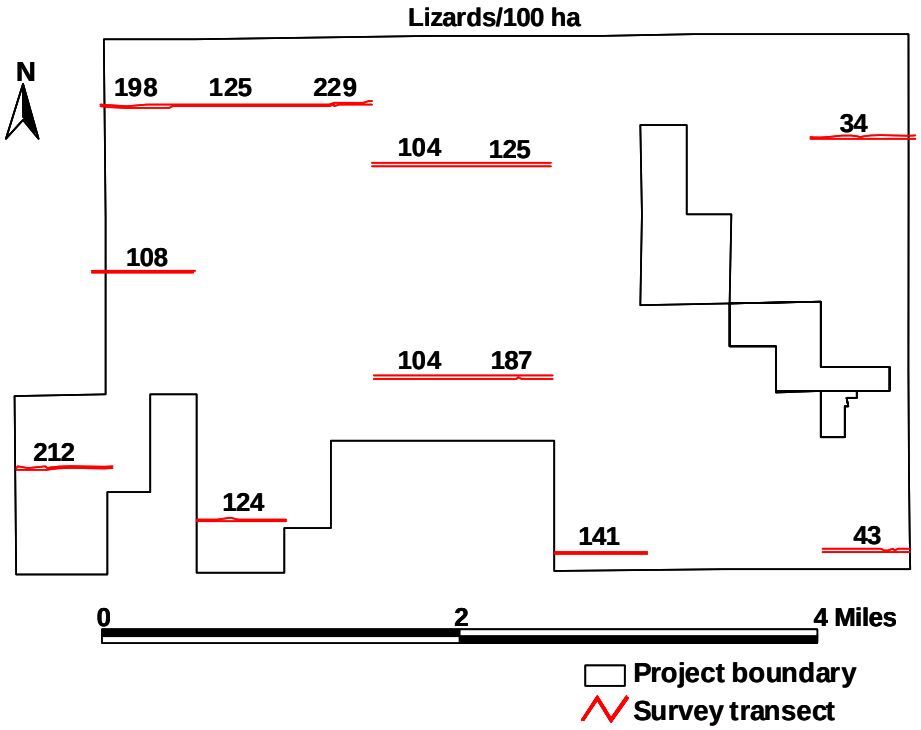


Figure 6-6. Lizards seen per 100 ha along foot survey transect segments for mammals in the Amargosa Farm Road Solar Project site, 2009.

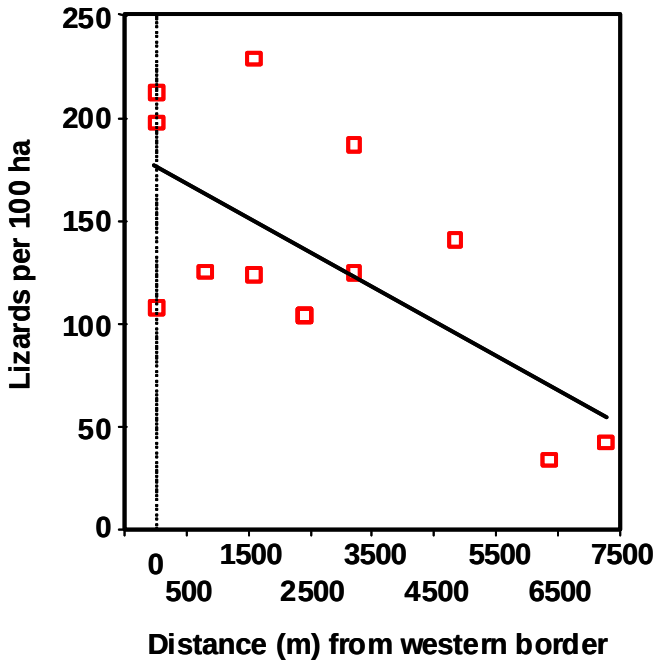


Figure 6-7. Lizards seen while surveying for mammals declined in abundance with increasing distance from the western boundary of the Amargosa Farm Road Solar Project site.

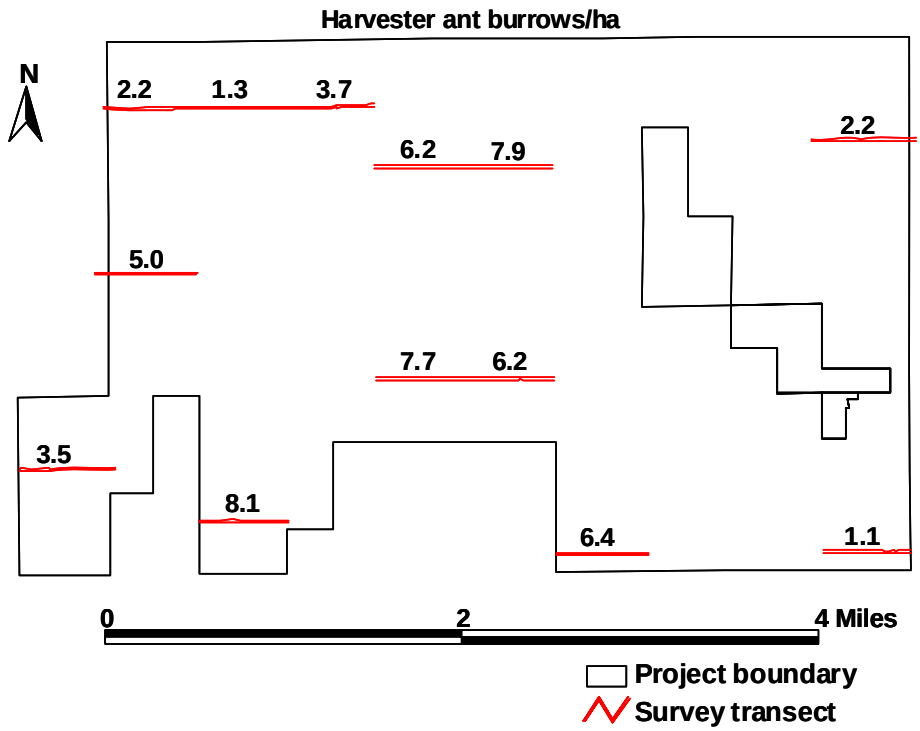
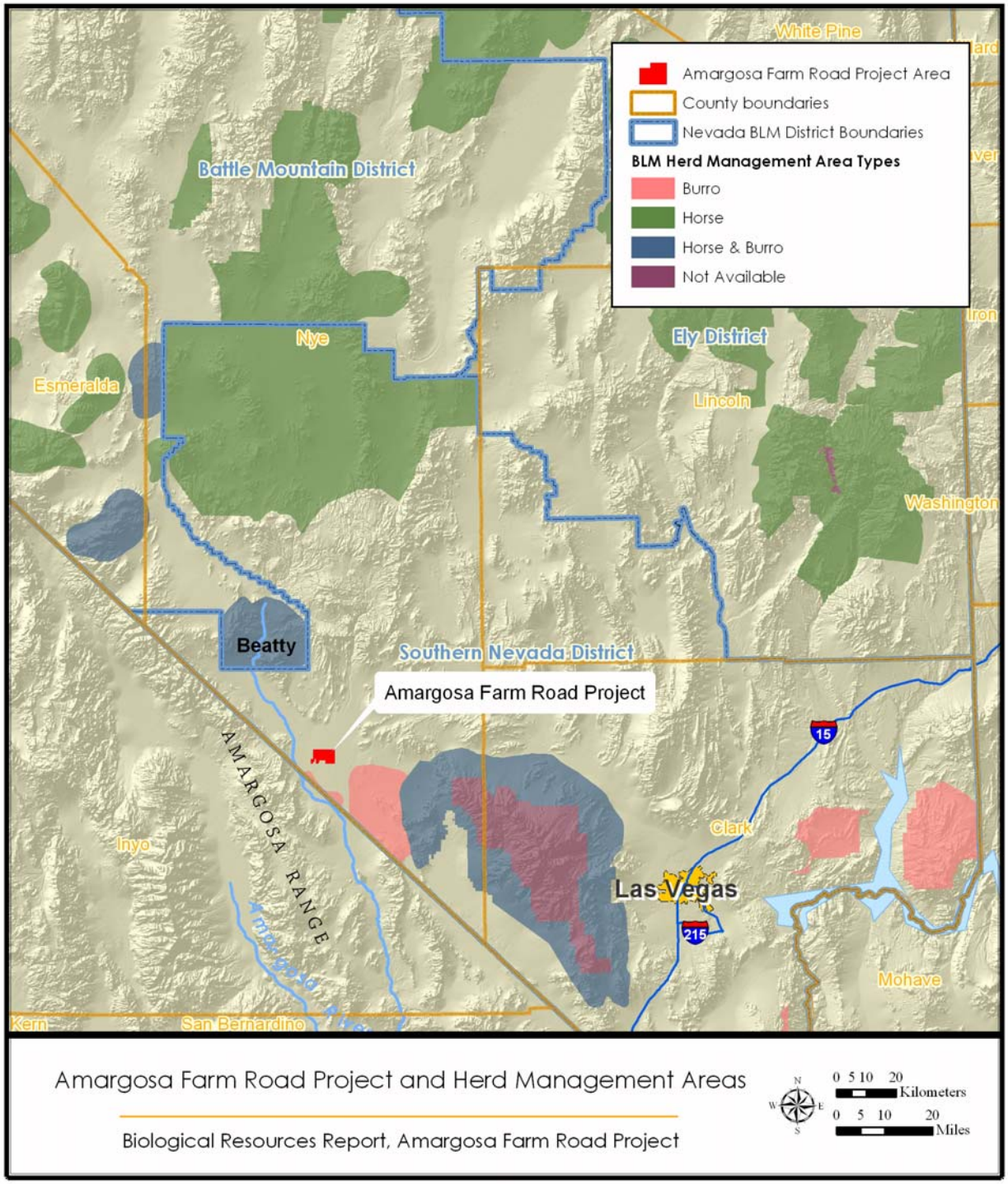


Figure 6-8. Harvester ant burrows per ha observed while surveying for mammals along foot survey transects in the Amargosa Farm Road Solar Project site, 2009.

6.5.3 Discussion

There were no special-status species of mammal detected in the project area. Of the species detected, pocket mice were most abundant along the west side of the project area, and declined eastward. Lizards also were most abundant along the west side of the project area, declining to the east. Harvester ant colonies were most abundant in the middle of the project area (Figure 6-8), and anecdotally birds were most abundant and most diverse along the west side of the project area. Biological impacts caused by the project could probably be minimized by favoring the eastern aspect of the project area for development.



Map 6-8. Herd management areas near Amargosa-Farm Road Solar Project site.

6.6 Bat Surveys

6.6.1 Methods

Surveys to document the bat community within the project area were conducted by a way of active searches of known and potential activity sites and by placement of sonar detection units at various locales throughout the project area. The analysis of the sonar tracings recorded by the passive recorders (described below) was done by Michael J. O'Farrell, a mammalogist and recognized expert on Nevada bats.

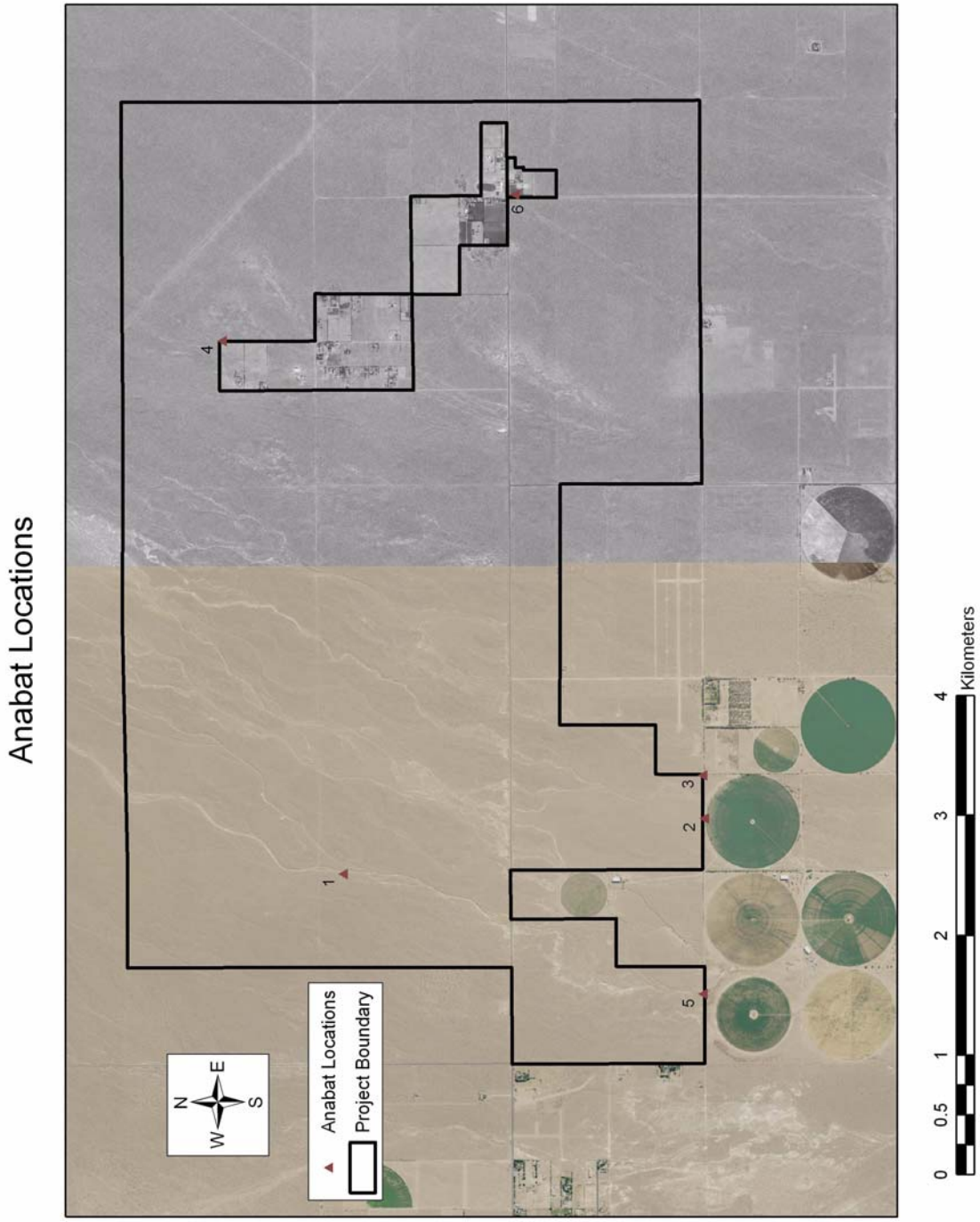
Jim Kellogg performed all field visits and installed the bat monitoring equipment. The locations were determined after an initial trip was made and active searches identified areas deemed likely to contain the most bat activity. This assessment was made by Mr. Kellogg who is familiar with bat behavior and habitat tendencies. Areas that appeared to have the highest likelihood of bat productivity; roosting structures, flying corridors, and abundant prey, were isolated and a bat monitoring station was installed.

Active searches took place from dusk to midnight (highest level of bat activity) and involved walking various portions of the property and observing bat activity. In doing so it was possible to maximize the amount of bat recordings compared to randomly selecting station locations. The stations recorded bat activity over the entire course of the evening and into the morning until around dawn.

Mobile acoustic monitoring units were placed at the five locations (Map 6-9). See Photo 6-21 through Photo 6-24 and Map 6-9 for individual Anabat unit site locations. Each mobile acoustic unit contained a microphone encased in a protective shroud utilizing a reflector plate to collect bat vocalizations and mounted on a ground level stand (Photo 6-23). The reflector plate is intended to be oriented to provide a 45° angle upwards for the volume of detection. The remaining equipment consisted of an Anabat II bat detector, a Compact Flash storage Zero-crossings Analysis Interface Module (CF ZCAIM), and a rechargeable battery encased in a weatherproof NEMA case. The detector and CF ZCAIM were from Titley Electronics, Ballina, New South Wales, Australia. The reflector/shroud assembly (bat-hat) was from EME Systems, Berkeley, California.

The battery capacity (7.5 amp hour) provided sufficient power to operate the equipment all night, every night for approximately a week. The acoustic data were stored as a single digital file on a Compact Flash memory card. Each location file is interpreted using CFCread, an Anabat utility software, which produces discrete Anabat sequence files varying in size from 1 to 15 seconds (sec) in length. The algorithm adds a length of silence following recognized bat calls; that is, a file will be created within >5 sec of silence following a bat call. If bat calls are continuous for >15 sec, a file will be created at 15 second intervals. Each Anabat sequence filename is named with a time date code (e.g., B8012024.16#, where B = 2001, 8 = August, 01 = day of the month, 2024.16 = 8:24:16 PM).

Identification of species used the methods of O'Farrell *et al*. (1999) based on frequency characteristics, call shape, and comparison with a comprehensive library of vocal signatures developed by O'Farrell and colleagues. Thus, species richness (number of species verified as present) was obtained for each location.



Map 6-9. Anabat survey locations at the Amargosa Farm Road site.

Photo 6-21. Looking down the anabat in the wash (Location number 1), May 7-9 and 21-22, 2009.

Photo 6-22. Looking down the anabat system onto the alfalfa field along the southern end of the project area (Location number 2), May 21-22, 2009.

Photo 6-23. Looking along the anabat near the alfalfa field in the middle of the survey area (Location number 3), July 1, 2009.

Photo 6-24. Looking down the anabat along the wash (Location number 5), July 2-4, 2009.

6.6.2 Results

Bats were recorded over 16 nights of passive acoustic surveys, at the various locations where Anabat units were placed. The most productive location was adjacent to the alfalfa fields along the road, most likely due to the available forage resulting from agricultural activities.

Table 6-8. Summary of the number of files and species richness (S).*

Location Number	Survey Dates	Files	S*
1	May 7-9, 2009	21	3
1	May 21-22, 2009	56	3
2	May 21-22, 2009	358	5
3	July 1-4, 2009	623	5
4	July 1, 2009	5	2
5	July 2-4, 2009	717	4
6	July 5, 2009	113	4

Bat species are identifiable by the unique sonar sounds they emit while in flight. All of the recordings were evaluated by Mr. O'Farrell, who is a bat expert specialized in reading sonar recordings to determine species.

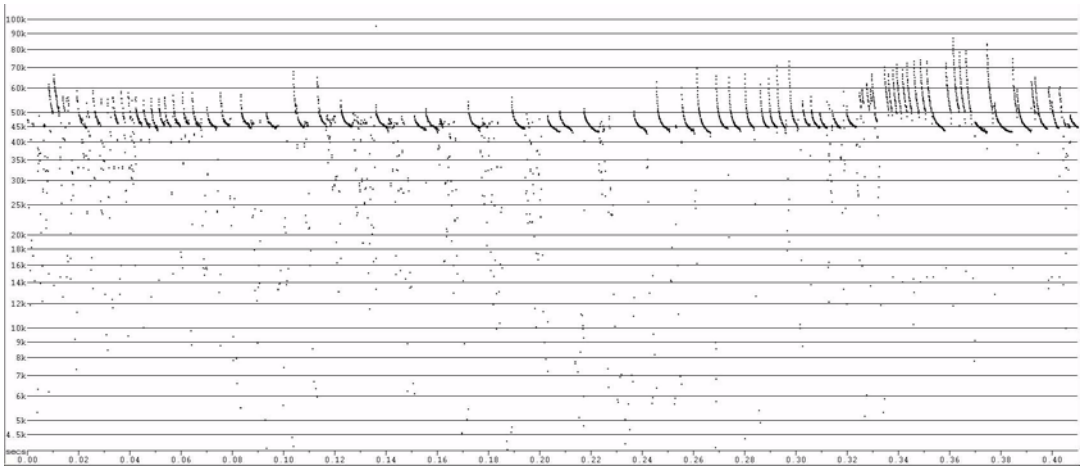
Figures 6-9 and 6-10 shows some of the time-frequency displays of the calls recorded during these surveys. A total of six species of bats were recorded (Table 6-9), including one listed as Nevada Sensitive, two listed as Nevada protected, and two listed as federal Species of Concern (four total special status species).

Table 6-9. Checklist and status of bats found to occur within the property, 2009.

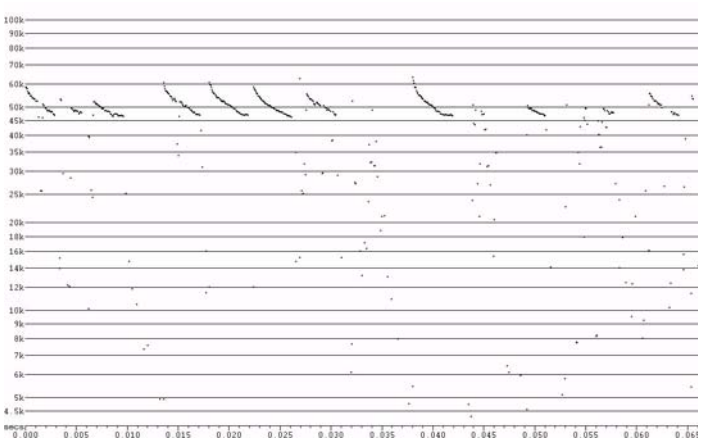
Family/Species	Common Name
Vespertilionidae	
Myotis californicus	California myotis
Myotis yumanensis	Yuma myotis ++
Parastrellus hesperus	Western parastrelle
Corynorhinus townsendii townsendii	Pacific western big-eared bat **,++
Antrozonous pallidus	Pallid bat ‡
Molossidae	
Tadarida brasiliensis	Brazilian free-tailed bat ‡

** Nevada-listed Sensitive
‡ Nevada-listed Protected
++ Federal Species of Special Concern (formerly Category 2 for Federal Listing)

***Myotis californicus* - California Myotis**



***Myotis yumanensis* - Yuma Myotis**



***Parastrellus hesperus* - Western Parastrelle**

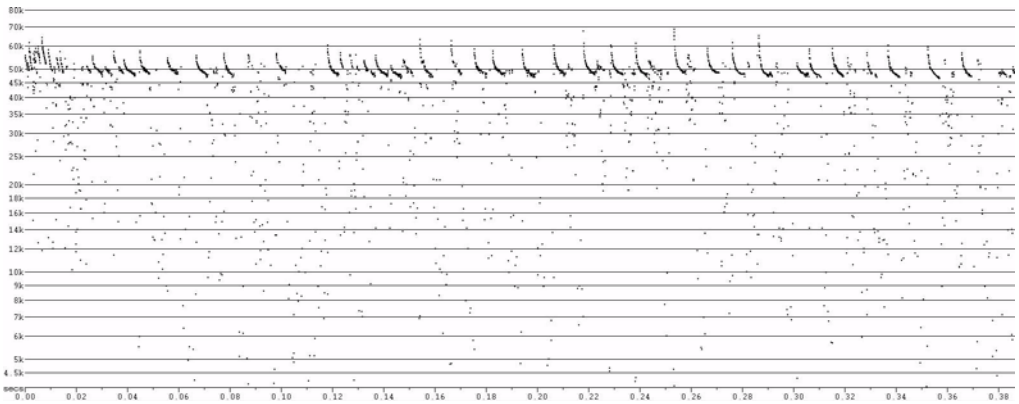
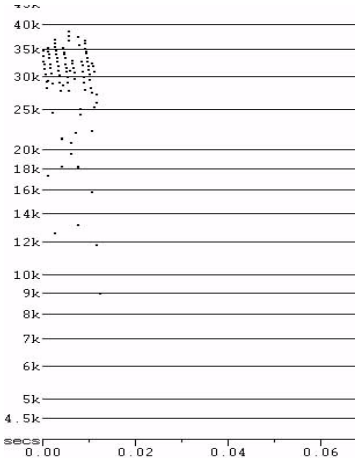
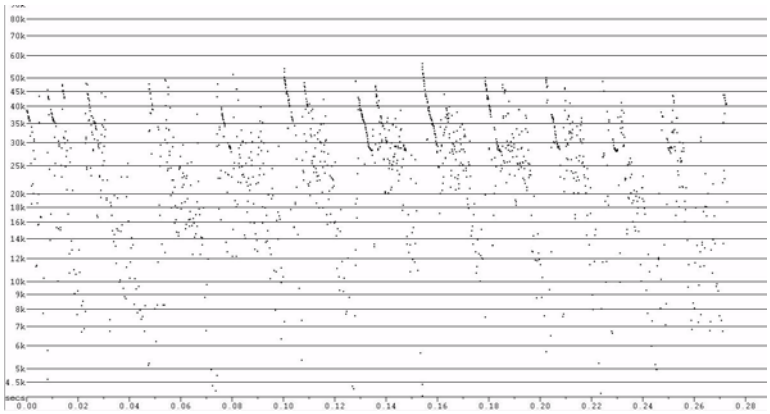


Figure 6-9. Samples of sonar time-frequency displays recorded by the Anabat recorders at Amargosa Valley.

***Corynorhinus townsendii townsendii* - Pacific Western Bat**



***Antrozonous pallidus* - Pallid Bat**



***Tadarida brasiliensis* - Brazilian Free-Tailed Bat**

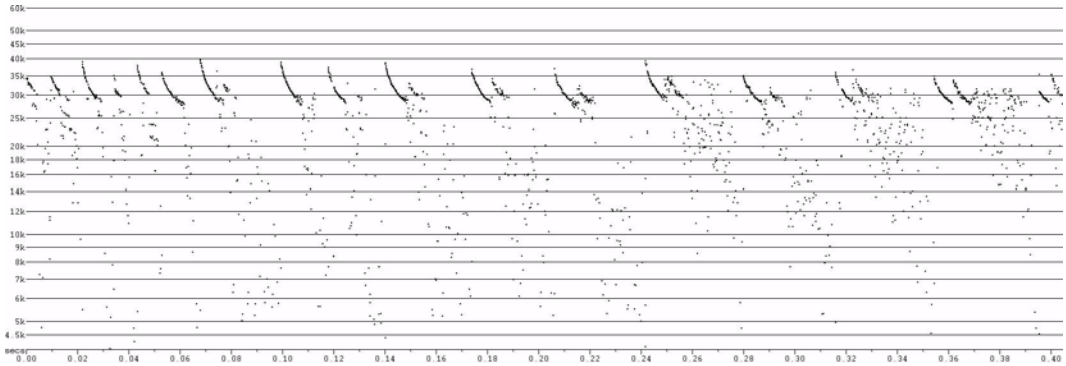


Figure 6-10. Samples of sonar time-frequency displays recorded by the Anabat recorders at Amargosa Valley.

6.6.2.1 Profiles for Bats Confirmed Present

The following species profiles were digested from Bradley *et al.* 2006, *The Revised Nevada Bat Conservation Plan.*

California Myotis *(Myotis californicus)* - BLM Sensitive, NNHP G5S4

The California Myotis is widespread throughout Nevada, but is more common in the south. It is a year-round resident. In the winter, it hibernates but periodically arouses to actively forage and drink in the water. It day roosts in crevices including mines, caves, buildings, rocks, hollow trees, and under exfoliating bark for surrounding areas. Night roosts include a wider variety of structures. The California myotis consumes small moths, flies, and beetles.

Yuma Myotis *(Myotis yumanensis)* - BLM Sensitive, NNHP G5S3S4

The Yuma myotis is known from the southern and western half of Nevada. Reflecting this wide distribution, it may occur in a full range of habitats including sagebrush, salt desert scrub, agriculture, playa, and riparian. It is more tolerant of human disturbance than other bats. It is a year-round resident. It roosts day and night in buildings or under bridges. Day roosts may also include trees, rock crevices, mines, or caves. It depends primarily on aquatic insects for food. It is usually foraging over relatively still water such as ponds, reservoirs, or pools.

Western Parastrelle *(Parastrellus hesperus)* (previously known as Western Pipstrelle or *Pipistrellus hesperus*) - BLM Sensitive, NNHP G5S4

The western parastrelle is found throughout most of Nevada, most commonly at low to middle elevations. It is considered common in appropriate habitat. Plant communities occupied by this species include desert habitats of blackbrush, creosote, salt desert scrub, and sagebrush, with occasional occurrence in Ponderosa pine and pinyon-juniper, usually in association with rocks or canyons. It is a year-round resident, hibernating, and arousing on occasion to forage and drink. Roosting during the day as individuals or small groups, it is mostly found in rock crevices, mines, caves, buildings, and vegetation. It forages for small moths, leafhoppers, mosquitoes, and flying ants.

Pacific Western Big-eared Bat *(Corynorhinus townsendii townsendii)* - Nevada State Sensitive, BLM Sensitive, USFS Sensitive, NNHP G4S2

The Pacific western big-eared bat is found throughout Nevada from the low desert to high mountains. Its distribution is tied to the availability of caves and abandoned mines. Found from low desert to lower, mid to high-elevation mixed coniferous-deciduous forest, including pinyon juniper-mahogany, white fir, blackbrush, sagebrush, salt desert scrub, agricultural, and occasionally in urban habitats. It is a year round resident, hibernating and arousing through the winter to move, forage, and drink. This is a species that primarily depends on mines and caves, also using buildings and holes in trees.

This species is a moth strategist, and may travel great distances to forage. Telemetry studies in northern Nevada have revealed over 95 percent of foraging activity to be concentrated in open forest habitats of pinyon, juniper, mahogany, white fir, aspen, and cottonwood (Bradley, 200a, cited in Bradley *et al.* 2006).

Pallid Bat *(Antrozonous pallidus)* - Nevada State Protected, BLM Sensitive, NNHP G5S3

The pallid bat is found throughout Nevada in a wide range of habitat from low desert to coniferous forest. It is a year-round resident that hibernates, but rouses occasionally to drink and forage through the winter. Day roosts may include rocks, mines, caves, hollow trees, buildings and bridges. Night roosts include bridges, caves, and mines.

The pallid bat's food includes large moths and ground arthropods (scorpions, centipedes, millipedes, grasshoppers, long-horned beetles, Jerusalem crickets). Pallid bats may actually land to take prey (Bradley *et al.* 2006).

Brazilian Free-tailed Bat *(Tadarida brasiliensis)* - State Protected, BLM Sensitive, NNHP G5S3S4

The Brazilian free-tailed bat is widespread through most of Nevada, ranging from the low desert to high mountains. It is a summer resident found in a wide range of habitats. Migrations of 1,840 km are documented for this species (Wilkins 1989). Day roosts may include cliff faces, mines, caves, buildings, bridges, and hollow trees. Although colonies number in the millions in some areas, colonies in Nevada are generally several hundred to several thousand (largest known colonies have been estimated at ca. 70,000-100,000) (Bradley *et al.* 2006). It primarily consumes moths. Some individuals are known to travel more than 40 km to reach feeding grounds and feed more than 300 m above the ground (Bradley *et al.* 2006).

7.0 Delineation of Wetlands and Waters of the U.S.

7.1 Introduction and Purpose

This narrative reports on the work to delineate all wetlands and non-wetland waters of the U.S., both jurisdictional and non-jurisdictional, on the approximately 7,810-acre project area for a right-of-way application known as the Amargosa-Farm Road Solar Project (U.S. Bureau of Land Management (BLM) Land Use Application File NVN 84359).

A jurisdictional delineation was conducted based on the 1987 U.S. Army Corps of Engineers (USACE) Wetland Manual; USACE Arid West Supplement (December 22, 2006 version 2.0); USACE Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States (2008); USACE Sacramento District's "minimum standards;" combined with any Clean Water Act Section 401 areas of concern. A jurisdictional wetland delineation and determination of waters of the U.S. identifies the legal boundaries within which the USACE has regulatory jurisdiction. Wetlands are a type and subset of waters of the U.S. The objective of a delineation is to provide sufficiently detailed and accurate field surveys and reporting to support the subsequent assessment of impact, permit processing and mitigation planning.

The assessment of jurisdictional waters and wetlands was conducted by Tierra Data Inc. Senior Ecologist Elizabeth M. Kellogg and biological technician Joseph Kean. Field visits took place in 2009 on March 20, April 23-25, May 8, and June 9-10. Interpretation of hydrologic patterns was assisted by Tory Walker of Tory R. Walker Engineering, Inc.

The USACE shares regulatory authority with the U.S. Environmental Protection Agency (EPA) over waters of the U.S. under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899. Jurisdictional wetland determinations are necessary for land owners and managers to comply with the relevant laws, which require permits if impacting these ecologically valuable jurisdictional resources.

Although their physical area is relatively small, ecosystem functions in waters and wetlands profoundly affect the natural vitality of a region. The reason there has been a national focus on wetlands is in part because so few remain from presettlement times. Historic losses have been detrimental to bird, mammal, fish, and other wildlife populations. Also, wetland degradation can be caused by seemingly unrelated or indirectly connected activities, such as changes in upstream drainage contours, altered runoff from upslope developments including roads, pumping, or plowing too deeply in a claypan. Effects originating offsite have necessitated comprehensive regulation in order to adequately protect wetland resources.

7.2 Legal Framework

The USACE regulates "discharge of dredged or fill material" into "waters of the U.S., which includes tidal waters, interstate waters, and all other waters that are part of a tributary system to interstate waters or to navigable "waters of the U.S.," the use, degradation, or destruction of which could affect interstate or foreign commerce or which are tributaries to waters subject to the ebb and flow of the tide (33 CFR 328.3(a)). The regulation is pursuant to Section 404 of the CWA and to a precursor of the CWA, Section 10 of the Rivers and Harbors Act of 1899. The USACE generally takes jurisdiction of rivers and streams to the OHWM determined by erosion, the deposition of vegetation or debris, and changes in vegetation. The law requires authorization from the Secretary of the Army, acting through the Corps of Engineers, for the construction of any structure in or over any navigable water of the United States, or any other water of the U.S. Structures or work outside the limits defined for navigable waters of the United States also require a Section 10 permit if the structure or work affects the course, location, or condition of the water body. The law applies to any modification of a water of the United States, and to all structures, from the smallest floating dock to the largest commercial undertaking.

Before the USACE will issue a Section 404 permit, applicants must receive a Section 401 Water Quality Certification from the Nevada Department of Environmental Protection, Bureau of Water Quality Planning. If a CWA Section 404 permit is not required for a project, the State may still require a 401 Certification.

7.2.1 Framework of Federal Waters of the U.S. Delineation

A jurisdictional delineation of waters of the U.S. and wetland delineation identifies the legal boundaries within which the USACE has regulatory jurisdiction. Wetlands are a type and subset of waters of the U.S. The Corps shares regulatory authority with the EPA over waters of the U.S. under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The objective of a delineation is to provide sufficiently detailed and accurate field surveys and reporting to support the subsequent assessment of impact, permit processing and mitigation planning. Jurisdictional wetland determinations are necessary for land owners and managers to comply with the pertinent laws that require that these ecologically valuable areas be protected.

Waters of the U.S. is a broader definition that includes all wetlands and tributaries to navigable waterways regulated under Section 404 of the CWA, all interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters. The USACE's jurisdiction in fresh waters includes the channel itself for waters (defined by the ordinary high water mark), to the outer edge of adjacent wetlands. Some water bodies are specifically exempted, such as irrigation ditches or drainage ditches excavated in uplands.

The agencies and jurisdictions involved in federal wetland regulation are listed in Table 7-1.

Table 7-1. Jurisdictional authorities over wetlands and other regulated waters.

Agency	Regulation	Authority	Jurisdiction
U.S. Environmental Protection Agency	Clean Water Act	Enforcement; veto power over a Corps-issued permit.	Waters of the U.S., including wetlands.
	NEPA, CEQA	Comment only.	
U.S. Army Corps of Engineers	Clean Water Act Section 404	Regulates dredge and fill.	Waters of the U.S., including wetlands.
	Rivers and Harbors Act Section 10	Regulates construction of structures, dredge and fill.	Navigable waters (subject to ebb and flow of the tide and could be used for interstate or foreign commerce).
U.S. Fish and Wildlife Service	Fish and Wildlife Coordination Act	Review and comment only.	Waters of the U.S., including wetlands.
	Endangered Species Act	USACE must consult with USFWS on 404 permits if endangered species on site.	
	CEQA, NEPA	Comment only.	
Natural Resource Conservation Service	Food Security Act, 59 CFR 12, January 19, 1994	Regulates activities in agricultural areas.	Farmed wetlands associated with agricultural lands. (USACE responsible in some counties where Natural Resource Conservation Service (NRCS) has not implemented its authority, mostly in the San Francisco Bay Area).
State and Regional Water Quality Control Boards, Nevada Bureau of Water Quality Planning	Clean Water Act Section 401	Issues water quality certification, which is required for 404 permit.	Waters of the U.S., including wetlands.
	Clean Water Act Section 402	Regulates discharge of waste.	
	NEPA	Comment only.	

7.2.2 Recent Court Decisions

A U.S. Supreme Court ruling in the Solid Waste Agency of Northern Cook County vs. the USACE, No. 99-1178 (January 9, 2001), known as “the SWANCC Case”, held that the CWA does not give the federal government regulatory authority over non-navigable, isolated, intrastate waters. As a result of this decision, some previously regulated depressions such as mudflats, sandflats, wetlands, prairie potholes, wet meadows, playa lakes, natural ponds, and vernal pools which are not hydrologically connected to other intrastate or interstate “waters of the U.S.” are no longer regulated by the USACE.

Federal regulatory authority over wetlands and waters of the U.S. only extends to activities that affect interstate commerce pursuant to Article 1, Section 8 of the U.S. Constitution. In accordance with the interstate commerce requirement, USACE restricted its jurisdiction on isolated (intrastate) waters, such as ponds or vernal pools lacking connection to waters of the United States prior to 1985. The EPA issued a memorandum asserting USACE jurisdiction over isolated waters that are used or could be used by migratory birds or endangered species (51 Fed. Reg. 41217 [1986]). This became known as the “Migratory Bird Rule.” Consequently, the definition of “waters of the United States” in USACE regulations was modified to include isolated waters, such as vernal pools or mining ponds, which qualified under the Migratory Bird Rule.

With the SWANCC Case, the Court held that the Migratory Bird Rule is not a fairly supported interpretation of the term “waters of the United States.”

The SWANCC ruling, however, did not refute USACE jurisdiction and Section 404's applicability to interstate waters, “navigable waters,” and waters and wetlands adjacent to or connected to navigable waters. The courts have found Congress' concern for protecting water quality and aquatic ecosystems is “inseparably bound up with” jurisdictional waters (474 U.S. at 134; 68 Fed. Reg. [2003]), and SWANCC upheld that wetlands adjacent to navigable waters “clearly remain jurisdictional” (68 Fed. Reg. [2003]). The written opinion notes that the court’s previous support of the USACE’s expansion of jurisdiction beyond navigable waters (United States v. Riverside Bayview Homes, Inc.) was for a wetland that abutted a navigable water and that the court did not express any opinion on the question of the authority of the USACE to regulate wetlands that are not adjacent to bodies of open water. In conclusion, the SWANCC ruling denied USACE jurisdiction over “non-navigable, isolated, intrastate” waters based only on use by migratory birds, but did not strike down any regulation or definition of “water of the United States” or adjacency. The opinion goes on to state: “In order to rule for the respondents here, we would have to hold that the jurisdiction of the USACE extends to ponds that are not adjacent to open water. We conclude that the text of the statute will not allow this. Therefore, we believe that the court’s opinion goes beyond the migratory bird issue and says that no isolated, intrastate water is subject to the provisions of Section 404(a) of the Clean Water Act (regardless of any interstate commerce connection)”.

Recent legislation in 2006 reaffirmed in two rulings (Rapanos v. United States and Carabell v. USACE), that the Clean Water Act has jurisdiction over wetlands that have a “significant nexus” to waters of the United States and that there is no requirement that the wetlands directly abut navigable waters of the United States. The use of the term “adjacent wetlands” as opposed to “isolated” wetlands, which include ephemeral streams and ponds, is taken to mean that connectivity exists to navigable waters. “Navigable waters” are defined as “waters of the United States.” In Carabell v. USACE, the Sixth Circuit Court of Appeals held that the Carabells' property contains wetlands adjacent to neighboring tributaries of navigable waters of the United States. Specifically, the Carabells' property is separated only by a man-made berm from a ditch that connects to the Sutherland-Oemig Drain, which connects to Lake St. Clair. Accordingly, the Carabells’ property was not isolated from waters of the United States but constitutes “adjacent wetlands” within the meaning of the CWA.

It should be noted that the courts have interpreted the criterion for adjacency broadly, and found that wetlands were “adjacent” even when separated by substantial distances or by substantial barriers. For example, one court found adjacency for lots one-half-mile from a navigable water and in another instance where a wetland was separated from a navigable water by a fifty-foot wide paved street.

The EPA and USACE have issued a joint Memorandum (5 June 2007) providing guidance on implementing the most recent Supreme Court decisions.

7.2.3 Executive Order 11990: Protection of Wetlands

The Protection of Wetlands Executive Order (EO) directs all federal agencies to "take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands." This applies to the acquisition, management, and disposal of federal lands and facilities; to construction of improvements undertaken, financed, or assisted by the federal government; and to the conducting of federal activities and programs affecting land use, including but not limited to water and related land resource planning, regulating, and licensing activities. Under this EO, agencies are also required to consider "factors relevant to a proposal's effect on the survival and quality of the wetlands." One such factor is the "...maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources..."

Section 4 of the EO requires that when federally owned lands are leased and easement is assigned, or when disposed of to a non-federal party, a reference be included in the conveyance to identify any wetlands and indicate those uses which are restricted in such areas.

7.2.4 State of Nevada Wetland Protection and Water Quality Certification

The State of Nevada implements its wetland and water quality protection through the federal Clean Water Act Section 401 water quality protection pathway. Protecting and rehabilitating wetlands is recently focused on the competition for water rights for land and water resources required for increasing urban, agricultural, and transportation system developments. Recent projects by Nevada Department of Wildlife (NDOW), Nevada Division of State Lands (NDSL), and federal agencies are focused on purchasing water rights for premier wetland areas to provide for long-term stabilization of core wetland habitats. The most significant wetland areas in Nevada are already located within state wildlife management areas, federal wildlife refuges, tribal lands, and other specially designated management units. The NDOW has acquired or leased large tracts of land to establish 12 wildlife management areas (WMAs), 10 of which contain 59,250 acres of wetlands and open waters.

The Nevada Division of Environmental Protection (NDEP) - Bureau of Water Quality Planning (BWQP) must certify water quality protection plans of any federal permit (33 CFR and Clean Water Act, Section 402). Any individual 404 permit issued by the Corps requires 401 certification from BWQP. An individual certification is needed for any Corps 404 nationwide permit when the NDEP requires a discharge permit for the proposed project.

7.3 Existing Conditions and Literature Review

Primary access to the site is Amargosa Farm Road, which traverses east-west through the site. The property extends east from near Valley View Road, and west from Highway 373. These are the primary access routes to the site. See Figure 7-1 for roads and a 2009 aerial photo depiction of the site.

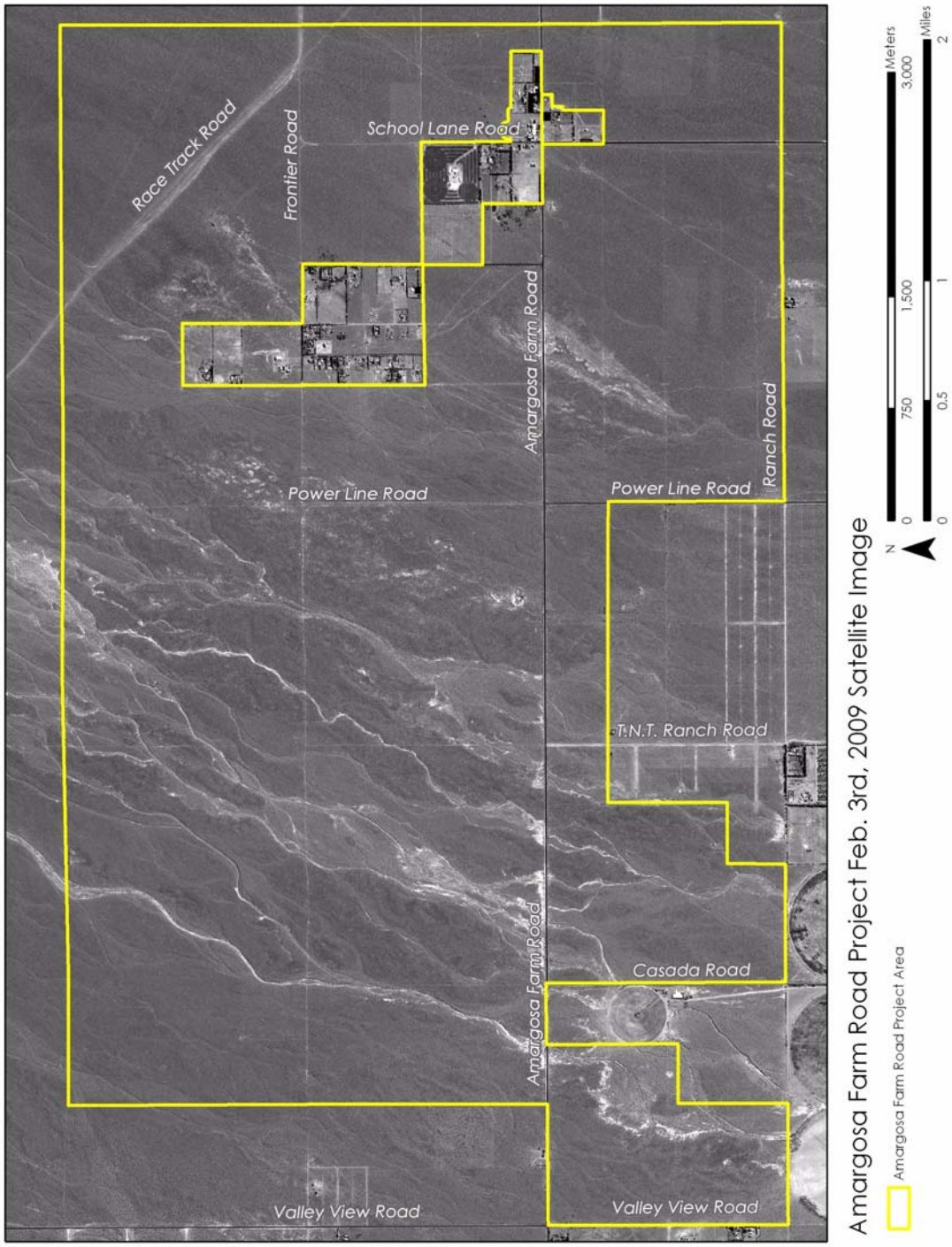


Figure 7-1. Project aerial photo, taken in February 2009, and paved and unpaved roads on project site. Photo also shows dispersal of ephemeral washes across the alluvial fan as distributary channels that lose water through absorption in the alluvial fan as they progress downslope.

7.3.1 Geomorphology

Located in the Northern subregion of the Mojave Desert, the Amargosa Valley is a gently sloping alluvial fan that, characteristic of the region, forms part of an internally drained basin. Elevations on site range from about 2,358 to 2,500 feet above mean sea level. Erosional forces transport materials downslope from the surrounding mountains and this alluvium coalesces into extensive fans along the margins of the valley and basin. These deposits are now being actively eroded and dissected by flows from the upslope mountains, and end in an enclosed basin with no external drainage, the playa basin at the former (now dry) Lake Manly in Death Valley National Park.

The formation of desert pavement and the underlying fine-textured, windblown sediment are two important features that coincide with progressive development of soils on desert piedmonts such as at the project site. Soil hydrology is strongly affected by soil development in the Mojave, particularly the thin surface horizon known as the vesicular A horizon, which represents the accrual of dustfall immediately beneath the rock pavement surface of the site (Miller *et al.* 2009). Windblown silt and sand, common across the Mojave Desert, collect immediate below rocks and gravel, and promote the formation of desert pavements (McDonald *et al.* 1995 as cited in Webb *et al.* 2009). Varnish accumulates on surface rock of desert pavement, producing the dark surface coloration common to the Mojave Desert piedmonts and visible throughout the site at Amargosa Farm Road. Changes in surface microrelief also coincide with soil development and the formation of desert pavement. Surface relief tends to decrease with time to a nearly flat surface as a result of windblown additions in swales and local redistribution of materials by sheetflow. (Webb *et al.* 2009)

The surfaces of alluvial fans vary in particle size and cohesiveness, as well as degree of sorting, based on how they were deposited. As a result, the deposit types also vary in how moisture is retained and processed. In general, the mean grain size of deposits decreases with distance from the mountain front, as do features such as channel incision and slope (Blair and McPhearson 1994).

As runoff causes erosion of desert pavement soils on alluvial fans, it eventually leads to the establishment of surface drainages and the ultimate widespread dissection of the deposit. How water moves through the project site is related to the distance from the mountains that are the source of the alluvial fan sediment, and the soil profile depth and development discussed above that allows for exceptionally high moisture infiltration in the alluvial fan. This is a process characteristic of ephemeral channels that they lose water along their way through the basin, spreading across the landscape into multiple channels with paths that may change from event to event. See Figure 7-1 for a view of how the Fortymile Wash channel, which is a a single channel north of US-95 has dispersed as it traverses the project site.

7.3.2 Hydrologic Setting and Floods

The climate is also characteristic of the Northern Mojave and southern Nevada. The Sierra Nevada Range of California act as a barrier to moisture-bearing storms moving inland from the Pacific Ocean. Precipitation on the basin floor averages about 3.9 inches per year based on long-term records at Amargosa Farms (1971-2000; NOAA, 2002) and 4.4 inches at the Amargosa Desert Research Site (1981-2005). Maximum precipitation normally falls between

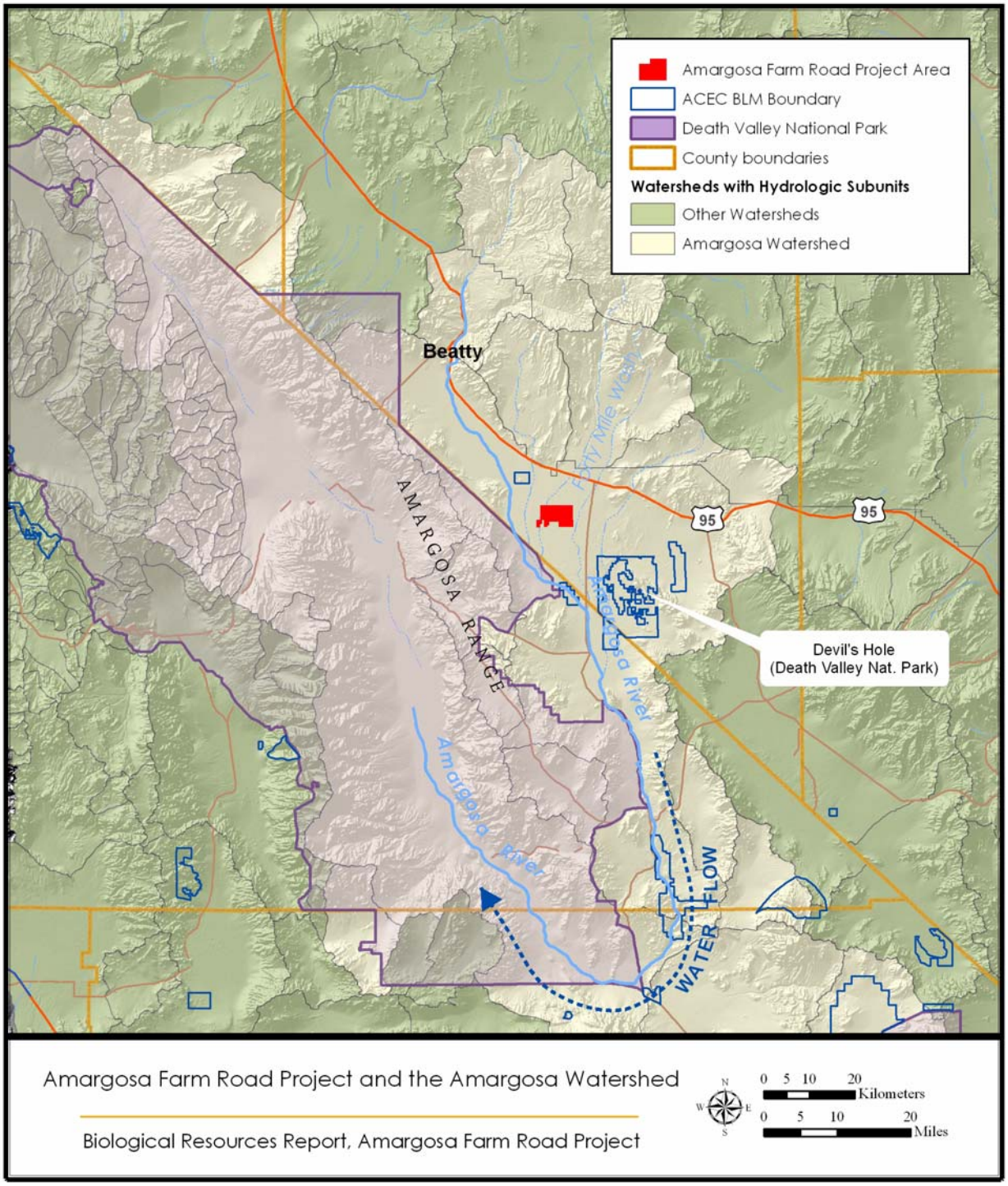
November and March, when an average of about 60 percent of annual amounts are received. Minimum precipitation occurs in May, June, September, and October. During July and August, thunderstorms are common, contributing between 25 and 40 percent of annual precipitation.

In this region, perennial streamflow is rare. Most surface water is either runoff or discharge from springs. Precipitation falling on the slopes forms small, ephemeral streams that quickly disappear and infiltrate as ground-water recharge. Numerous ephemeral washes transect the area, conveying flows only after storms. Groundwater is much more abundant than surface water in the Amargosa Desert. Springs are an important water source regionally, particularly for special status species.

The project site is traversed by Fortymile Wash, which is tributary to the Amargosa River and originates in the mountains of the Nevada Test Site (NTS) directly to the north. The Amargosa River is part of the Death Valley Basin hydrographic unit. The Amargosa River Basin drainage area composes approximately two-thirds of the 8,533 square mile Death Valley watershed and has the largest drainage basin discharging into Death Valley. Despite the large drainage area, most of the Amargosa River and its tributaries are ephemeral, except in a few relatively short reaches of the River where discharging springs maintain small, perennial base flows. However, the Amargosa Desert portion of the river is dry more than 98 percent of the time (Stonestrom *et al.* 2007).

Water flow in the local washes is very infrequent and it can be very localized. A flash flood in one or more minor washes in a watershed, for example, might not result in any notable flow downstream. The dry climate results in quick percolation of surface water into the ground and rapid evaporation. Although infrequent, storm and runoff conditions can also be extensive enough to result in flow throughout the drainage system. This can occur after unusually strong summer thunderstorms or during sustained winter precipitation.

At least three events have occurred for which it is well documented that flows from Fortymile Wash and Amargosa River completely traversed the Amargosa Desert Basin from the Nevada Test Site to Death Valley. These were in 1969, 1995, and 1998. The 1969 flood was the largest on record, producing a peak flow that exceeded the median annual peak flow by more than two orders of magnitude (Stonestrom *et al.* 2003). Ephemeral flows exhibit extreme variability in magnitude, as shown by annual peak flows at the basin inlet, and often are negligible by the time they reach the project site even if well documented north of US-95 (Stonestrom *et al.* 2007). Glancy and Beck (1998) documented conditions during March 1995 and February 1998 when Fortymile Wash and the Amargosa River flowed simultaneously through their primary channels to Death Valley. The 1995 incident was the first documented case of this flow condition, though undocumented incidents probably occurred during the preceding 30 years when there were several instances for which records show sections of the primary channels flowing with floodwater. Tanko and Glancy (2001) compared the two incidents.



Map 7-1. Watersheds, hydrologic units, and natural resource jurisdictions in the vicinity of Amargosa Farm Road Solar Project.

During both floods, surface water from NTS flowed to the Amargosa River mainly by way of Fortymile Wash, and road overflows were observed at similar locations. In Fortymile Wash, a peak streamflow of about 3,000 cubic feet per second in 1995 severely scoured and eroded the channel and caused extensive road damage on NTS and to US-95 (Beck and Glancy 1995). Major streamflow from NTS during the March 1995 flood was observed only in Beatty and Fortymile Washes. During the February 1998 flood, Topopah Wash also flowed off NTS. Based on peak-flow estimates and observations of channel scour and fill, streamflows were greater in Beatty and Fortymile Washes during March 1995 than February 1998. (Tanko and Glancy 2001)

Durations of streamflows also differed between the two floods; the February 1998 streamflows in washes on NTS lasted 12 to 36 hours, whereas the March 1995 streamflows lasted only 10 to 12 hours. (Tanko and Glancy 2001)

Runoff from the Ash Meadows area played an important role in sustaining streamflow in the central and southern reaches of the Amargosa River in February 1998. Near-peak streamflow discharge was observed at Carson Slough draining into Alkali Flat approximately 24 hours after flow completely ceased in Fortymile Wash and in the Amargosa River upstream from Nevada State Highway 373 (David A. Beck, U.S. Geological Survey, oral commun., 1998, as cited in Tanko and Glancy [2001]).

These incidents and the above results are described further in the “Discussion” section below. See Figure 7-2 for a generalized view of surface flow patterns in the vicinity of the project area.

7.3.3 Groundwater and Groundwater Recharge

Three types of aquifers are recognized in the region: the volcanic aquifer, alluvial aquifer, and carbonate aquifer. The most developed and utilized water-bearing source is the valley fill alluvial aquifer. Many springs are associated with carbonate rock or sandstone layers. The carbonate rock system is composed of primarily limestone and dolomite deposited during the period that the area was covered by water. The ability of the carbonate aquifers to store and transmit water is known to differ depending on location, but characteristics of the carbonate aquifers are largely unknown. Ground water in the Death Valley region occurs in several interconnected, extremely complex ground-water flow systems. The water moves along relatively shallow and localized flow paths that are superimposed on deeper, regional flow paths. Regional ground-water flow is predominantly through conduits in the carbonate rocks.

Depth to water varies throughout the region, but can be generally characterized as ranging from at or near the surface to several thousand feet, as in the case of the carbonate aquifer. Most groundwater recharge in southern Nevada is derived from winter and spring precipitation, which represents approximately 40-60 percent of the total annual precipitation. Precipitation reaches the groundwater reservoirs by way of streams, which eventually discharge onto alluvial aprons, or by infiltrating directly into consolidated rock and percolating vertically and laterally to the valley fill aquifer (BLM Las Vegas District Resource Management Plan 1998).

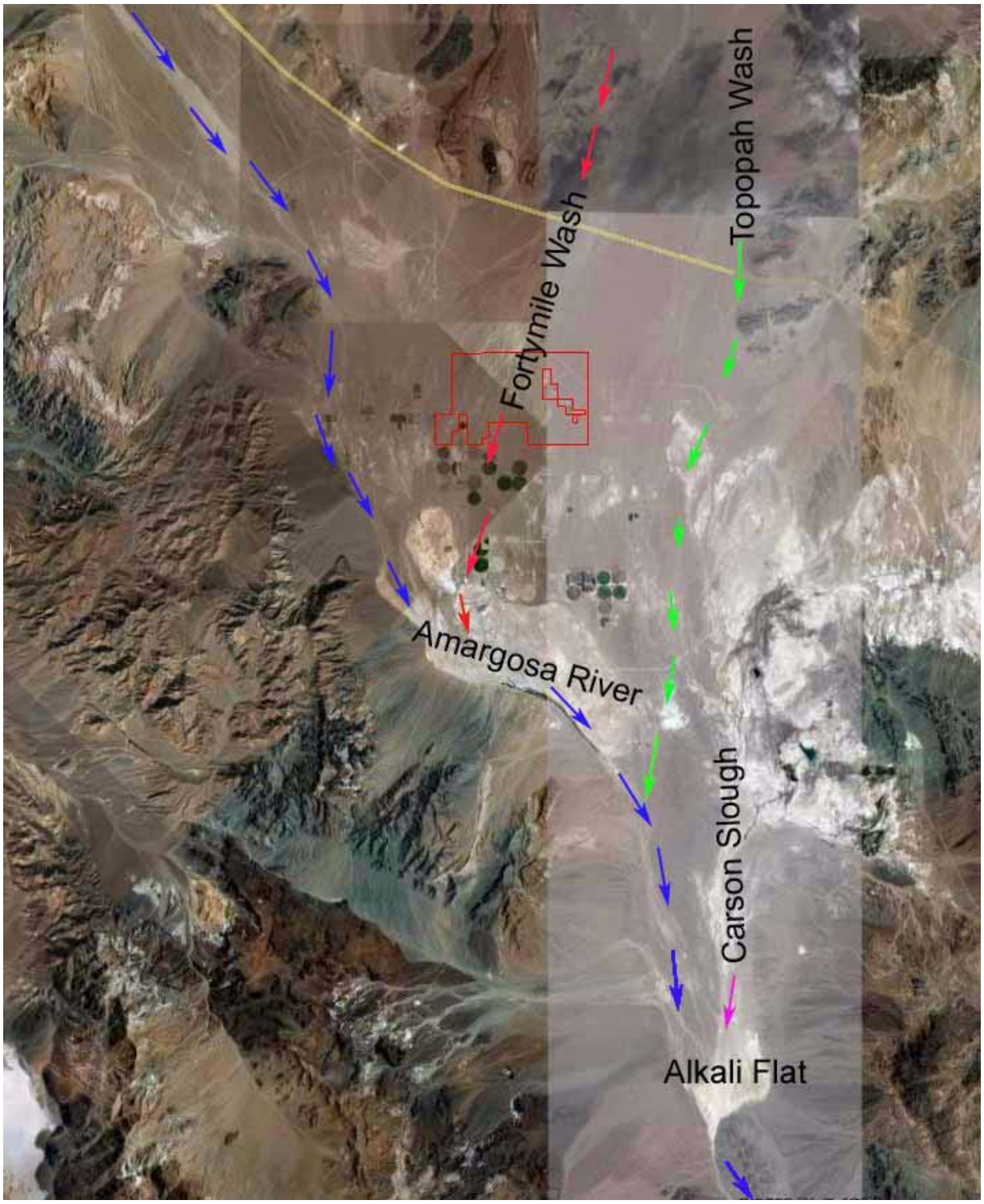


Figure 7-2. Generalized flow patterns in the vicinity of the project area (shown with red outline).

Infiltration losses during ephemeral flows of the Amargosa River and Fortymile Wash provide the main sources of groundwater recharge on the Amargosa Desert basin floor (Stonestrom *et al.* 2007). Groundwater recharge beneath the Amargosa River was found to be narrowly focused beneath the Amargosa River channel, flanked by large tracts of recharge-free basin floor, in a study 1998-2001 (Stonestrom *et al.* 2007).

The primary use of ground water in the Amargosa Desert Basin is for irrigation. Irrigation began around 1917 and continued on a modest scale until 1954. Between 1954 and 1965, the number of wells grew by about 150 to support agricultural production. Irrigation withdrawals have fluctuated since 1965, but maximum withdrawals about 20 million cubic meters per year rival the natural discharge of ground water at Ash Meadows (Laczniak *et al.* 1999; Stonestrom *et al.* 2003).

Stonestrom *et al.* (2007) noted differences in recharge beneath agricultural areas versus native vegetation. Recharge was found to be negligible beneath undisturbed native vegetation covering most of the Amargosa Desert floor, where water-potential profiles indicate upward flow and atmospherically deposited salts have been accumulating more or less continuously since the end of the Pleistocene. Accumulation of salts has formed pronounced bulges just below the root zone. In contrast, beneath both irrigated fields and the Amargosa River channel, extreme water potentials and low salt concentrations indicate active deep percolation and ground-water recharge. Transit times of recharge beneath the channel are on the order of centuries. Transit times of irrigation-return flow are on the order of decades. (Stonestrom *et al.* 2007)

7.3.4 Soils

The generalized soils map for the area is presented in Map 7-2. The soil descriptions presented below are generated for southwest Nye County, Nevada from the U.S. Department of Agriculture database of major soil types (families). None of the soils are classified as hydric.

Map Unit: 2054 - Yermo, Hot-Yermo-Arizo Association

Component: Yermo and Hot Yermo(70%). The Yermo, hot component makes up 40 percent of the map unit. Slopes are 2 to 4 percent. This component is on fan remnants, fan piedmonts. The parent material consists of alluvium derived from mixed rock sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Arizo (15%). The Arizo component makes up 15 percent of the map unit. Slopes are 2 to 4 percent. This component is on inset fans. The parent material consists of alluvium derived from mixed rock sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available

water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R030XA065NV Dry Wash ecological site. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 3 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map Unit: 2070 - Shamock Gravelly Fine Sandy Loam, 2 to 4 Percent Slopes

Component: Shamock (90%). The Shamock component makes up 90 percent of the map unit. Slopes are 2 to 4 percent. This component is on bolsons, alluvial flats. The parent material consists of alluvium derived from mixed rock sources. Depth to a root restrictive layer, duripan, is 25 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 6 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map Unit: 2451 - Sanwell-Sanwell, Warm-Yermo Association

Component: Sanwell (40%). The Sanwell component makes up 40 percent of the map unit. Slopes are 0 to 4 percent. This component is on alluvial flats, intermontain basins. The parent material consists of lacustrine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 3 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a moderately sodic horizon within 30 inches of the soil surface.

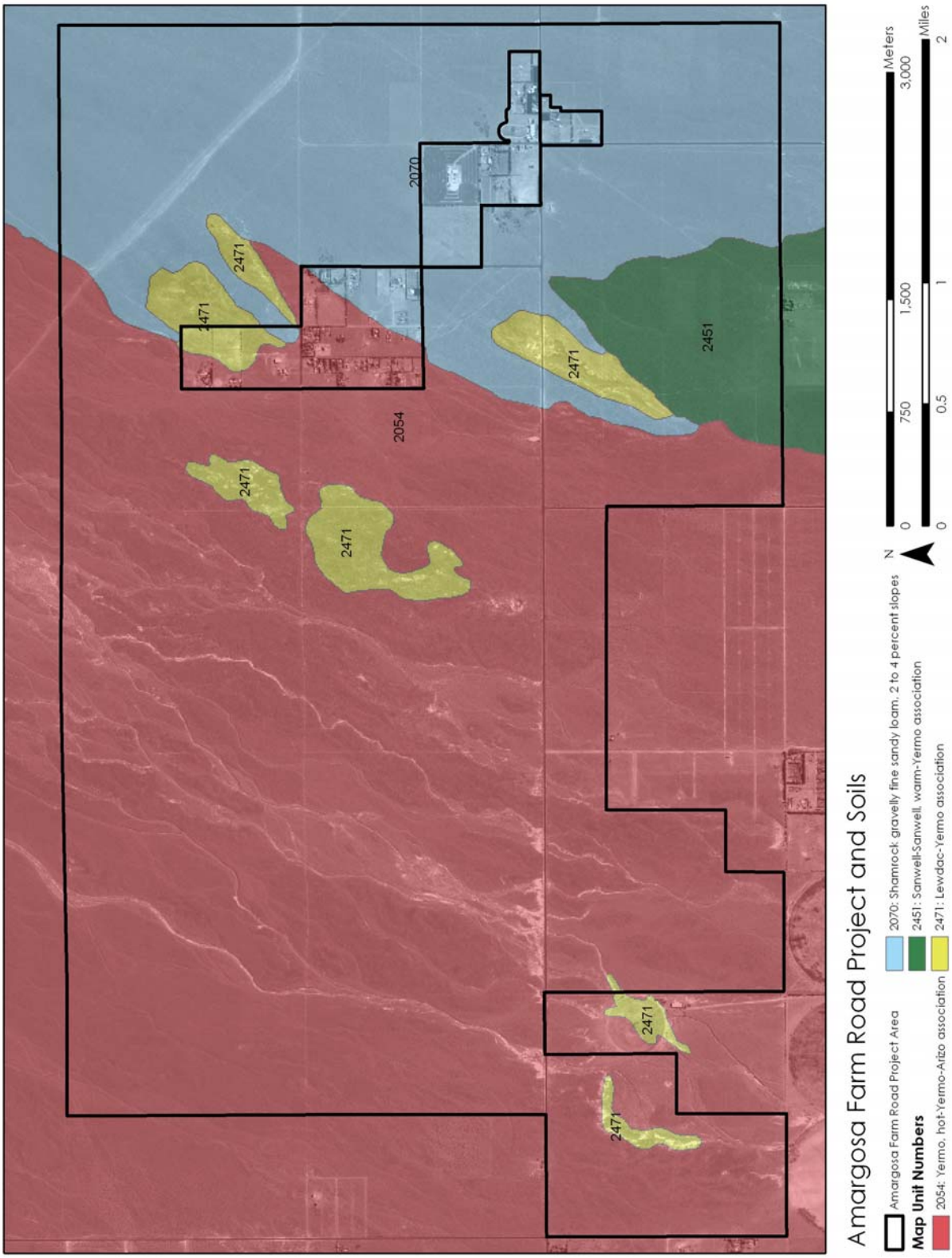
Component: Yermo (20%) - See Description Above

Map Unit: 2471 - Lewdlac-Yermo Association

Component: Lewdlac (70%). The Lewdlac component makes up 70 percent of the map unit. Slopes are 2 to 4 percent. This component is on intermontain basins, alluvial flats. The parent material consists of alluvium derived from mixed rocks over lacustrine deposits. Depth to a root restrictive layer, duripan, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbon-

ate equivalent within 40 inches, typically, does not exceed 20 percent. The soil has a very slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Yermo (15%) - See Description Above



Map 7-2. General soil types for the project site.

7.4 Methods

The USACE's 1987 Wetland Delineation Manual (USACE Environmental Laboratory 1987) is the mechanism by which potential wetlands are assessed to determine if they meet the three parameter test discussed above. Recently the USACE provided a Regional Supplement designed for use with the current version of the 1987 Wetland Delineation Manual, and all subsequent versions (USACE 2006). Where differences in the two documents occur, the Regional Supplement takes precedence over the Manual for applications in the Arid West Region. The USACE Districts have final authority over the use and interpretation of the Wetland Delineation Manual and the Arid West Regional Supplement. The Manual provides technical guidance and procedures, from a national perspective, for identifying and delineating wetlands that may be subject to regulatory jurisdiction under Section 404 of the CWA (33 U.S.C. 1344). The methods set forth in the 1987 Wetland Delineation Manual generally requires that a wetland should normally meet each of the following "three-parameter test":

- More than 50 percent of the dominant plant species at the site must be typical of wetlands (i.e. rated as facultative or wetter in the National List of Plant Species that Occur in Wetlands [Reed 1988]);
- Soils must exhibit physical and/or chemical characteristics indicative of permanent or periodic saturation (e.g. a gleyed color, or redoximorphic features with a matrix of low chroma indicating a relatively consistent fluctuation between aerobic and anaerobic conditions); and
- Hydrologic characteristics must indicate that the ground is saturated (in our Arid West region) for "14 or more consecutive days of flooding or ponding, or a water table 12 inches or less below the soil surface, during the growing season at a minimum frequency of 5 years in 10." This latter approach is supposed to be used only when wetland hydrology indicators are absent from an area that has indicators of hydric soil and hydrophytic vegetation.

The Arid West Regional Supplement presents wetland indicators, delineation guidance, and other information that is specific to Nevada and other areas of the Arid West. The development of the supplement follows National Academy of Sciences recommendations to increase the regional sensitivity of wetland delineation methods (National Research Council 1995), and brings the 1987 Wetland Delineation Manual up to date with current knowledge and practice in the region. It is not intended to change wetland boundaries.

The joint USACE-EPA memorandum on the recent court rulings (Rapanos v. United States and Carabell v. USACE) was also used to evaluate questions of isolation of wetlands/waters of the U.S. These rulings address the question of "significant nexus" to navigable waters of the United States, and use of the term "adjacent wetlands" as opposed to "isolated" wetlands, which include ephemeral streams and ponds.

In addition to the materials described above, the USACE Field Guide for determining the ordinary high water mark in the Arid West was also used (Lichvar and McColley 2008). The ordinary high water mark is the line on the drainages established by the fluctuations of water and indicated by physical characteristics such as: a clear natural line impressed on the bank; shelving; changes in the

character of the soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas.

The data reviewed for the delineation is generally described in Section 1.3; The following were also assembled for the interpretation and assessment of potentially jurisdictional features:

- Maps and plans submitted by the project applicant
- U.S. Geological Survey 7.5-minute topographic maps
- Aerial photos 2005 (Google Earth)
- Aerial photos February 2009 (Terraserver)
- Map of major soil types for southwestern Nye County, their classification as hydric or non-hydric, their respective ecological site descriptions, and water feature descriptions. U.S. Department of Agriculture Natural Resources Conservation Service.

The entire site was characterized on aerial photos and in the field. All areas were identified as being potentially subject to the jurisdiction of the USACE were field verified and mapped. The potential for "waters of the U.S." was investigated based on the absence or presence of an OHWM, or if not clearly visible, as determined by erosion, the deposition of vegetation or debris, and changes in vegetation or sediment character. Lengths of wash with and without an OHWM were mapped by walking and by studying 2005 and 2009 ortho-rectified aerial photos. The Field Guide (Lichvar and McColley 2008) was used to interpret high water boundaries in these channels with very infrequent flow and duration of flow, using the active flood plain as the boundary in most cases as suggested in the Field Guide. Since channels were more defined upstream than downstream, the northern boundary of the site was traversed to locate washes at the beginning of the survey. Also, evidence of deposition along Amargosa Farm Road, which functions as an impoundment to water flow, was used as a trigger to follow washes to evaluate their continuity upstream and downstream. All features depicted as blue lines on the USGS 7.5-minute quadrangle maps were considered potentially jurisdictional, and were examined in the field.

The entire site was evaluated for the presence of hydrophytic vegetation that could indicate the presence of a wetland.

Finally, the regulations contained in 33 CFR and recent court cases (the SWANCC ruling) to evaluate the interstate commerce connection of these washes.

7.5 Results

As shown in the above description of site conditions and literature review of previous work (Section 1.3), no hydric soils or vegetation were identified on maps, aerial photos, or in the field. Therefore, the work focused on assessing the limits of jurisdiction for waters of the U.S.

The drainages on site are low-gradient, ephemeral, distributary channels on an alluvial fan of Fortymile Wash that develops in the mountainous areas of the Nevada Test Site near Yucca Mountain, a few miles north of US-95. The Fortymile Wash forms a tributary to the Amargosa River in the Amargosa hydrographic unit, which is part of the Amargosa Desert hydrographic area, and Death Valley Basin. Death Valley basin is internally drained and is not a Traditional Navigable Water in that it is not subject to the ebb and flow of tides.

Fortymile Wash originates in Nevada, but joins the Amargosa River in distributary channels approximately at the California-Nevada state line. The Amargosa River crosses the state line form Nye County, Nevada to Inyo County, California. Therefore, the Amargosa River is a water of the U.S. based on the interstate connection to the CWA definition, and at least portions of Fortymile Wash are also jurisdictional based on being a tributary to this interstate water.

All of the drainages identified on the USGS 7.5-minute quadrangle map as "blue-line streams" and field evaluated are tributary to the Amargosa River. The drainages have been impacted by road impoundment especially at Amargosa Farm Road but also along north-south roads such as Casada, through interruption by actively irrigated alfalfa fields or grading for irrigated agriculture, and by off-road vehicle use up and down their lengths.

The alluvial fan washes are ephemeral and display active and distributary characteristics (USACE / Lichvar and McColley 2008). They are often discontinuous, especially as the assessment moved eastward across the project area which is climbs to slightly higher elevation. There is a decrease in channel capacity as the washes progress downslope due to extremely high infiltration rates for water. Channel and sheetflow are evident as the channels become swales, and then channels again. Channel morphology generally lessens as they move downstream. Road impoundments sometimes discontinue the flow altogether.

In most case, the OHWM was determined to be the same as the active channel. As field work progressed eastward across the site, the drainages become more and more discontinuous, with progressively greater swale conditions vice distinct bed-and-bank. The low flow features in these ephemeral channels develop as a result of channel changes occurring during very infrequent events, perhaps only one to three events in the past 100 years. They are characterized by alternating channel/swale features.

The portions of Fortymile Wash determined to be waters of the United States were so assessed because of the following characteristics of the westernmost (largest and most pronounced) portion of the drainage:

- Is tributary and connected to the interstate Amargosa River, which are waters of the U.S. as defined under 33 CFR part 328(a) and associated guidance. The Amargosa River is not a navigable waterway because it is not a tributary to water subject to the ebb and flow of tides. However, it crosses the Nevada-California boundary so it falls under the CWA by being an interstate water.
- The waters of Fortymile Wash are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. This is based on the presence of irrigated crops and a dairy that use the water.

- An OHWM, often the same as the high water mark created by the last historic flood of these channels that flow very infrequently, is relatively consistent through the drainage length as it crosses the property, and continues on the downslope side of irrigated alfalfa fields.

The water contributes to ecological functions in Death Valley National Park, as well as to a BLM Area of Critical Environmental Concern downstream on the Amargosa River. Some of this reach has been proposed for Wild and Scenic status. The surrounding wash contains areas with very low density evidence of the presence of tortoise *(Gopherus agassizii)*. However, the desert tortoise does not depend on the wash for use of the site. These findings are consistent with the observations of Rautenstrauch *et al.* (1994) for Fortymile Wash at the Nevada Test Site. Fortymile Wash may in some years may support the movement of bighorn sheep between the Funeral Mountains and mountains of the Nevada Test Site, based on the location of a bighorn sheep skull on the project area.

The most consistent sign of high water was the loss of upland vegetation, a distinct bed and bank, a slope break, and a change in the sediment composition to finer materials without desert pavement or varnish. Vegetation was mostly absent in the channels except for occasional islands or bars. Along the channel margins, there tended to be an increased presence of alkali saltbush *(Atriplex polycarpa;* also known as allscale or cattle spinach), and cheesebush *(Hymenoclea salsola)*. In some cases the only evidence of water presence was that creosote grew larger, probably a result of deeper, unconfined soils as well as water confinement. In swales without a high water mark, white burrobush *(Ambrosia dumosa)* remained as vegetation while the creosote had been eliminated.

This surface water of this site does not drain towards Ash Meadows and so does not support the federally protected species there. Recharge of the basin aquifer by Fortymile Wash is also not expected to contribute to Ash Meadows, which is supported by deep carbonate aquifers, among other water sources. However, the underground waters of Fortymile Wash do contribute to the biological integrity of the Amargosa River from the junction of the two, through the BLM Areas of Critical Environmental Concern, and into Death Valley.

Also, the sensitive Amargosa toad *(Bufo nelsoni)* resides in perennial portions of the Amargosa River which are upstream of the junction of the river and Fortymile Wash. The Amargosa toad is found only along a 10-mile stretch of the Amargosa River and interconnected spring systems. Therefore, Fortymile Wash does not directly support this toad.

Areas considered non-jurisdictional were excluded based on the field investigator's best professional judgment of both the lack of a consistent high water mark and discontinuity with downstream channels. These drainages are considered non-jurisdictional in accordance with Rapanos Guidance. They have extremely low frequency, duration, and volume of flow, perhaps once to three events in 100 years for a matter of hours (see Discussion below for more detail). These more eastern drainages are predominantly vegetated and nonvegetated swales with intervening channel portions that show significant discontinuity with downstream areas of Fortymile Wash. They are at a slightly higher elevation than the western wash that is considered jurisdictional, and often contain

upland perennial shrubs. Based on the literature review of Fortymile Wash and behavior of distributary channels, the next significant flood may create completely new channels across this alluvial fan.

Our best estimate of the peak 100-year discharge to be approximately 3000-4000 cfs (cubic feet per second) distributed among all the channels at Amargosa Farm Road (Tory Walker, personal communication). Such a flow would likely cause the creation of a new channels across the project site.

Therefore, the judgment of observer and considering all the facts taken together, is that these more easterly washes should be considered terrace or paleo channels as described in the USACE field guide (Lichvar and McColley 2008), with insufficient frequency, duration, and volume of flow and continuity with the interstate Amargosa River. They are, therefore, excluded from jurisdiction.

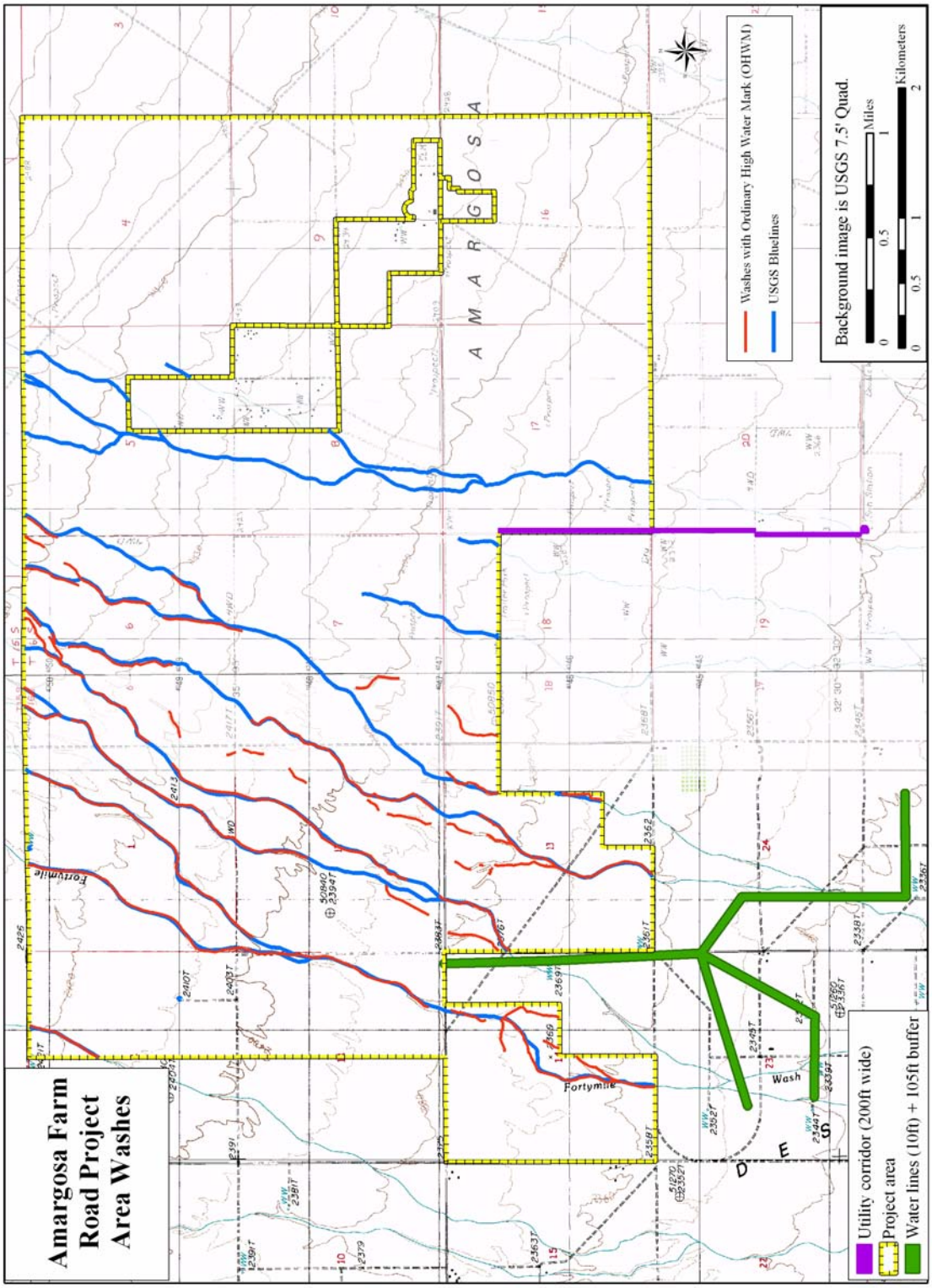
The length of jurisdictional area is approximately 4.75 miles (25,105 feet), out of a total drainage length with an observable high water mark of 15.32 miles. The approximate jurisdictional area is 14.41 acres (see Table 7-2 below).

Table 7-2. Summary of Features With Ordinary High Water Mark. No wetlands were identified on the property.Total miles of drainage with a high water mark if 15.32 miles.

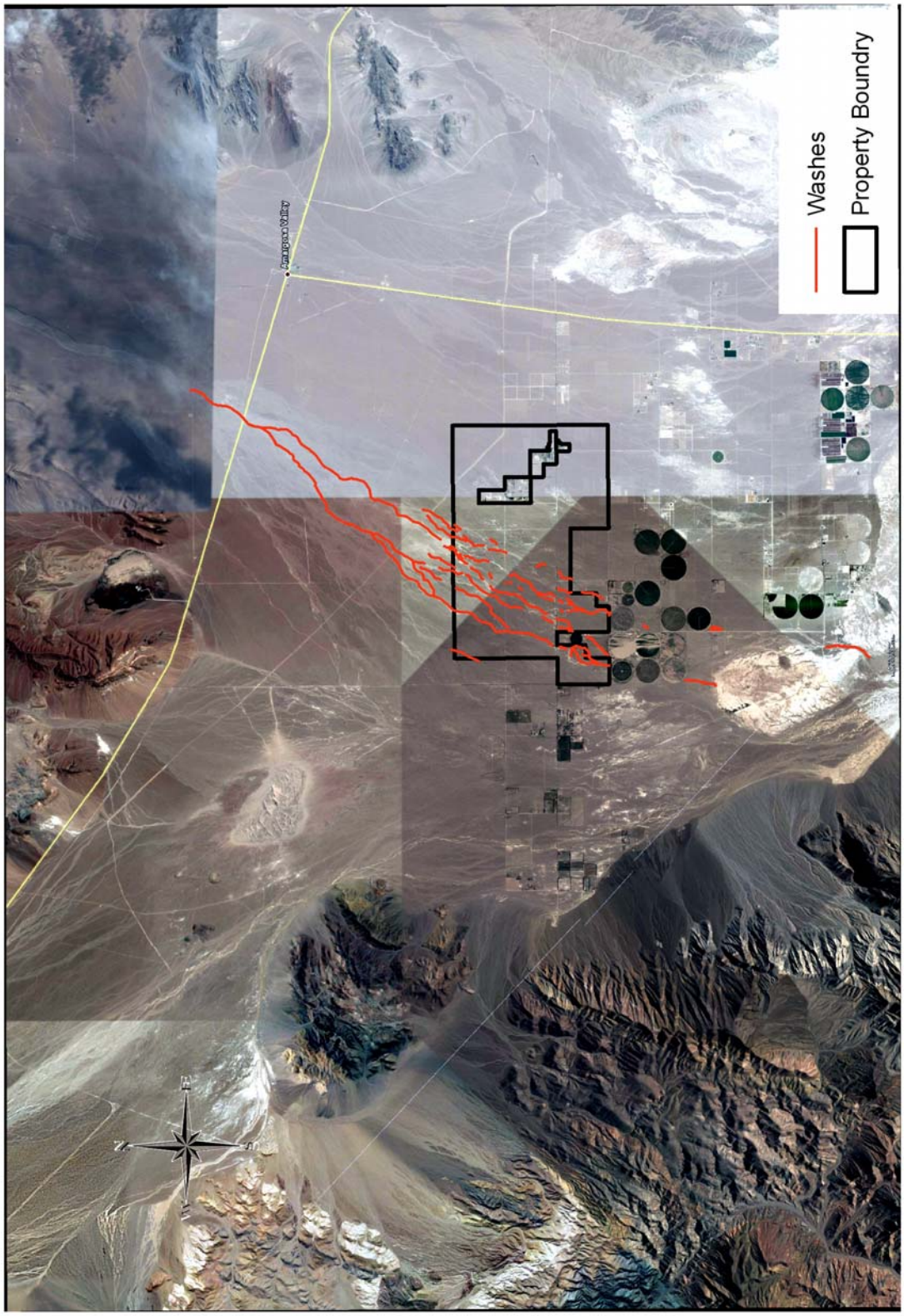
Feature (labelled from west to east)	Length (feet)	Jurisdictional?	Average Width (feet)	Area (acres)	Nature
Drainage A	1955	No			Ephemeral, low-flow, distributary
Fortymile Wash Drainage B	25105	Yes	25	14.41	Ephemeral, low-flow, distributary
Drainage C	24334	No			Ephemeral, low-flow, distributary
Drainage D	17162	No			Ephemeral, low-flow, distributary
Drainage E	12356	No			Ephemeral, low-flow, distributary

7.5.1 Jurisdictional Maps

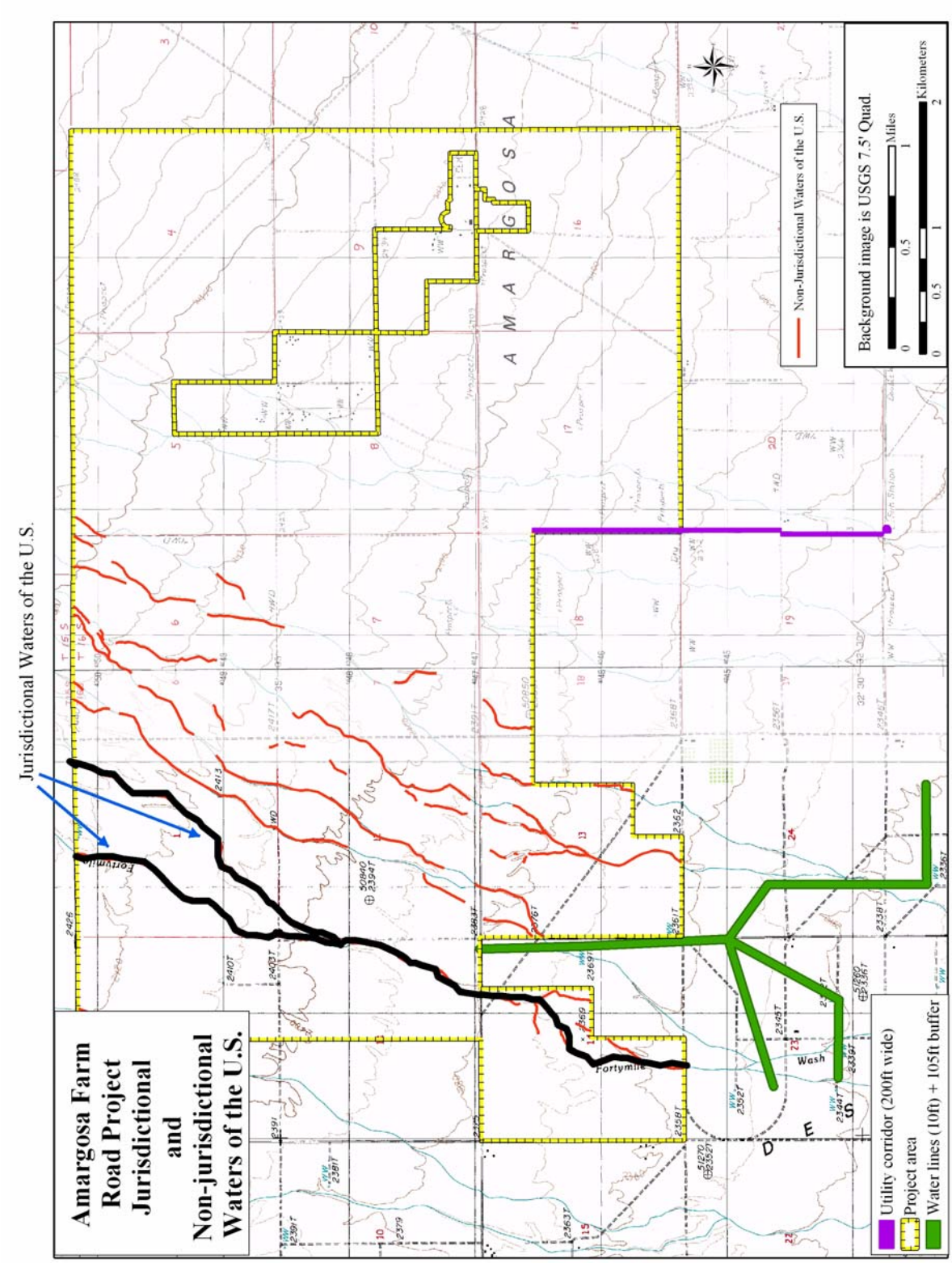
The following maps (Map 7-3 through Map 7-5) show the USGS blue lines overlaid with the delineation of channels with a high water mark from field observation; a map showing Fortymile Wash channel patterns upstream and downstream of the project site; and a map showing the jurisdictional conclusion.



Map 7-3. USGS blue lines with the subject delineation of channels field verified for ordinary high water mark on top.



Map 7-4. View of distributary channels of Fortymile Wash above and below the project area.Connection to Amargosa River is in white alkali sink area.



Map 7-5. Jurisdictional waters of the U.S.

7.5.2 Photos of Wash Condition

The following photos (Photo 7-1 through Photo 7-17) illustrate the findings described above. The first set of photos are all of conditions in Fortymile Wash, the jurisdictional area. The second set of photos is of portions of easterly wash conditions that were not mapped with an ordinary high water mark. These are considered swales, discontinuous with downstream waters, or have insufficient frequency, volume, and duration of flow to be considered jurisdictional.

Photo 7-1. April 24/25, 2009. Fortymile Wash.

Photo 7-2. April 24/25, 2009. Fortymile Wash.

Photo 7-3. April 24/25, 2009. Fortymile Wash.

Photo 7-4. April 24/25, 2009. Fortymile Wash.

Photo 7-5. April 24/25, 2009. Fortymile Wash branch.

Photo 7-6. April 24/25, 2009. Fortymile Wash.

Photo 7-7. April 24/25, 2009. Fortymile Wash.

Photo 7-8. April 24/25, 2009. Fortymile Wash.

Photo 7-9. May 8, 2009. Fortymile Wash.

Photo 7-10. May 8, 2009. Eastern Wash with burrobush, with swale features.

Photo 7-11. May 8, 2009. Eastern wash portion classified as a swale.

Photo 7-12. May 8, 2009. Eastern wash portion mapped with a high water m ark.

Photo 7-13. May 8, 2009. Portion of eastern wash mapped with a high water mark.

Photo 7-14. May 8, 2009. Eastern wash mapped with a high water mark.

Photo 7-15. May 8, 2009. Eastern wash portion classified as a swale.

Photo 7-16. June 9/10, 2009. Westernmost wash portion mapped as a swale.

Photo 7-17. June 9/10, 2009. Eastern wash classified as a swale.

7.6 Discussion

Streamflow characteristics of the Amargosa River have been studied for at least 45 years, with USGS stream gage data being recorded since 1964 near Beatty (USGS streamflow-gaging station 10251220). Other stream gages and thermal detection gages have since been installed and monitored, though not continuously. Streamflow characteristics of Fortymile Wash, a major tributary to Amargosa River, have similarly been studied for the past 26 years, primarily within the Nevada Test Site (NTS), which is directly to the north of the project area and US- 95, but also in the Amargosa Valley to a lesser extent. USGS stream gage data is available at the NTS southwest boundary, upstream of US-95 (USGS streamflow-gaging station 10251258). These ephemeral systems, which have been described through the years in a number of USGS publications, converge several miles south of the subject site.

Even though these two systems have been studied for a number of years, it has been noted in one of the USGS publications that,

"Prior to Yucca Mountain site-characterization studies, few data were available on the streamflow of the Amargosa River and its major tributaries. Flow characteristics of the basin are generally poorly understood."

Since this was written in 1995, one storm (Feb 1998) has added new information. Nevertheless, most of the studies and gage data relate to the systems upstream of the subject site. The same USGS publication quoted above also notes:

"Near U.S. Highway 95, the Fortymile Wash channel changes from being moderately confined to several distributary channels that are poorly confined. This poorly-defined, distributary-drainage pattern persists downstream to its conflu-

ence with the Amargosa River. Streamflow losses to infiltration and evaporation within this reach are high. The Amargosa River is likewise moderately confined upstream from the Big Dune. Downstream from the Big Dune, the river splits into several channels that are poorly defined through the Amargosa Valley farm area."

These poorly confined distributary channels result in a large degree of uncertainty regarding flow continuity within and between the two drainages. This is also evident from onsite and aerial photographs. Prior to the storm events of 1995 and 1998, these two fluvial systems had not experienced flows of any significance in the Amargosa Valley since February 1969, which is the largest known event to occur in recent history. All three of these were regional storm events, with larger-than-normal snowpacks in the surrounding mountains contributing runoff.

It should be noted that in the arid Southwestern U.S., convective storm events will generally produce higher volumes of runoff over a shorter period than regional storm events. This phenomenon can be observed for smaller watersheds in the area, but due to the size of these watersheds and the infiltration losses of these two systems for miles upstream, the Amargosa Valley has not experienced significant flooding from convective storm events.

On the other hand, runoff from both the 1995 and 1998 regional storm events occurred over a short duration. In the March 1995 event, the rainfall was intense, but of relatively short duration; the resulting flow in both the Fortymile Wash and Amargosa River lasted approximately 10 to 12 hours. The February 1998 flooding event occurred as a result of widespread, sustained precipitation over several days, yet with a similar result of short duration in runoff through the Amargosa Valley.

In the 1995 storm event, which generated 1,200 cfs at the NTS southwest boundary stream gage, peak flow in Fortymile Wash was significantly attenuated when the flow split into several distributary channels between the stream gage and US-95. Similarly, peak flow in the Amargosa River between Beatty and Big Dune was attenuated significantly. Downstream from Big Dune, it was noted in the previously referenced USGS publication that:

"…the flow turned southward and split into several shallow distributary channels through the Amargosa Valley farm area. Peak flows for Fortymile Wash and Amargosa River were again attenuated at the confluence of the two streams near the southeast end of the Funeral Mountains. Flow within this broad, flat confluence area was slow and shallow (only inches deep) owing to the absence of well-defined channels and the low land-surface gradient."

Peak flows are summarized in Tanko and Glancy (2001) for both the 1995 and the 1998 storm events. In 1995, the peak flow in Fortymile Creek of 1,200 cfs at the NTS southwest boundary stream gage was reduced to 27 cfs at Highway 127 near the State Line. This 27 cfs includes flow from both Fortymile Creek and Amargosa River. Flow was not determined at Amargosa Farms for this event. In 1998, the peak flow in Fortymile Creek of 340 cfs at the NTS southwest boundary stream gage was reduced to 30 cfs at Highway 127 near the State Line (again including flow from both Fortymile Creek and Amargosa River). At Amargosa Farms the 340 cfs was reduced to an estimated 90 cfs.

Another USGS publication, (Savard 1998) estimates an average stream flow loss of 7,300 cubic meters per kilometer (410,000 cubic feet per mile) within the reaches of Fortymile Creek that are within the NTS. Downstream, in the Amargosa Valley, where channels are not well defined and the gradient is flatter, one would expect to see an even higher rate of infiltration.

It is evident from the above that the ephemeral braided distributary channels comprising Fortymile Wash and Amargosa River through Amargosa Valley convey flows that are of a short duration and very infrequent. It is also evident that infiltration losses in these small braided washes is extremely high and that the infrequent flows spread out widely across the valley, greatly attenuating the peak flows and runoff volumes. This infiltration has also been documented in several USGS publications.

As part of early studies for the NTS, peak 100-year discharges have been estimated for Fortymile Wash within the NTS (Squires and Young 1984). A peak discharge rate of 12,000 cfs was estimated within the NTS property, but the analysis appears to ignore the significant effects of infiltration within the miles of alluvial channels and washes that the flows are conveyed through. The largest flow estimated in Fortymile Wash at the NTS southwest boundary is 3,330 cfs from February 1969. It is unlikely that 100-year peak discharge at the NTS southwest boundary will be as high as 12,000 cfs, considering what has been observed and recorded in this region and throughout the Southwestern US. Also, statistically, with at least 60 years of record (including anecdotal accounts of long-time residents), it is more likely that the peak 100-year discharge is less than 6,000 cfs at US-95. This flow would be further attenuated by US-95 (as in past storms) and by the poorly confined distributary channels that are characteristic of the Amargosa Valley south of the highway.

7.7 Disclaimer

Interpretation of the field data collected and conclusions about jurisdictional status in this report are subject to confirmation and review by the USACE for federal jurisdiction. The USACE makes the final jurisdictional determination, and should be contacted as this site-specific project will need a determination. Similarly, the responsible State of Nevada agency (Bureau of Water Planning) must verify jurisdictional calls requiring CWA Section 401 Certification.

7.8 Permitting Requirements

Jurisdictional features in the project area are subject to permitting requirements of the USACE/NDEP-BWQP. These authorizations are required prior to any impacts. The following discussion concentrates on the USACE Section 404 permitting process because the processing time of an Individual Permit (IP) or Nationwide Permit (NWP) generally drives the other permits.

Section 404

Section 404 of the CWA authorizes the Secretary of the Army, through the Chief of Engineers, to issue permits for actions involving dredge and fill of waters under their jurisdiction. Permits can be issued for individual projects (Individual Permits) or for general categories of projects (General Permits). “Waters of the U.S:' are defined by the CWA as “rivers, creeks, streams, and lakes extending to their headwaters and any associated wetlands.” Wetlands are defined by the CWA as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions.” Over the years, the USACE has adopted several revisions to their regulations in order to more clearly define “waters of the U.S.” The most recent revision occurred in January 2001 as a result of the SWANCC case ruling. The U.S. Supreme Court held that the CWA does not give the federal government regulatory authority over non-navigable, isolated, intrastate waters. Prior to the SWANCC ruling, “waters of the U.S.” included, among other things, isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters that are not part of a tributary system to interstate waters or to navigable “waters of the U.S:' However, as a result of the court ruling, some of the previously regulated depressional areas which are not hydrologically connected to other intra- or inter-state “waters of the U.S.” are no longer regulated by the USACE.

Once the limits of USACE jurisdiction are determined and an application is submitted to the USACE, the USACE determines whether or not the activity meets the terms and conditions of one of the NWPs. If a project qualifies under one of the NWPs, a letter may be issued verifying compliance with the NWP program. Verification of compliance may be conditioned with specific terms regarding construction protocol, 4Se of best management practices, avoidance of endangered species habitat, and mitigation requirements to ensure that the project will have minimal incremental or cumulative impacts to aquatic resources. If a project meets the general terms and conditions of a NWP, but will result in greater than minimal impacts, the District Engineer may take discretionary authority and require the project to be processed as an IP. The review process for a NWP is generally less extensive than for an IP and can often be completed within 30 days.

Projects that cannot be permitted under a NWP must undergo a more extensive review under the IP process, which typically takes 120 days. The USACE decides whether to issue an IP based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity. According to USACE regulations, permits should not be issued for activities that will create “significant” degradation of the “waters of the U.S.” or have “significantly adverse effects on wetland values.” However, the CWA provides no clear definition of “significant.”

The evaluation process for an IP is based on guidelines established under Section 404(b)(1) of the CWA and on the “public interest review” procedures. The public interest review involves a broad, qualitative evaluation of a project's benefits and detriments. USACE regulations have identified 21 factors that are relevant to permit review. These factors are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and

wildlife values, flood hazards, flood plain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, consideration of property ownership, and the general needs and welfare of the people. The public interest review is facilitated by the issuance of a 15- to 30-day Public Notice period when comments are solicited from the public and resource agencies, such as the U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency, and the CDFG regarding the proposed project. A public hearing may be held for highly controversial projects.

The Section 404(b)(I) guidelines are often considered the driving force in the USACE permit process. The 404(b)(I) guidelines prohibit discharges of dredged or fill material if there is a less environmentally damaging practicable alternative. Practicability is determined based on technological, economic, social, and logistic considerations. If a proposed project has greater than significant impacts, attempts must be made to avoid and minimize impacts. Impacts that cannot be avoided must be mitigated to a level where the net impacts to "waters of the U.S." are not significant. In some cases, projects that result in significant impacts may be permitted if they provide a substantial benefit to the public, such as projects affecting national security or considerable production of energy, and appropriate off-site compensatory mitigation is implemented.

The USACE must ensure that permitted projects comply with all other applicable federal resource protection laws such as the Endangered Species Act, the National Historic Preservation Act, and the Coastal Zone Management Act. In addition, certification that the proposed activity will comply with all applicable effluent limitations and water quality standards of Section 401 of the CWA is needed prior to issuance of a Section 404 permit. The need for a Section 404 permit constitutes a federal action under the National Environmental Policy Act (NEPA). Therefore, during the review of a proposed project an Environmental Assessment is prepared according to NEPA guidelines. If the impacts of the proposed activity are determined to be significant according to NEPA. an Environmental Impact Statement must be prepared and reviewed according to all NEPA requirements.

If a proposed project complies with all the NEPA requirements, the 404(b)(l) guidelines is determined not to be contrary to the public interest, and does not violate any federal resource protection laws, the USACE will issue an IP authorizing the proposed discharge of dredged or fill material into "waters of the U.S." or wetlands. If a proposed project violates any of the above, then the USACE must deny the Section 404 permit.

Section 401

Section 401 of the CWA requires that arty applicant for a federal permit for activities that involve a discharge to "waters of the U.S:' shall provide the federal permitting agency a certification from the State in which the discharge is proposed that states that the discharge will comply with the applicable provisions under the federal CWA.

Therefore, before the USACE will issue a Section 404 permit, applicants must apply for and receive a Section 401 Water Quality Certification from the NDEP-BWQP. A public comment period is included in the processing of the Water Quality Certification. The BWQP may add conditions to their certification to remove or mitigate potential impacts to water quality standards. Such conditions must ultimately be included in the federal Section 404 permit.

Section 7 Endangered Species Consultation

This process is required only if the proposed project may affect a federally-listed threatened or endangered species and if federal authorization is required. The only federally listed species that m a occur on the site is the desert tortoise, which may be present some years in very low numbers. The process begins when the project proponent and federal agency (the BLM through the USACE) completes a Biological Assessment and formally requests to initiate consultation. The USACE, in cooperation with the applicant, coordinates with the USFWS (and/or the National Marine Fisheries Service (NMFS) in cases that involve marine waters or anadromous fish) regarding avoidance and minimization of impacts to endangered species and habitat. After these avenues have been exhausted, the USFWS will recommend offsetting measures, which will allow a “take” of individual animals or plants along with occupied habitat. The USFWS or NMFS will then issue a Biological Opinion, which is required before the USACE can make a permit decision. By the regulations, the USFWS has 90 days from the initiation of consultation in which to complete the biological assessment and 45 days to write the BO. However, the USACE and the USFWS can agree to a 60-day extension without approval from the applicant. If there are substantial impacts to endangered species, the USFWS can issue an opinion that the proposed project would jeopardize the continued existence of the species, which would result in a permit denial from the USACE. If there are no substantial impacts, the USFWS will issue a “no jeopardy” decision with specific terms and conditions to allow the project to move forward.

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Appendix A: Species Lists

A.1 Mammals

Table A-1. Mammals.

Scientific Name	Common Name	Sign	Seen
Ammospermophilus leucurus	white-tailed antelope squirrel		X
Canis latrans	coyote	X	X
Chaetopdipus formosus	long-tailed pocket mouse		X
Dipodomys merriami	Merriam's kangaroo rat		X
Equus assinus	feral burro	X	X
Felis concolor	mountain lion (?)	old mandible	
Lepus californicus	jackrabbit	X	X
Myotis californicus	California bat		sonar
Odocoileus hemionus	mule deer	skull	
Ovis aries	domestic sheep	X	
Ovis canadensis	desert bighorn sheep	carcass	
Parastrellus hesperus	canyon bat		sonar
Perognathus longimembris	little pocket mouse		X
Peromyscus maniculatus	deer mouse		X
Sylvilagus audubonii	desert cottontail	X	X
Tadarida brasiliensis	Mexican free-tailed bat		sonar

A.2 Birds

Table A-2. Birds .

Scientific Name	Common Name	Sign	Seen
Accipiter cooperii	Cooper's hawk		X
Amphispiza bilineata	black-throated sparrow		X
Aquila chrysaetos	golden eagle		X
Ardea alba	great egret		X
Buteo jamaicensis	red-tailed hawk		X
Buteo swainsoni	Swainson's hawk		X
Carduelis tristis	American goldfinch		X
Carpodacus mexicanus	House Finch		X
Cathartes aura	Turkey Vulture		X
Chordeiles acutipennis	lesser nighthawk		X
Chordeiles minor	night hawk		X
Corvus corax	common raven		X
Eremophila alpestris	horned lark		X
Falco mexicanus	prairie falcon		X
Falco sparverius	American kestrel		X
Geococcyx californianus	greater roadrunner		X
Icterus galbula	northern oriole	audio	X
Melospiza lincolnii	Lincoln's sparrow		X
Myiarchus cinerascens	Ash-throated Flycatcher		X
Passer domesticus	House Sparrow		X
Pheucticus melanocephalus	Black-headed Grosbeak		X

Table A-2. Birds (continued).

Scientific Name	Common Name	Sign	Seen
Plegadis chihi	White-faced Ibis		X
Spizella passerina	chipping sparrow		X
Streptopelia decaocto	Eurasian collared-dove		X
Struthio camelus	domestic(?) ostrich	carcasses	
Tyrannus verticalis	western kingbird		X
Toxostoma lecontei	LeConte's thrasher [family group]	audio	X
Vermivora celata	orange-crowned warbler		X
Wilsonia pusilla	Wilson's Warbler		X
Zenaida macroura	mourning dove		X

A.3 Reptiles and Amphibians

Table A-3. Reptiles and Amphibians .

Scientific Name	Common Name	Sign	Seen
Arizona elegans	glossy snake		X
Callisaurus draconoides	zebra tail lizard		X
Chionactis occipitalis talpina	Nevada Shovel-nosed snake		X
Cnemidophorus tigris	western whiptail		X
Crotalus cerastes cerastes	Mojave Desert sidewinder		X
Dipsosaurus dorsalis	desert iguana		X
Gambelia wislizenii	leopard lizard		X
Gopherus agassizii	desert tortoise	4 inactive burrows	
Masticophis taeniatus	red racer		X
Phrynosoma platyrhinos calidiarum	southern desert horned lizard		X
Phyllorhynchus decurtatus	leaf-nosed snake		X
Rhinocheilus lecontei lecontei	western long-nosed snake		X
Uta stansburiana	side-blotched lizard		X

A.4 Invertebrates

Table A-4. Invertebrates .

Order	Family	Taxa	Notes
Araneida	Salticidae	Jumping spider	
Araneida	unk	Spiders (16 types)	This is an approximate number only. Most of these are too small to identify,and only the largest ones are included in the pinned collection.
Coleoptera	Anobiidae	Death-watch beetle	small, brown, hairy
Coleoptera	Anthicidae	Anthicid beetle (Anthicus)	
Coleoptera	Bruchidae	Seed beetle	
Coleoptera	Carabidae	Carabid beetle A	huge, black
Coleoptera	Carabidae	Ground beetle B	small, dark brown, glossy with a few long straight hairs here and there
Coleoptera	Cerambycidae	Long-horned beetle	
Coleoptera	Chrysomelidae	Cylindrical leaf beetle	tan-brown
Coleoptera	Cleridae	Checkered beetle A	black with yellow markings
Coleoptera	Cleridae	Checkered beetle B	metallic blue green, [Necrobia rufipes (BG)]

Table A-4. Invertebrates (continued).

Order	Family	Taxa	Notes
Coleoptera	Coccinelidae	seven-spotted lady beetle (Coccinella septem-punctata)	
Coleoptera	Cryptophagidae	Silken fungus beetle	
Coleoptera	Cucujidae	Flat bark beetle	small, tan, sparsely hairy
Coleoptera	Curculionidae	Snout beetle A	v large, grey and white
Coleoptera	Curculionidae	Snout beetle B	med, white & tan scales, scales circular and not overlapping, snout short and stout, eyes and ant groove at right angles, lines of curved hairs on elytra, hairs longer than SBC
Coleoptera	Curculionidae	Snout beetle C	med, white & tan scales, scales smaller and overlapping, snout longer and pinched in middle, eyes and ant groove in line, lines of hairs on elytra, hairs short and straight
Coleoptera	Curculionidae	Snout beetle D	mottled tan & brown, snout mod long and thin; 2 var's, poss male and female
Coleoptera	Curculionidae	Snout beetle E	med, white, robust, thx deeply pitted
Coleoptera	Dermestidae	Dermestid beetle	hairy, tan with brown markings
Coleoptera	Elateridae	Click beetle	
Coleoptera	Lagriidae?	Long-jointed bark beetle	has the elongated final segment of antennae,but a keeled pronotum
Coleoptera	Melandryidae	False darkling beetle	dk brown, 1.5 cm
Coleoptera	Meloidae	Master blister beetle (Lytta magister)	huge, hd & thx red, ely black
Coleoptera	Melyridae	Soft-winged flower beetle A	small, brown, hairy
Coleoptera	Melyridae	Soft-winged flower beetle B	3mm, hd & thx black, ely black & red, sparsely hairy
Coleoptera	Melyridae	Soft-winged flower beetle C	4-5 mm, thx black & red, ely greenish-blue metallic on red, densley stiff-hairy
Coleoptera	Scarabeidae	Scarab beetle A	4-5 mm. brown, hairy
Coleoptera	Scarabeidae	Scarab beetle B	large, tan-brown
Coleoptera	Staphylinidae	Rove beetle A	3-4 mm, brown, somewhat stout-bodied (for a rove beetle)
Coleoptera	Tenebrionidae	Darkling beetle A	tiny, brown, front legs mod. for digging
Coleoptera	Tenebrionidae	Darkling beetle B	medium (6mm), dark brown, keeled ridge over center of eye
Coleoptera	Tenebrionidae	Darkling beetle C	large, black, elytra roughly tubercled
Coleoptera	Tenebrionidae	Darkling beetle D	huge, black, abd grooved, shiny
Coleoptera	Tenebrionidae	Darkling beetle E	med, shiny brown, head highly sculptured
Coleoptera	Tenebrionidae	Darkling beetle F	similar to GBE, but tarsi even more modified, incl. the hinh ones
Coleoptera	Tenebrionidae	Darkling beetle G	black, 9 mm, very rounded in all dimensions, builds like a little tank
Coleoptera	Tenebrionidae	Darkling beetle H	8mm, brown, hairy, eyes divided in half by ridge
Coleoptera	Tenebrionidae	Darkling beetle I	6mm, reddish-brown
Coleoptera	Tenebrionidae	Darkling beetle J	large, elytra somewhat textured, more gracile than 'C'
Coleoptera	Tenebrionidae	Eleodes (armata?)	prominent teeth on each femur
Collembola	Entomobryidae	Elongate bodied springtails	
Collembola	Sminthuridae	Globular springtail	
Dictyoptera	Mantidae	Ground mantid (Litaneutria nymphs?)	seen running around on ground during tortoise surveys-nothing to collect them with!!!
Dictyoptera	Polyphagidae	Desert cockroach	
Dictyoptera	Polyphagidae	Sand roach (Arenivaga sp.)	
Diptera	Agromyzidae	Leaf miner fly	
Diptera	Anthomyidae	Anthomyid fly A	tannish brown, small to medium sized
Diptera	Anthomyiidae	Anthomyiid fly B	black, somewhat larger than A
Diptera	Apioceridae?	Flower-loving fly	small, black
Diptera	Bombyliidae	Bee fly	large, black, wings smoky
Diptera	Calliphoridae	Blow fly A	large, thx striped gray & black, arista plumose
Diptera	Calliphoridae	Blow fly B	black, R5 cell narrowed but not closed
Diptera	Calliphoridae	Blow fly C	large, metallic green

Table A-4. Invertebrates (continued).

Order	Family	Taxa	Notes
Diptera	Cecidomyiidae (gall)	Clasping leaf gall midge (Contarinia sp.)	several clusters of 3-4 each on 3 twigs
Diptera	Cecidomyiidae (gall)	Creosote antler gall midge (Asphondylia digitata)	
Diptera	Cecidomyiidae (gall)	Creosote bush gall midge (Asphondylia apicata)	
Diptera	Cecidomyiidae (gall)	Creosote bush midge (Asphondylia barbata)	
Diptera	Cecidomyiidae (gall)	Creosote cone gall midge (Asphondylia rosetta)	
Diptera	Cecidomyiidae (gall)	Creosote stem gall midge (Asphondylia auripila)	galls common in study area
Diptera	Cecidomyiidae (gall)	Leaf club gall midge (Asphondylia pilosa)	
Diptera	Cecidomyiidae (gall)	Leaf pod gall midge (Asphondylia silicula)	
Diptera	Cecidomyiidae (gall)	Leafy bud gall midge (Asphondylia foliosa)	
Diptera	Ceratopogonidae	Punkies	
Diptera	Chironomidae	Midge	
Diptera	Chloropidae	Frit fly	
Diptera	Dryomyzidae	Dryomyzid fly	
Diptera	Empididae	Dance fly A	small, black
Diptera	Empididae	Dance fly B	whitish with black markings, eyes irridescent green-yel-low
Diptera	Empididae	Dance fly C	white, eyes red
Diptera	Empididae	Dance fly C	
Diptera	Muscidae	Muscid fly A	black
Diptera	Muscidae	Muscid fly B	R5 cell closed but not reaching edge of wing
Diptera	Muscidae	Muscid fly C	huge!
Diptera	Phoridae	Hump-backed fly	
Diptera	Piophilidae	Skipper fly	
Diptera	Sciaridae	Dark-winged fungus gnat	
Diptera	Sepsidae	Black scavenger fly	
Diptera	Syrphidae	Syrphid fly	
Diptera	Tabanidae	Horse fly	huge, black
Diptera	Tachinidae	Tachinid fly	
Diptera	Tephritidae	Fruit fly	striking brown patterns on wings
Diptera	Tephritidae (gall)	Bud gall tephritid	found on AMBDUM
Diptera	Therevidae	Stiletto fly	
Diptera	Thethinidae	Tethinid fly	known to occur in alkaline habitats, which is where Bug4 site is located
Diptera	Tipulidae	Crane fly	
Diptera	unk	"Golden teddybear fly	"Fly covered with thick, gold hair; long probscis; wing vein pattern doesn't match anything in PG.
Diptera	unk	Unk. Fly A	tiny (1-2 mm), shiny black, head hairs very short and bristly, wing vein pattern sim. to p299)
Diptera	unk	Unk. Fly B	black, wing veins sim. to Blow/Muscid/Tachinid, but not really
Diptera	unk	Unk. Fly C	yellow thx w/ black markings, eyes large and very pink, proboscis extr long (as long/longer than body), eing veins sim. To Tabanidae
Hemiptera	Alydidae	Broad-headed bug	
Hemiptera	Geocoridae	Big-eyed bug	
Hemiptera	Largidae	Bordered plant bug	
Hemiptera	Lygaeidae	Seed bug	
Hemiptera	Miridae	Plant bug A	small, white, very delicate
Hemiptera	Miridae	Plant bug B	mottled brown
Hemiptera	Miridae	Plant bug C	light green, ends of wings smoky
Hemiptera	Miridae	Plant bug D	brownish, antennae rel. short and hairy
Hemiptera	Miridae	Plant bug E	mottle blackish, ant short, bare
Hemiptera	Miridae	Plant bug F	bright green
Hemiptera	Miridae	Plant bug G	brown, very narrow-bodied
Hemiptera	Miridae	Plant bug H	light green, scutellum bright green
Hemiptera	Miridae	Plant bug I	golden-tan

Table A-4. Invertebrates (continued).

Order	Family	Taxa	Notes
Hemiptera	Miridae	Plant bug J	Light green, eyes red, red splashes on thx and wings
Hemiptera	Nabidae	Damsel bug	
Hemiptera	Pentatomidae	Stink bug	Large, green, red fringe on edge of abd
Hemiptera	Tingidae	Lace bug	
Homoptera	Aphidae	Aphid	black
Homoptera	Cicadellidae	Leaf hopper A	dark brown with dark veins in wings
Homoptera	Cicadellidae	Leaf hopper B	golden brown, no distinct patterning
Homoptera	Cicadellidae	Leaf hopper C	small, yellowish
Homoptera	Cicadellidae	Leaf hopper D	brown, 2 spots on head, 2 spots and wavy lines on pro-thorax
Homoptera	Cicadellidae	Leaf hopper E	yellowish, abdomen tiger striped
Homoptera	Cicadellidae	Leaf hopper F	2 black dots on tip of nose, 2 red spots and 2 black bar-bells on head, black-brown patterns on thx
Homoptera	Cicadellidae	Leaf hopper G	nose highly patterned in strip of brown and white, eyes with a striking grid of white cells with brown borders, wings solid golden brown
Homoptera	Coccoidea	Scale insect (nodule)	nodule 2mm, pinkish to red, resinous
Homoptera	Membracidae	Tree hopper	either a nymph or the thoracic projection is greatly reduced
Homoptera	Psyllidae	Psyllid A	body black with orange markings, wings clear
Hymenoptera	Adrenidae	Adrenid bee A	small, black-brown, 4 mm
Hymenoptera	Adrenidae	Adrenid bee B	4-5 mm, brownish black, hairy
Hymenoptera	Adrenidae:Panurginae	Adrenid bee C	
Hymenoptera	Behylidae	Bethilid wasp	
Hymenoptera	Braconidae	Braconid wasp A	large, tan
Hymenoptera	Braconidae	Braconid wasp B	medium, dark brown, black w/ red abd
Hymenoptera	Braconidae	Braconid wasp C	small, black
Hymenoptera	Braconidae	Braconid wasp D	tiny, black, extr long antennae
Hymenoptera	Bradynobaenidae	Bradynobaenid wasp	Chyphotes?
Hymenoptera	Ceraphronidae	Ceraphronid wasp	small, tan, wings undeveloped
Hymenoptera	Chrysididae	Cuckoo wasp A	bright metallic green
Hymenoptera	Chrysididae	Cuckoo wasp B	smaller, bluish-green metallic
Hymenoptera	Colletidae	Plasterer bee	
Hymenoptera	Colletidae	Yellow-faced bee	
Hymenoptera	Encyrtidae	Encyrtid wasp	antennae large, highly modified
Hymenoptera	Eulophidae	Eulophid wasp A	tiny, black
Hymenoptera	Eulophidae	Eulophid wasp B	tiny, antennae v hairy
Hymenoptera	Eupelmidae	Eupelmid wasp	tiny, brown
Hymenoptera	Formicidae	Crematogaster californica	Acrobat ant (N)
Hymenoptera	Formicidae	Dorymyrmex sp.	
Hymenoptera	Formicidae	Forelius mccooki	
Hymenoptera	Formicidae	Formica (xerophila?)	FORXIL is distributed along the Ca-Nv border; FORMOK is more coastal
Hymenoptera	Formicidae	Messor pergandei	
Hymenoptera	Formicidae	Pheidole sp. A	features sim. to P. vistana
Hymenoptera	Formicidae	Pogonomyrmex sp.	very similar to P. anzensis or P. californica
Hymenoptera	Formicidae	Solenopsis xyloni (fire ant)	
Hymenoptera	Halictidae	Halictid bee	
Hymenoptera	Ichneumonidae	Ichneumonid wasp B	large, orange-brown
Hymenoptera	Ichneumonidae	Ichneumonid wasp A	small, hd & thx black w/ yellowish-white markings
Hymenoptera	Mimaridae	Fairy fly	
Hymenoptera	Mutillidae	Velvet ant B	large, white, v hairy
Hymenoptera	Pompilidae	Spider wasp A	black, wings smoky, 1.2 cm
Hymenoptera	Pompilidae	Spider wasp B	black, wings darkly-smoky, wings veins differ from A & C, 1.2 cm
Hymenoptera	Pompilidae	Spider wasp B	black, wings darkly-smoky, wings veins differ from A & C, 1.2 cm

Table A-4. Invertebrates (continued).

Order	Family	Taxa	Notes
Hymenoptera	Pompilidae	Spider wasp C	black w/ silvery highlights, wings only smoky at ends, wings veins differ from A & B, 1.2 cm
Hymenoptera	Proctotrupidae	Proctotrupid wasp A	
Hymenoptera	Proctotrupidae	Proctotrupid wasp B	Larger than A, wing venation different
Hymenoptera	Proctotrupidae	Proctotrupid wasp C	v small, black, wing veins nearly invisible
Hymenoptera	Pteromalidae	Pteromalid wasp A	small, black
Hymenoptera	Pteromalidae	Pteromalid wasp B	huge head, teenie little body
Hymenoptera	Sphecidae: Crabroninae	Sphecid wasp B	6 mm, hd-thx black, abd reddish brown, veins identical to 'Cercerini' in PG
Hymenoptera	Sphecidae: Crabroninae	Sphecid wasp C	3 mm, black with white legs (on upper surfaces)
Hymenoptera	Sphecidae: Crabroninae	Sphecid wasp E	black, 3 mm, lacking the white markings of SWC
Hymenoptera	Sphecidae:Larinae	Sand-loving wasp A	
Hymenoptera	Sphecidae:Larinae	Sand-loving wasp B	slighter larger than SLWA, legs with far fewer spines
Hymenoptera	Sphecidae:Nyssoninae	Sphecid wasp A	5 mm, hd-thx black, abd reddish brown
Hymenoptera	Sphecidae:Philanthinae	Sphecid wasp D	black, hairy, 3 sub-mariginal cells, 1 apical spur on middle tibi
Hymenoptera	Sphecidae:Sphecinae	Thread-waisted wasp	med, abd stalk very long and thin
Hymenoptera	Tiphiidae: Brachycistidinae	Tiphiid wasp	med, reddish brown
Hymenoptera	Tiphiidae: Methochinae?	Methochis wasp A (female)	larvae parasitize beetle larvae
Hymenoptera	Tiphiidae: Methochinae?	Methochis wasp B (female)	much, much larger than A
Hymenoptera	Torymidae	Torymid wasp	metallic green, long ovipositor
Hymenoptera	Trichogrammatidae	Trichogrammatid wasp	
Hymenoptera	unk	Tiny wasp, wingless	1mm of less, golden brown, wingless
Hymenoptera	unk	Unk wasp A	6mm, brown, somewhat hairy, maybe another Bradynobaenid
Hymenoptera	unk	Unk. wasp B	MC cell (p. 313 in PG) on front margin of forewing divided in half. I can't find find anything in PG or BG that has this. May be some kind of Sphecd wasp, but I won't call it that.
Isopoda	Armadillidiidae	Pill bug	
Ixodida	Ixodidae	Tick A	small, tan
Ixodida	Ixodidae	Tick B	brown
Ixodida	unk	mite (red)	
Ixodida	unk	mite (tan, fuzzy)	
Lepidoptera	Hesperiidae	Mohave sootywing (Hesperopsis libya)	
Lepidoptera	Microlepidoptera	Microlep A	tan, 5 mm
Lepidoptera	Microlepidoptera	Microlep B	tan, 3mm
Lepidoptera	Nymphalidae	Painted lady (Vanessa cardui)	
Lepidoptera	Pieridae	Pieris rapae (Cabbage white)	maybe male Checkered white, but specimen badly damaged
Lepidoptera	unk	caterpilar A	large (3cm), dark brown; possibly a skipper of some kind
Lepidoptera	unk	Caterpilars (2 types)	
Lepidoptera	unk	Microlep C	brown, 3-4mm
Lepidoptera	unk	Moth A	silvery tan, 8-9 mm
Lepidoptera	unk	Moth B	brown, 1 cm
Lepidoptera	unk	Moth C	med, white-tan
Lepidoptera	unk	Moth D	1 cm, plumose antennae
Lepidoptera	unk	Moth E	2 cm, dark brown, plumose antennae
Lepidoptera	unk	Moth F	1 cm, white with transverse brown line across wings
Neuroptera	Chrysopidae	Green lacewing	
Neuroptera	Coniopterigidae	Dusty-wing	
Neuroptera	Hemerobiidae	Brown lacewing	
Odonata	unk	Damselflies and Dragonflies	At least 3 types of Odonata were seen on the wing. None were captured for positive ID.
Orthoptera	Acrididae	Grasshopper A	body 34mm, mottled tan & black, legs tan, hind wings clear, no spur throat

Table A-4. Invertebrates (continued).

Order	Family	Taxa	Notes
Orthoptera	Acrididae	Pallid-winged Grasshopper (Trimerotropis pallidipennis)	this specimen was collected from the Eddie World parking lot in Beatty, but is almost certainly the same one seen all over the site.
Orthoptera	Tetragoniidae	Katydid	large, bright green
Psocoptera	Psocidae	Common barklouse	
Scorpiones	unk	Scorpion	Large, not collected
Scorpiones	Vaejovidae?	Scorpion	most scorpions in the region are in Family Vaejovidae. This one's too small to ID for certain.
Solpulgida	unk	Wind scorpion	
Thysanoptera	unk	Thrips	
Thysanura	Lepismatidae	Silverfish	

A.5 Plants

Table A-5. Plants .

Family Name	Scientific Name	Common Name	Native Status (USDA)
Asteraceae	Ambrosia dumosa	bursage	L48 N
Boraginaceae	Amsinckia menziesii	Menzies' fiddleneck*	L48 N
Boraginaceae	Amsinckia tessellata	fiddleneck	L48 N
Chenopodiaceae	Atriplex polycarpa	cattle saltbush	L48 N
Chenopodiaceae	Atriplex confertifolia	shadscale	L48 N
Brassicaceae	Brassicaceae no. 1	mustard?	NA
Brassicaceae	Brassicaceae no. 2	mustard?	NA
Poaceae	Bromus madritensis ssp. rubens	red brome	L48 I
Onagraceae	Camissonia boothii	Booth's evening primrose	L48 N
Asteraceae	Chaenactis fremontii	pincushion flower	L48 N
Asteraceae	Chaenactis macrantha	bighead dustymaiden	L48 N
Asteraceae	Chaenactis glabriuscula	yellow pincushion	L48 N
Euphorbiaceae	Chamaesyce polycarpa	smallseed sandmat	L48 N
Polygonaceae	Chorizanthe rigida	spineflower	L48 N
Boraginaceae	Cryptantha circumscissa	cushion cryptantha	L48 N
Boraginaceae	Cryptantha intermedia	clearwater cryptantha	L48 N
Boraginaceae	Cryptantha maritima	Guadalupe cryptantha	L48 N
Boraginaceae	Cryptantha no. 2		NA
Cuscutaceae	Cuscuta sp.	dodder	NA
Cactaceae	Cylindropuntia echinocarpa	golden cholla	L48 N
Solanaceae	Datura stramonium	jimsonweed	L48 I
Polygonaceae	Eriogonum contiguum	Reveal's buckwheat	L48 N
Polygonaceae	Eriogonum deflexum	flat-topped buckwheat	L48 N
Polygonaceae	Eriogonum inflatum	desert trumpet	L48 N
Polygonaceae	Eriogonum nidularium	Birdnest buckwheat	L48 N
Polygonaceae	Eriogonum thomasii	Thomas' buckwheat	L48 N
Polygonaceae	Eriogonum sp.	buckwheat	NA
Poaceae	Erioneuron pilosum	woollygrass	L48 N
Geraniaceae	Erodium cicutarium	redstem stork's bill	L48 I
Papaveraceae	Eschscholzia glyptosperma	desert poppy	L48 N
Asteraceae	Geraea canescens	desert sunflower	L48 N
Chenopodiaceae	Grayia spinosa	spiny hopsage	L48 N
Poaceae	Hordeum sp.	barley	NA
Asteraceae	Hymenoclea salsola	cheesebush	L48 N
Polemoniaceae	Langloisia setosissima ssp. punctata	Great Basin langloisia	L48 N
Polemoniaceae	Langloisia setosissima ssp. setosissima	Great Basin langloisia	L48 N

Table A-5. Plants (continued).

Family Name	Scientific Name	Common Name	Native Status (USDA)
Zygophyllaceae	Larrea tridentata	creosote	L48 N
Asteraceae	Lasthenia sp.	goldfields	NA
Brassicaceae	Lepidium fremontii	desert allysum	L48 N
Brassicaceae	Lepidium lasiocarpum	shaggyfruit pepperweed*	L48 N
Asteraceae	Malacothrix sonchoides	sowthistle desertdandelion	L48 N
Loasaceae	Mentzelia affinis	blazing star	L48 N
Asteraceae	Nicolletia occidentalis (?)	Mojave hole-in-the-sand plant	L48 N
Onagraceae	Oenothera deltoides	devil's lantern	L48 N
Onagraceae	Onagraceae sp.2	evening primrose	NA
Cactaceae	Opuntia basilaris	beavertail cactus	L48 N
Loasaceae	Petalonyx thurberi	Thurber's sandpaper plant**	L48 N
Hydrophyllaceae	Phacelia fremontii	Fremont's phacelia	L48 N
Asteraceae	Psathyrotes ramosissima	turtleback	L48 N
Chenopodiaceae	Salsola sp.	Russian thistle	L48 I
Chenopodiaceae	Salsola tragus	Spiny Russian thistle	L48 I
Poaceae	Schismus barbatus	Mediterranean grass	L48 I
Brassicaceae	Sisymbrium irio	London rocket	L48 I
Asteraceae	Stephanomeria pauciflora	brownplume wirelettuce	L48 N
Tamaricaceae	Tamarix aphylla	Athel tamarisk	L48 I
Boraginaceae	Tiquilia plicata	fanleaf crinklemat	L48 N
L48 N = native to the lower 48 United States L48 I = introduced to the lower 48 United States			

A.6 Fungi or Lichens

Table A-6. Fungi or Lichens.

Scientific Name	Common Name	Sign	Seen
Podaxis pistillaris	desert puffball		X

Data Sheet

(place a 4 X 6 photograph showing the area where the transect was conducted)

This form should be completed for those transects that contain one or more desert tortoise sign. After the project site and Zone of Influence have been surveyed for tortoise sign, the results from the transect forms should be compiled on a summary form.

If no tortoise sign occurs on the project site or Zone of influence, the summary form should be completed. Please fill in all section on the top 2/3 of the page of the summary form.

Date March 22, 2009
Transect No. 14
State NV
County NYE
City Amargosa Valley
Recorder W. Fisher
Address ~~Brigham City, UT~~
Project Name Solar Millennium
Type of Project Solar Plant / Presence / Absences
Quad Name
Scale
Scale
Site Name
T 16S R 48E Sec 1
¼ Sec NW ¼¼ Sec
LAT ~~UTM Zone~~ 36° 35.745 N
LONG ~~Northing~~ 116° 31.241 W
~~Easting~~

Parcel No. _____

DESERT TORTOISE HANDBOOK 1992:
FORM FOR PRESENCE-OR-ABSENSE AND CLEARANCE SURVEYS

Project Site | | Zone of Influence | | 0 ft from Project Site
Transect Length 1 Mile Width 30 ft Other ____ ft Time 1300
Land Form (e.g., mesa, bajada, wash) Flat Desert - Sand / Gravel
Slope: high ____ low ✓ Aspect S Elevation 2408 ft +- 13'
Soils Sand / Fine Sand to Sandy loam
Vegetation: dominant perennials Creosote / Bursage
dominant annuals

Adjacent Land Use: up to 1 mi Open Desert
Soils
Vegetation

TOTAL NUMBER OF

Corrected Sign	Live Tortoises Acult/Juv	Shelter Sites Pallets/Burrow/Den Active/Inactive	Scats	Shell Remains
1	A= J= 0	1	0	A= J= Unk= M= F= Unk= 0

Tracks	Eggshell Fragments	Drinking Sites	Courtship Rings	Other	Neotoma Middens w/sign	w/o sign
0	0	0	0	0	0	

SIGNS OF HUMAN DISTURBANCE - NUMBER TYPES SEEN

Tire Tracks	Human Footprnts	Dog Sign	Trash	Dump Sites	Shotgun/ Rifle Shells	Blading	Ravens	Other
✓	✓		✓				✓	

M/D/Y
Date March 22, 2009
Transect No. 14
State NV
County Nye
City Amargosa Valley
Recorder W. Fisher
Address
Project Name Solar Millennium

Parcel No.

INFORMATION ON SHELTER SITES
(Please indicate why you believe a shelter site is active or inactive)

Sign No.	Type	Location	Width	Estimated Length	Other Sign
1.	Burrow	Sec 1	8"	24"	0

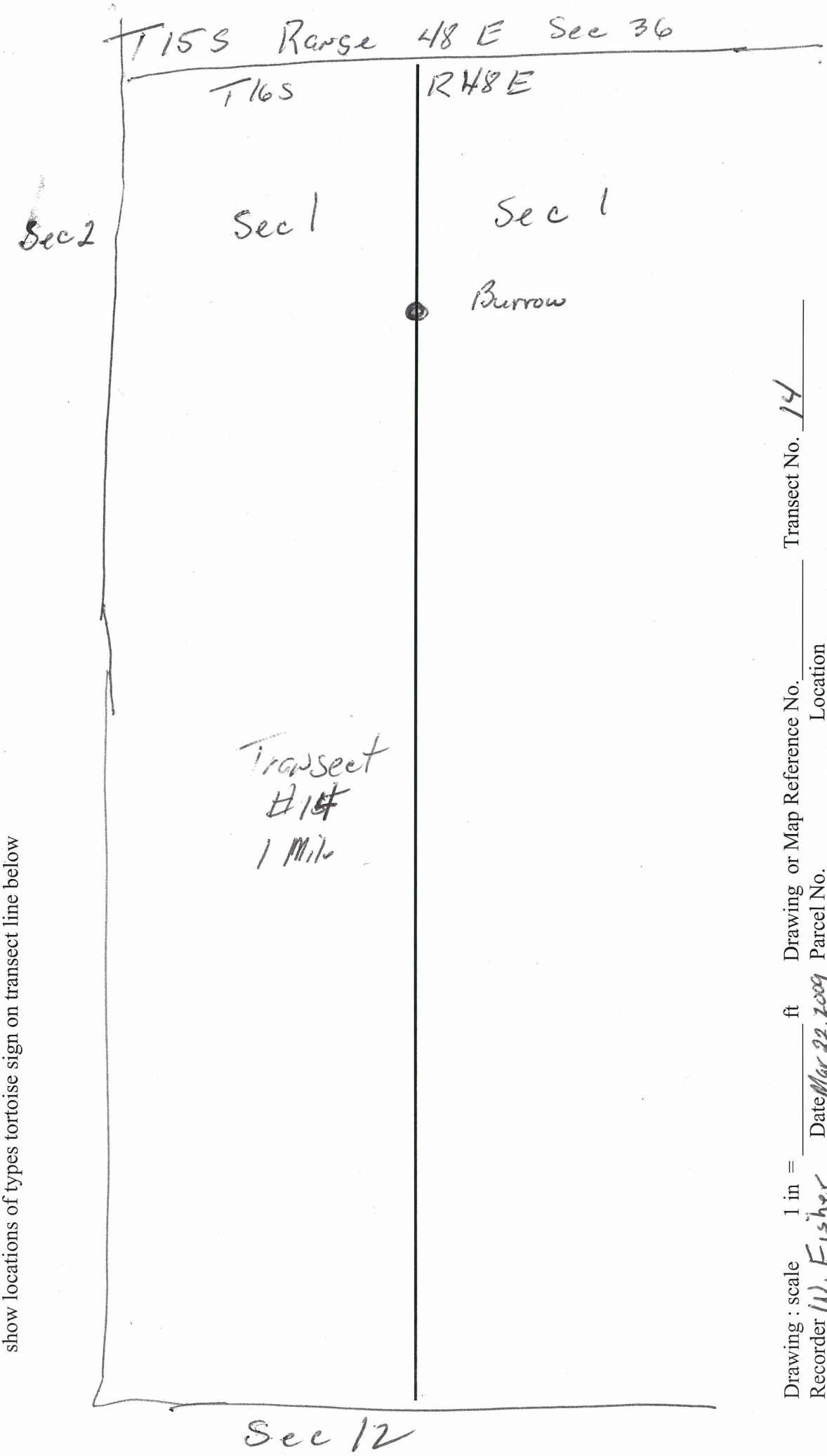
Condition of Shelter Site/Comments
Class 4 Burrow – Approx 24' deep. Spider webs and blown debris in mouth of Burrow

Burrow opening to Northeast turning to Southwest. Does not appear to be used since last spring (2008)

CONDITION OF SCATS – COMMENTS (see below)

CONDITION OF SHELL REMAINS – COMMENTS (see below)

SIGNS OF HUMAN DISTURBANCE – COMMENTS



show locations of types tortoise sign on transect line below

Drawing : scale 1 in = _____ ft Drawing or Map Reference No. _____ Transect No. 14

Recorder W. Fisher Date Mar 22, 2009 Parcel No. _____ Location _____

LAT 36° 35. 745N
LONG 116° 31. 241W

INFORMATION INDEX FOR DESERT TORTOISE SIGN

Burrows and Dens, Scats, and Shell Remains

Burrows and Dens:
1. currently active, with tortoise or recent tortoise sign
2. good condition, definitely tortoise; no evidence of recent use
3. deteriorated condition (please describe); definitely tortoise
4. deteriorated condition; possibly tortoise (please describe)
5. good condition; possibly tortoise (please describe)

2 Scats:
1. wet (not from rain or dew) or freshly dried; obvious odor
2. dried with glaze1 some odor1 dnrk brown
3. dried; no glaze or odor; siynu of bleaching (light brown), tightly packed material
4. dried; light light brown to pale yellow, loose material; scaly appearance
5. bleached, or consisting only of plant fiber

Shell Remains:
1. fresh or putrid
2. normal color; scutes adhere to bone
3. scutes peeling off bone
4. shell bone is falling apart;growth rings on scutes are peeling
5. disarticulated and scattered

Data Sheet

(place a 4 X 6 photograph showing the area where the transect was conducted)

This form should be completed for those transects that contain one or more desert tortoise sign. After the project site and Zone of Influence have been surveyed for tortoise sign, the results from the transect forms should be compiled on a summary form.

If no tortoise sign occurs on the project site or Zone of influence, the summary form should be completed. Please fill in all section on the top 2/3 of the page of the summary form.

Date March 23, 2009
Transect No. 15
State NV
County Nye
City Amargosa Valley
Recorder W. Fisher
Address
Project Name Solar Millennium
Type of Project Solar Plant Pres./Abs. Survey
Quad Name
Scale
Scale
Site Name
T 16S R 48E Sec 1
¼ Sec ____ ¼¼ Sec ____
LAT ~~UTM Zone~~ 36° 35.752 N
LONG ~~Northing~~ 116° 31.162 W
Easting

Parcel No. _____

DESERT TORTOISE HANDBOOK 1992:
FORM FOR PRESENCE-OR-ABSENSE AND CLEARANCE SURVEYS

Project Site | | Zone of Influence | | ____ ft from Project Site
Transect Length 1 mile Width 30 ft Other ____ ft Time 0815
Land Form (e.g., mesa, bajada, wash) Flat Desert - Sand/Gravel
Slope: high ____ low ✓ Aspect ____ Elevation 2418 ft +-13'
Soils Sand/Fine Sand to Sandy Loam
Vegetation: dominant perennials Creosote/Bursage
dominant annuals

Adjacent Land Use: up to 1 mi Open Desert
Soils Same
Vegetation Same

TOTAL NUMBER OF

Corrected Sign	Live Tortoises Acult/Juv	Shelter Sites Pallets/Burrow/Den Active/Inactive	Scats	Shell Remains
1	A= J= 0	1	0	A= J= Unk= M= F= Unk= 0

Tracks	Eggshell Fragments	Drinking Sites	Courtship Rings	Other	Neotoma Middens w/sign	w/o sign
0	0	0	0	0	0	

SIGNS OF HUMAN DISTURBANCE - NUMBER TYPES SEEN

Tire Tracks	Human Footprnts	Dog Sign	Trash	Dump Sites	Shotgun/ Rifle Shells	Blading	Ravens	Other
✓	✓		✓				✓	

M/D/Y
Date March 23, 2009
Transect No. 15
State NV
County Nye
City Amargosa Valley
Recorder W. Fisher
Address
Project Name Solar Millenium

Parcel No.

INFORMATION ON SHELTER SITES
(Please indicate why you believe a shelter site is active or inactive)

Sign No.	Type	Location	Width	Estimated Length	Other Sign
1	Burrow	Sec. 1	8"	26"	0

Condition of Shelter Site/Comments
Class 4 Burrow - Approx. 26" Deep - Spider webs / Debris in Burrow

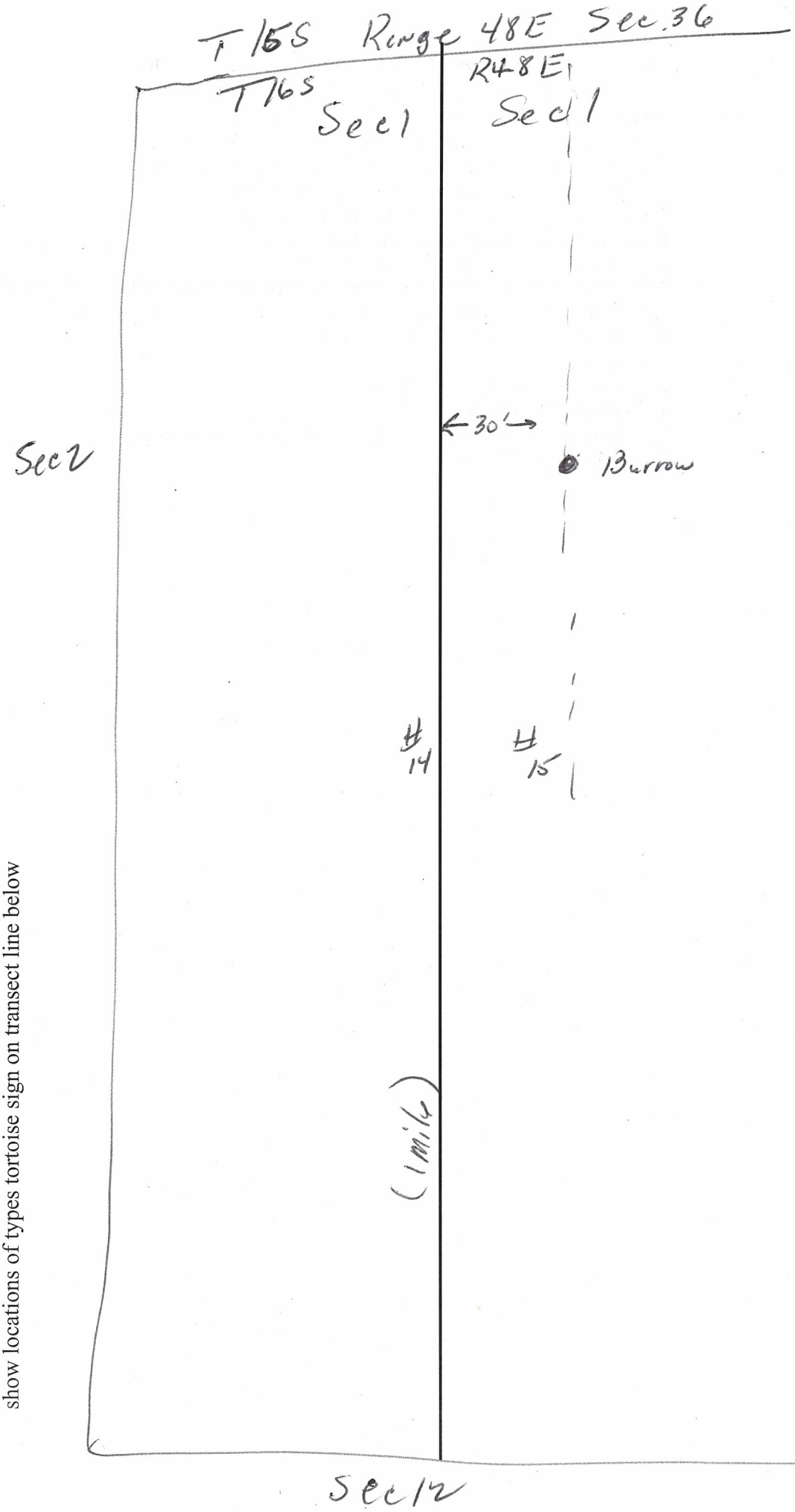
Burrow Opening to East South East to North North West - Does not appear to be used since spring of 2008

CONDITION OF SCATS – COMMENTS (see below)

CONDITION OF SHELL REMAINS – COMMENTS (see below)

SIGNS OF HUMAN DISTURBANCE – COMMENTS

show locations of types tortoise sign on transect line below



Drawing : scale 1 in = _____ ft Drawing or Map Reference No. _____ Transect No. 15

Recorder W. Fisher Date 03/23/2009 Parcel No. _____ Location _____

LAT 36° 35.752 N
LONG 116° 31.162 W

INFORMATION INDEX FOR DESERT TORTOISE SIGN

Burrows and Dens, Scats, and Shell Remains

Burrows and Dens:
1. currently active, with tortoise or recent tortoise sign
2. good condition, definitely tortoise; no evidence of recent use
3. deteriorated condition (please describe); definitely tortoise
4. deteriorated condition; possibly tortoise (please describe)
5. good condition; possibly tortoise (please describe)

2 Scats:
1. wet (not from rain or dew) or freshly dried; obvious odor
2. dried with glaze1 some odor1 dnrk brown
3. dried; no glaze or odor; siynu of bleaching (light brown), tightly packed material
4. dried; light light brown to pale yellow, loose material; scaly appearance
5. bleached, or consisting only of plant fiber

Shell Remains:
1. fresh or putrid
2. normal color; scutes adhere to bone
3. scutes peeling off bone
4. shell bone is falling apart;growth rings on scutes are peeling
5. disarticulated and scattered

Data Sheet

(place a 4 X 6 photograph showing the area where the transect was conducted)

This form should be completed for those transects that contain one or more desert tortoise sign. After the project site and Zone of Influence have been surveyed for tortoise sign, the results from the transect forms should be compiled on a summary form.

If no tortoise sign occurs on the project site or Zone of influence, the summary form should be completed. Please fill in all section on the top 2/3 of the page of the summary form.

Date March 23, 2009
Transect No. 17
State NV
County Nye
City Amargosa Valley
Recorder W. Fisher
Address
Project Name Solar Millenium
Type of Project Solar Plant - Pres./Abs. Survey
Quad Name
Scale
Scale
Site Name
T 16S R 48E Sec 1
¼ Sec ____ ¼¼ Sec ____
LAT ~~UTM Zone~~ 36°35.619N
LONG ~~Northing~~ 116°31.153W
Easting

Parcel No. _____

DESERT TORTOISE HANDBOOK 1992:
FORM FOR PRESENCE-OR-ABSENSE AND CLEARANCE SURVEYS

Project Site | | Zone of Influence | | ____ ft from Project Site
Transect Length 1mile Width 30 ft Other ____ ft Time 1015
Land Form (e.g., mesa, bajada, wash) Flat Desert - Sand/Gravel
Slope: high ____ low ✓ Aspect ____ Elevation 2421 ft ~~+-13'~~
Soils Sand / Fine Sand to ~~Desert~~ Sandy loam
Vegetation: dominant perennials Creosote / Bursage
dominant annuals

Adjacent Land Use: up to 1 mi Open Desert
Soils Same
Vegetation Same

TOTAL NUMBER OF

Corrected Sign	Live Tortoises Acult/Juv	Shelter Sites Pallets/Burrow/Den Active/Inactive	Scats	Shell Remains
1	A= J= 0	1	0	A= J= Unk= M= F= Unk= 0

Tracks	Eggshell Fragments	Drinking Sites	Courtship Rings	Other	Neotoma Middens w/sign	w/o sign
0	0	0	0	0	0	

SIGNS OF HUMAN DISTURBANCE - NUMBER TYPES SEEN

Tire Tracks	Human Footprnts	Dog Sign	Trash	Dump Sites	Shotgun/ Rifle Shells	Blading	Ravens	Other
✓	✓		✓				✓	

M/D/Y
Date 03/23/2009
Transect No. 17
State NV
County Nye
City Amargosa Valley
Recorder W. Fisher
Address
Project Name Solar Millenium
Parcel No.

INFORMATION ON SHELTER SITES
(Please indicate why you believe a shelter site is active or inactive)

Sign No.	Type	Location	Width	Estimated Length	Other Sign
1	Burrow	Sec. 1	8"	30"	0

Condition of Shelter Site/Comments
Class 4 Burrow - Approx 30" Deep - Spider Webs / Debris in Burrow

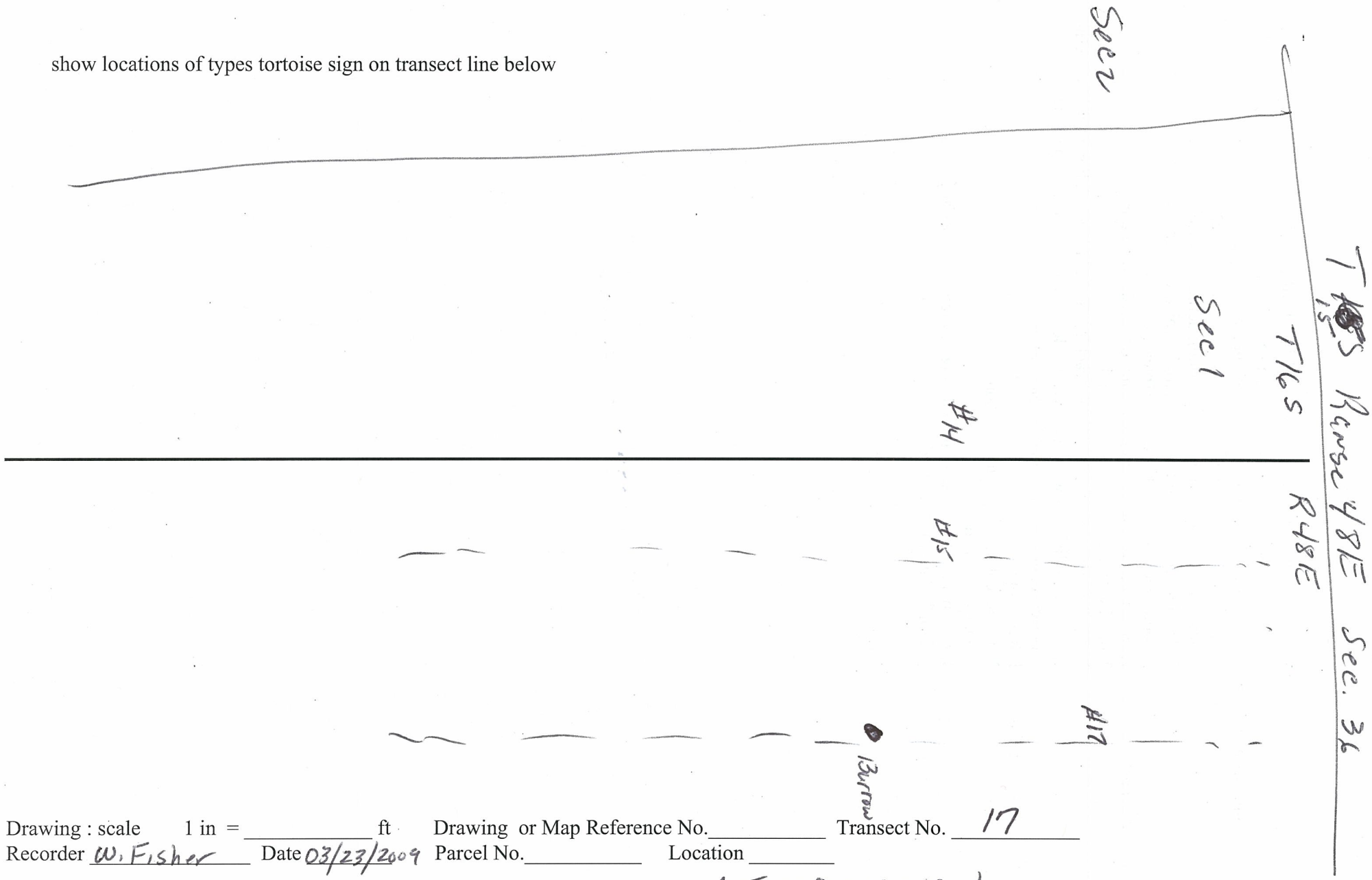
Burrow Opening to East South East - Turning to West
Does Not Appear to have been used in past year

CONDITION OF SCATS – COMMENTS (see below)

CONDITION OF SHELL REMAINS – COMMENTS (see below)

SIGNS OF HUMAN DISTURBANCE – COMMENTS

show locations of types tortoise sign on transect line below



Drawing : scale 1 in = _____ ft Drawing or Map Reference No._____ Transect No. 17

Recorder W. Fisher Date 03/23/2009 Parcel No._____ Location _____

LAT 36° 35.619 N

LONG 116° 31.153 W

INFORMATION INDEX FOR DESERT TORTOISE SIGN

Burrows and Dens, Scats, and Shell Remains

Burrows and Dens:
1. currently active, with tortoise or recent tortoise sign
2. good condition, definitely tortoise; no evidence of recent use
3. deteriorated condition (please describe); definitely tortoise
4. deteriorated condition; possibly tortoise (please describe)
5. good condition; possibly tortoise (please describe)

2 Scats:
1. wet (not from rain or dew) or freshly dried; obvious odor
2. dried with glaze1 some odor1 dnrk brown
3. dried; no glaze or odor; siynu of bleaching (light brown), tightly packed material
4. dried; light light brown to pale yellow, loose material; scaly appearance
5. bleached, or consisting only of plant fiber

Shell Remains:
1. fresh or putrid
2. normal color; scutes adhere to bone
3. scutes peeling off bone
4. shell bone is falling apart;growth rings on scutes are peeling
5. disarticulated and scattered

Data Sheet

(place a 4 X 6 photograph showing the area where the transect was conducted)

This form should be completed for those transects that contain one or more desert tortoise sign. After the project site and Zone of Influence have been surveyed for tortoise sign, the results from the transect forms should be compiled on a summary form.

If no tortoise sign occurs on the project site or Zone of influence, the summary form should be completed. Please fill in all section on the top 2/3 of the page of the summary form.

Date April 3, 2009
Transect No. 74
State NV
County Nye
City Amargosa
Recorder W. Fisher
Address
Project Name Solar Millenium
Type of Project Solar Plant
Quad Name
Scale
Scale
Site Name
T 16S R 48E Sec 2
¼ Sec NE ¼¼ Sec
LAT ~~UTM Zone~~ 36° 35.298N
LONG ~~Northing~~ 116° 31.921W
Easting

Parcel No. _____

DESERT TORTOISE HANDBOOK 1992:
FORM FOR PRESENCE-OR-ABSENSE AND CLEARANCE SURVEYS

Project Site | | Zone of Influence | | _____ft from Project Site
Transect Length 1 mile Width 30 ft Other 45 ft Time 0930
Land Form (e.g., mesa, bajada, wash)
Slope: high ____ low ✓ Aspect S Elevation 2397 ft ±13
Soils Sand / Fine sand to Sandy Loom
Vegetation: dominant perennials Creosote / Burrsage
dominant annuals
Adjacent Land Use: up to 1 mi Open Desert / House, sub-divided parcels
Soils
Vegetation

TOTAL NUMBER OF

Corrected Sign	Live Tortoises Acult/Juv	Shelter Sites Pallets/Burrow/Den Active/Inactive	Scats	Shell Remains
1	A= J= 0	1	0	A= J= Unk= M= F= Unk= 0

Tracks	Eggshell Fragments	Drinking Sites	Courtship Rings	Other	Neotoma Middens w/sign	w/o sign
0	0	0	0	0	0	

SIGNS OF HUMAN DISTURBANCE - NUMBER TYPES SEEN

Tire Tracks	Human Footprnts	Dog Sign	Trash	Dump Sites	Shotgun/ Rifle Shells	Blading	Ravens	Other
✓	✓		✓					

M/D/Y
Date April 3, 2009
Transect No. 74
State NV
County Nye
City Amargosa Valley
Recorder W. Fisher
Address
Project Name Solar Millenium

Parcel No.

INFORMATION ON SHELTER SITES
(Please indicate why you believe a shelter site is active or inactive)

Sign No.	Type	Location	Width	Estimated Length	Other Sign
1	Burrow	Sec. 2	8"	24"	0

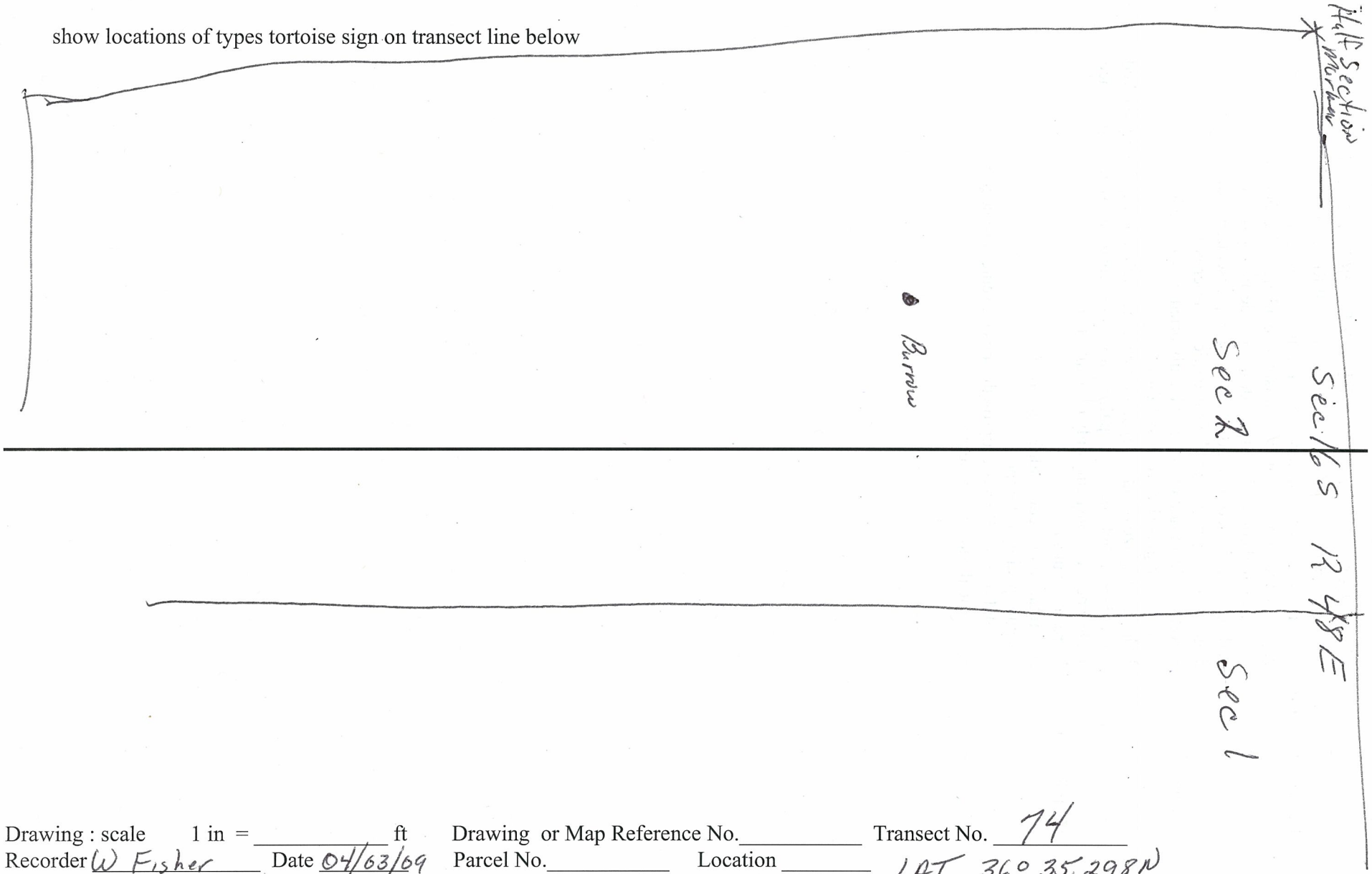
Condition of Shelter Site/Comments
Class 4 Burrow - Spider webs full length of burrow
Burrow opening to Southeast - No evidence of use in past year

CONDITION OF SCATS – COMMENTS (see below)

CONDITION OF SHELL REMAINS – COMMENTS (see below)

SIGNS OF HUMAN DISTURBANCE – COMMENTS

show locations of types tortoise sign on transect line below



Drawing : scale 1 in = _____ ft Drawing or Map Reference No._____ Transect No. 74

Recorder W Fisher Date 04/03/09 Parcel No._____ Location _____ LAT 36° 35.298N

Long 116° 31.921W

INFORMATION INDEX FOR DESERT TORTOISE SIGN

Burrows and Dens, Scats, and Shell Remains

Burrows and Dens:
1. currently active, with tortoise or recent tortoise sign
2. good condition, definitely tortoise; no evidence of recent use
3. deteriorated condition (please describe); definitely tortoise
4. deteriorated condition; possibly tortoise (please describe)
5. good condition; possibly tortoise (please describe)

2 Scats:
1. wet (not from rain or dew) or freshly dried; obvious odor
2. dried with glaze1 some odor1 dnrk brown
3. dried; no glaze or odor; siynu of bleaching (light brown), tightly packed material
4. dried; light light brown to pale yellow, loose material; scaly appearance
5. bleached, or consisting only of plant fiber

Shell Remains:
1. fresh or putrid
2. normal color; scutes adhere to bone
3. scutes peeling off bone
4. shell bone is falling apart;growth rings on scutes are peeling
5. disarticulated and scattered