# DOCKETED

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|---|---|
| **Docket Number:** | 09-AFC-07C |
| **Project Title:** | Palen Solar Power Project - Compliance |
| **TN #:** | 200009 |
| **Document Title:** | Palen Solar Holding's Bat Habitant Assessment |
| **Description:** | N/A |
| **Filer:** | Tiffani Winter |
| **Organization:** | Marie Fleming, Applicant's Counsel |
| **Submitter Role:** | Applicant's Representative |
| **Submission Date:** | 7/23/2013 3:05:29 PM |
| **Docketed Date:** | 7/23/2013 |

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July 22, 2013

California Energy Commission
Dockets Unit
1516 Ninth Street
Sacramento, CA 95814-5512

***Subject:*** **PALEN SOLAR HOLDINGS, LLC'S BAT HABITAT ASSESSMENT**
**PALEN SOLAR ELECTRIC GENERATING SYSTEM**
**DOCKET NO. (09-AFC-7C)**

Enclosed for filing with the California Energy Commission is the electronic version of **PALEN SOLAR HOLDINGS, LLC'S BAT HABITAT ASSESSMENT**, for the Palen Solar Electric Generating System (09-AFC-7C).

Sincerely,

Marie Fleming

Southern California Office • 2550 N. Hollywood Way • Suite 203 • Burbank CA 91505

# BAT HABITAT ASSESSMENT FOR PALEN SOLAR

# ELECTRIC GENERATION SYSTEM

# RIVERSIDE COUNTY, CALIFORNIA

Conducted for:

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## INTRODUCTION

The goal of this survey was to assess the potential for bat roosting and foraging habitat at the site of the proposed Palen Solar Electric Generation System (PSEGS) located north of Interstate 10 and west of Desert Center, Riverside County, California. The list of the species that could occur on the site (Table 1) is the result of previous bat surveys that Dr. Patricia Brown has conducted in the vicinity of the project over the past 45 years. Possible impacts to bats would be largely through removal of roosting and/or foraging habitat. Since the project site is not in mountainous terrain, direct impacts would be to species (pallid bats and canyon bats) that roost in or under objects on the ground (e.g., rocks, woody debris), in crevices in soil or standing wood and the loss of foraging habitat for several species that roost in rocky hills adjacent to the project and in multiple abandoned mines within a 16 km radius of the project.

**SURVEY METHODS**:
Acoustic monitoring was conducted for four nights from May 11 through May 14, 2013 to sample bats utilizing the Study Area. Passive acoustic monitors consisted of a sealed enclosure containing a battery, broadband frequency-dividing ultrasound detector and a programmable data storage device (Anabat II and CF-ZCAIM; Titley Electronics, Ballina, NSW, Australia), with an extension cable with a microphone in a weather shroud, flat acoustic reflector and bracket (Figures 5-10 ). The microphone and reflector assemblies were elevated approximately 3 ft above the terrain on a metal stake. Recorded data were stored on Compact Flash cards that were programmed with sampling start and stop times (1800-0600 Pacific Standard Time) for a sampling interval longer than the time from local sunset to sunrise. An estimate of local sunset times was obtained from project site coordinates and U.S. Naval Observatory web services (http://aa.usno.navy.mil/data/docs/RS_OneYear.php). After a brief site reconnaissance, twelve monitors were deployed (Figure 1 and Table 2) at sites with varied vegetative cover to identify bat species and document activity levels at this season. Half of the monitors had standard Titley ultrasonic microphones (20 kHz to greater than 120 kHz) and half had low frequency microphones with the same ultrasonic capability, but higher sensitivity to sounds in the audio range (4.5 to 20 kHz). This enhances detection of human audible bat sounds (e.g., pallid and California leaf-nosed bat social calls, hoary bat, western mastiff, and other larger freetail bat calls), but also increases the probability of recording insects, rodents, birds and leaf rustle.

Identification of call sequence files combined software filter based screening using Analook W 3.9c (available at www.hoarybat.com/Beta) with user examination and active labeling of the data. Acoustic data sets inevitably contain call sequences of widely varying quality. Some are recognizable as bats in a particular frequency range, but are fragmentary and not assignable to a single species. An issue remaining even when call sequence quality is adequate is that call repertoires of some species overlap substantially, so that some sequences from those taxa are not reliably separable, leading to use of sonotypes or multispecies categories. Echolocation is a sensory modality analogous in many ways to vision in terms of how the information in the returning echo is processed and used. Echolocation is not analogous to communication signals where the information conveyed by the sounds will consistently identify an individual of a species. Within anatomical constraints, a single bat species will typically emit a variety of echolocation signals tailored to the perceptual task (obstacle avoidance, foraging, etc.) in different habitats (cluttered environments, open air, over water; see Schnitzler and Kalko 2001). Different species of bats can use similar echolocation signals in similar tasks. Most species of bats emit some call types that are distinctive within a local species assemblage, but often there is convergence or overlap among species using similar call frequencies. Therefore, a call may be classified as being produced by a bat, but exact species identification may not always be possible. The information is still valuable in determining habitat use by bats. Communication signals produced by bats are generally lower in frequency and can be diagnostic of the species.

In this analysis, two nominally multispecies categories are M50 (steep calls that end near 50 kHz) and in the Project Area could include two species of Myotis, *M yumanensis* and *M. californicus*, and Q25 (calls ending near 25 kHz attributable to several mid-frequency larger species). All M50 calls were assigned to *M. californicus* based on our knowledge of distributional and habitat information. Diagnostic mid frequency sequences were recorded for both *A. pallidus* and *T. brasiliensis*, but additional non-diagnostic sequences may have come from one of these or two other species. We have retained the Q25 category in the data table to show relative larger bat activity among sites. Values in the table are counts of one minute intervals during the night that had at least one identified sequence file (activity index of Miller 2001). Further discussion of methods and most filters are available from Rainey et al. (2009).

**Results:**

Four bat species are interpreted as detected acoustically within the Study Area (Tables 1 and 3). Three of these (pallid bat, canyon bat, Mexican freetail bat) yielded multiple call sequences identifiable to those species. There are also many 50 kHz Myotis sequences (M50). California myotis is nearly ubiquitous at low elevation in California deserts and far more common in open habitats distant from surface water than any other myotis species, so we interpret M50 call sequences as this species. No audible frequency bats were identified, and (at this sample size) no obvious difference between monitors with low and standard frequency microphones was seen (Table 2, Table 3).

In Table 3, 989 identified bat call minutes were recorded at the 12 detector locations over the four nights. In this relatively low activity sample there were few instances of two different species or sonotypes calling within the same minute at one site, so the value obtained by summing across species and sonotypes is a reasonable representation. The highest number of call minutes (443) was recorded at Site 10 (Figure 9, the furthest north station located next to a large palo verde tree).

Canyon bats (*Parastrellus hesperus*) were the most common species detected at all detector locations within the solar project area, followed closely by California myotis (*Myotis californicus*). Canyon bats were the earliest detections at most sites and nights, with many recorded approximately 30 minutes after sunset. Pallid bats (*Antrozous pallidus*) and Mexican free-tailed bats (*Tadarida brasiliensis*) were considerably less abundant acoustically and not detected at all locations (Figures 3 and 4; Table 3). Pallid bats were detected at six of the stations concentrated along the west and north project boundaries (Figure 2).

**DISCUSSION:**

Using data from a 14 month acoustic monitoring project with 7-9 similar detectors at fixed locations in the Nevada desert separated by several km, Skalak et al. (2012) examined the number of species detected in relation to the number of monitors and duration of sampling. Among their conclusions is that monitoring with multiple detectors at fixed sites for 2-5 nights in summer will yield the 'common' species (60% of number of taxa detected in much more extended monitoring). This provides a perspective on the species assemblage found in the current brief study.

The natural history of the four species detected is discussed below, beginning with the most common. Six additional species could be active on the project area at some season, though two (California leaf-nosed bat and Townsend's big-eared bat) may not be readily detectable acoustically even when present.

**Canyon Bat** (*Parastrellus hesperus*): This common species is the smallest of all North American bats, and can be distinguished from *Myotis californicus* by a club-shaped tragus, compared to the pointed tragus of *Myotis* (Barbour and Davis, 1969). They are often associated with rocky canyons and outcrops (usually at elevations below 2,000 meters), where they can roost in small crevices (Stager, 1943; Cross, 1965). Crevices within mines and caves are also used. They have been observed at dusk flying over creosote bush scrub several km from rocky areas. Von Bloeker (1932) and several other early investigators reported finding canyon bats under detached rocks on soil and Barbour and Davis (1969) suggest that they may roost in rodent burrows, as has been observed for other bat species. They typically emerge early in the evening, often before sunset, and may be active after sunrise. Near rocky canyons, their small fluttery forms can fill the sky in the fading desert light. They are often the first bats captured in the evening in mist nets set over isolated desert water holes (O'Farrell and Bradley, 1970) or across mine entrances as they enter to roost at night. Stomach content analysis suggests that they feed on small swarming insects such as dipterans and flying ants (Hayward and Cross, 1979). During cooler winter months, canyon bats hibernate in rock crevices (sometimes in mines), although on warm winter days, they may emerge to forage during the day. It is reported that females give birth to twins in late May through June, and mothers with their young may roost alone or in groups of less than 10 individuals. The young are volant within a month. The bats that use roosts within the creosote bush flats are usually solitary and the degree of roost fidelity may change with the season. In the current survey, the distinctive echolocation signals were recorded in creosote bush scrub at a distance from the mountains shortly after sunset, suggesting roosting locally on the flat terrain.

**California myotis** (*Myotis californicus*): This small myotis is ubiquitous in most habitats in the Southwest below about 7,000 feet elevation (Barbour and Davis 1969; Krutzsch, 1954; Simpson 1993). They roost singly or in small groups in crevices in rocks, mines, trees and manmade structures. While Yuma myotis are usually found near open fresh water, California myotis are recorded in the driest habitats where they forage in the open for small moths and dipterans. In the current survey California myotis were recorded every evening at most sites at considerable distance from any substantial rocky outcrops. Using light tags, Hirshfeld et al. (1977) found that California myotis frequently night roost on small shrubs, presumably for prey digestion, close to the initial capture site.

**Pallid bat** (*Antrozous pallidus*): The communication sounds of pallid bats (Brown, 1976; Orr, 1954) are better acoustic tools for identification than the echolocation signals, which can resemble those used by *Tadarida* and *Eptesicus.* With sufficient moonlight, pallid bats can navigate visually, use prey-produced sounds to hunt (Bell, 1982), and may not emit echolocation signals. Therefore the activity of this species may be under-estimated based solely on acoustic detections.

The relatively powerful jaws of pallid bats are essential to disable their prey, which include scorpions, solpugids, beetles, grasshoppers, cicadas, katydids and sphinx moths (Barbour and Davis, 1969; Hermanson and O'Shea, 1983) captured on or near the ground. Radio-telemetry (Brown and Grinnell, 1980; P. Brown pers. obs.) and the known behavior of favored prey items suggest pallid bats fly close to the ground, and land on the ground to capture prey. Between foraging bouts, pallid bats may congregate in night roosts in mines, buildings and under bridges where they leave guano and the remains of scorpions, katydids, sphinx moths, Jerusalem crickets, and/or beetles. Hirshfeld et al. (1977) found with light tags that night roost sites also included willows in wash vegetation.

Roosts are apparently selected on the basis of temperature and proximity to foraging habitat. Radio-tracking studies in the Mojave Desert at Camp Cady near Barstow have demonstrated that the bats roost in crevices in granite boulders, between rocks in loosely-cemented conglomerate and in mud solution tubes in badlands formations (Brown and Berry, 1998). In another telemetry study near Coso Hot Springs on NAWS China Lake, the bats roosted in historic buildings, mines and rock crevices in granite boulders (Brown, pers. obs.). The bats often spend the day in rock crevices and congregate at night roosts for socialization (Lewis, 1994). They could potentially roost in burrows within the creosote bush scrub of the project area or in bark and bole defects of the desert trees such as the ironwood in Figure 10. In previous surveys, a maternity colony of pallid bats was detected in a mine at the SE corner of the Coxcomb Mountains 17 km northwest of the Project Area (Brown, pers. obs).

**Mexican free-tailed bat** (*Tadarida brasiliensis*): Mexican free-tailed bats can forage over large areas each night, ranging as far as 40 km from their roosts. They roost in crevices in cliff faces or manmade structures such as bridges and dams (Barbour and Davis 1969; Wilkins 1989). Acoustically, *Tadarida* often appear to be one of the most ubiquitous bat species, in part due to their loud, low frequency echolocation signals that are detectable over large distances. However, they were not that common on the project area and were recorded at only five sites in the current survey.

**Potentially occurring species not detected in current survey**

**California leaf-nosed bat** (*Macrotus californicus*): The California leaf-nosed bat is the most northerly representative of the Phyllostomidae, a predominantly Neotropical family. The type locality of *Macrotus* is Ft. Yuma, California (Baird, 1858). This species occurs in the Lower Sonoran life zone in the deserts of California, southern Nevada, Arizona and south to northwestern Mexico (Sonora and Sinaloa) and Baja California (Greenbaum and Baker, 1976; Hall, 1981; Hoffmeister, 1986). In the 1900s, California leaf-nosed bats were collected in several locations across southern California (Howell, 1920b; Anderson, 1969; Constantine 1998). As recently as 25 years ago, it was observed in southern San Diego County (Brown, pers. obs.). Extensive surveys conducted over the past 35 years indicate that the species now appears to be limited to the eastern portion of its former range in California (Brown and Berry 1998; 2004), and is found primarily in the mountain ranges bordering the Colorado River basin. The range of California leaf-nosed bats has contracted, and the species no longer occurs outside of desert habitats in California. The primary factors responsible for the declines are human roost disturbance, the closure of mines for renewed mining and hazard abatement, and the destruction of foraging habitat. The combination of limited distribution, restrictive roosting requirements, and the tendency to form large, but relatively few colonies make this species especially vulnerable.

A year-round population (wintering and maternity) of California leaf-nosed bats was monitored in one of the Kaiser Mine adits in the Eagle Mountains (30 km northwest of the project area) between 1990 and 2000 (Brown 1996 and 2000),*Macrotus* is a visually-orienting bat that uses prey-produced sounds while foraging. When echolocation signals are used, they are of low intensity. Therefore acoustic surveys may not detect this species, and would potentially underestimate their presence or activity on the Project Area. California leaf-nosed bats are dependent on either caves or mines for roosting habitat. While they have been found night roosting in buildings or bridges (Brown and Berry, 1998 and 2004; Constantine, 1961; Hatfield, 1937), all major maternity and over-wintering sites are in mines or caves. During extensive field investigations of this species over the last 45 years, Brown and Berry (1998; 2004) found that all known winter and most maternity day-roost sites are in abandoned mines in California. The exceptions are two small maternity colonies of less than 10 bats each in natural small caves. Several caves, which were used earlier in the century and which may have sheltered hundreds of bats (Grinnell, 1918; Howell, 1920b; Constantine, 1998), have been abandoned due to human disturbance and development or habitat alteration in the vicinity.

*Macrotus* neither hibernate nor migrate, and have a narrow thermal-neutral zone. They are incapable of lowering their body temperature to become torpid. No special physiological adaptations occur in *Macrotus* for desert existence, and behavioral adaptations such as foraging methods and roost selection contribute to their successful exploitation of the temperate zone desert even during the cooler months (Bell *et al*., 1986). To remain active throughout the year in the temperate zone deserts, *Macrotus* uses warm diurnal roosts in caves, mines and buildings with temperatures that often exceed 80º F. Depending on the season, they roost singly or in groups of up to several hundred individuals, hanging separately from the ceiling, rather than clustering. Often the bats hang from one foot, using the other to scratch or groom themselves. Most diurnal winter roosts are in warm mine tunnels at least 100 meters long. At this season, the large colonies of over 1000 bats may contain both males and females, although the sexes may also roost separately. The consistent feature of the areas in the mines used by the bats is warmth and high humidity with no circulating air currents. The temperature of the mines is usually warmer than the annual mean temperature, and the mines may be located in geothermally-heated rock formations. Except for the approximately two hour-nightly foraging period, in winter *Macrotus* inhabits a stable warm environment. Although longevity in this species does not approach the 30 or more years documented for temperate zone Vespertilionid bats, banded *Macrotus* in California have been recaptured after 15 years (Brown and Berry, 1998 and 2004). Banding studies also suggest that distances traveled between summer and winter roosts are generally no more than a few kilometers (Brown and Berry, 1998 and 2004). However, Musgrove (Cockrum, *et. al*., 1996) documented movement of two bats banded in the summer at the Rawhide Mine (north of the Bill Williams River) and recovered in mines in the Riverside Mountains in the winter--- a distance of 90 km.

Females congregate in large (>100 bats) maternity colonies in the spring and summer, utilizing different mines or areas within a mine separate from those occupied in the winter, although colonies of only 6-20 bats are also found (Barbour and Davis, 1969; Vaughan, 1959; Brown and Berry, 1998). Within the larger colonies, clusters of five to 25 females will be associated with a single “harem” male that defends the cluster against intruding males (Berry and Brown, 1995). Large male roosts may also form. The single young (weighing 25-30% of the mother’s mass) is born between mid-May and early July, following a gestation of almost 9 months. This species exhibits "delayed development" following ovulation, insemination and fertilization in September (Bradshaw, 1962). In March, with increased temperatures and insect availability, embryonic development accelerates. Since the newborn bats are poikilothermic, the maternity colony is located fairly close to the entrance, where temperatures exceed 90º F and daytime outside temperatures can reach over 120º F in the summer. This allows the bats to use shallow natural rock caves that would be too cold for a winter roost. Maternity colonies disband once the young are independent in late summer (Brown and Berry, 1998). In the fall, males aggregate in display roosts and attempt to attract females with a courtship display consisting of wing flapping and vocalizations. Aggression between males occurs at this time. The areas used as “lek” sites are usually in or near a mine that had been occupied by a maternity colony (Berry and Brown, 1995).

California leaf-nosed bats feed primarily on large moths and immobile diurnal insects such as butterflies, grasshoppers and katydids which they glean from surfaces (Anderson, 1969; Huey, 1925; Stager, 1943; Vaughan, 1959). Although *Macrotus* can echolocate, they appear to forage by utilizing prey-produced sounds and vision, even at low ambient light levels. The strategy of gleaning larger prey from the substrate as compared to aerial insectivory appears to reduce the total time and energy necessary for foraging (Bell, 1985; Bell and Fenton, 1986). Radio-telemetry studies of *Macrotus* in the California desert show that the bats forage almost exclusively among desert wash vegetation within 1-16 km of their roost. The close proximity of foraging areas to the roost is most important in winter, when the bats forage closer to the roost and are above ground for shorter periods than in the summer. The bats emerge from their roosts 30 or more minutes after sunset, and fly near the ground or vegetation in slow, maneuverable flight (Vaughan, 1959; Brown et al., 1993). Shallow caves and mines, buildings and bridges and desert trees are used by both sexes as night roosts between foraging bouts at all seasons, except for the coldest winter months. Wings and other culled prey parts are found under night roosts.

**Townsend's big-eared bat** (*Corynorhinus townsendii*): Acoustic studies are not the preferred method to determine the presence of this species, since they often gleans prey from foliage using low intensity calls that may only be detectable within a few meters. A known roost of this species occurs in mines near Corn Springs (14.5 km southwest of the Project Area). The determining factor in the distribution of this species in the Western United States tends to be the availability of cave-like roosting habitat (Pierson, 1998). Population concentrations occur in areas with substantial surface exposures of cavity forming rock (e.g., limestone, sandstone, gypsum or volcanic) and in old mining districts (Genter, 1986; Graham, 1966; Perkins et al., 1994; Perkins and Levesque, 1987). From the perspective of many bat species, old mines are cave habitat and are now sheltering many large colonies (Tuttle and Taylor, 1994; Altenbach and Pierson 1995; Brown *et al*., 1992; 1993).

This sensitive species has declined in numbers across the western United States, as documented in the Conservation Assessment and Strategy (Pierson *et al*. 1999) prepared by scientists and land managers for the Idaho Conservation Effort. The Western Bat Working Group rates *Corynorhinus* at high risk of imperilment across its range. A recent Center for Biological Diversity proposal for listing the species in California was reviewed and accepted in 2013 by the Department of Fish and Wildlife. Earlier studies by Pierson and Rainey (1996) for the California Department of Fish and Game showed marked population declines in many areas of California. Although several causative factors are identified, roost disturbance or destruction appears to be the most important reason for the decline. In another report, Pierson (1998) suggested that a combination of restrictive roost requirements and intolerance to roost disturbance or destruction has been primarily responsible for population declines of Townsend's big-eared bats in most areas. The tendency for this species to roost in highly visible clusters on open surfaces near roost entrances makes them particularly vulnerable to disturbance. Additionally, low reproductive potential and high roost fidelity increase the risks for the species. In all but two of 38 documented cases, roost loss in California was directly linked to human activity (e.g., demolition, renewed mining, entrance closure, human-induced fire, renovation, or roost disturbance; Pierson and Rainey, 1996).

The intense recreational use of caves and mines in California provides one explanation for why most otherwise suitable, historically significant roosts are currently unoccupied. Townsend's big-eared bats are so sensitive to human disturbance that a single entry into a maternity roost can cause a colony to abandon or move to an alternate roost (Graham, 1966; Stebbings, 1966; Stihler and Hall, 1993). Abandoned mines are also at risk from closure for hazard abatement, renewed mining and reclamation. Liability and safety concerns have led to extensive mine closure programs in western states, particularly on public lands, often without consideration for the biological values of old mines. The installation of bat-compatible gates on mines can protect the bats and exclude humans from hazardous mines. The mines at Corn Springs have been gated by the BLM.

**Hoary bat** (*Lasiurus cinereus*): This solitary tree-roosting bat species is morphologically and acoustically distinct (Corben pers. comm.). It migrates seasonally, both altitudinally and latitudinally apparently often in aggregations (Grinnell 1918; Krutzsch 1948; Shump and Shump 1982b) A continent wide analysis is provided by Cryan (2003). Most historic California records are from the winter, with fewer in the spring and fall, and none in the summer (Grinnell, 1918; Vaughan and Krutzsch, 1954). In early April 2011, migrating hoary bats were captured by Brown and Rainey in mist nets set at a spring at Ft. Irwin National Training Center in the western Mojave Desert. This species could potentially occur on the Project Area during migration. During a telemetry study along the Bill Williams River in Arizona, a hoary bat roosted in a palo verde tree (Brown 1996) and could also select this habitat on the Project Area.

**Western Yellow bat** (*Lasiurus xanthinus*): This species was recently split from the southern yellow bat (*Lasiurus ega*) based on genetic characteristics (Kurta and Lehr, 1995; Baker *et al.*, 1988; Morales and Bickham, 1995). Both species roost in trees, with preference given to palm trees with intact skirts, although some reports describe use of hackberry and sycamore, and even yucca (Higginbotham *et al.*, 2000). This species is known to occur in the palm groves of Joshua Tree National Park such as Cottonwood Springs north of Chiriaco Summit. The palm plantings at Desert Center and those on private land directly west of the Project Area could harbor this species, especially as the palms mature.

**Western mastiff bat** (*Eumops perotis*): Western mastiff bats belong to the free-tail family Molossidae, and are the largest bat species found in North America. They have a 60 cm wingspan and large bonnet-like ears, which extend forward over the eyes and are connected at the midline (Barbour and Davis, 1969; Best *et al.*, 1996). Unlike most other North American bat species that mate in the fall, free-tailed bats breed in the spring and give birth to a single young in the early to mid-summer. Most western mastiff bats give birth by early July (Krutzsch, 1955), in colonies generally containing fewer than 100 animals (Barbour and Davis 1969; Howell 1920a). Adult males and females may roost together at all times of year (Krutzsch 1955) in contrast to other North American bat species.

Western mastiff bats are found in a variety of biotic environments from low desert scrub to chaparral, oak woodland and ponderosa pine. However, the abiotic components appear to determine their distribution. This crevice-dwelling species predominantly selects cliff faces (granite, sandstone, or columnar basalt) or exfoliating granite boulders (Dalquest, 1946; Krutzsch, 1955; Vaughan, 1959), but also utilizes cracks in buildings (Howell, 1920a; Barbour and Davis, 1969). All roosts located in California by Pierson and Rainey (1996b) are in crevices at least 10 feet above the ground. The large granite boulders of Joshua Tree National Park provide ideal roosting habitat for this species.

The species appears to forage over open areas (Vaughan, 1959; Pierson and Rainey, 1996b), and many individuals have been heard feeding over agricultural fields in the Imperial Valley (P. Brown, pers. obs.). In California, western mastiff bats appear to feed primarily on moths (Lepidoptera), but may also take beetles and crickets (Whitaker *et al.*, 1997). Western mastiff bats emit an audible echolocation call and can be detected flying throughout the night. These strong, fast fliers cover an extensive foraging area in an evening. The species has been heard in open desert, at least 24 km from the nearest possible roosting site (Vaughan, 1959). From telemetry of several captured mastiffs, Siders et al. (1999) estimated the capture site to roost distances of 28-29 km in northern Arizona. Often multiple animals are detected together, and this species may travel or forage in groups (E. Pierson, pers. comm, P. Brown pers. obs.). Unlike Mexican free-tailed bats that undertake long seasonal migrations, western mastiff bats move relatively short distances seasonally. Although capable of lowering their body temperatures for short periods of time, they do not undergo prolonged hibernation, and may be periodically active throughout the winter. In Southern California, mastiff bats have been detected at all seasons, although they may change roost sites (Howell, 1920a; Krutzsch, 1948 and 1955; Leitner, 1966; Barbour and Davis, 1969). During surveys for the Eagle Mountain Landfill and Recycling Center, Brown (1996, 2000) heard the audible signals of western mastiff bats on several occasions, often in the vicinity of the open pit iron mines, where they could have potentially roosted in the high walls. This spring, a recently mummified specimen was discovered in an ironwood tree near Desert Center (N. Szatkowski, pers.obs.), examined by the authors and given to the UC Berkeley Museum of Vertebrate Zoology for curation.

**Pocketed free-tailed bat** (*Nyctinomops femorosaccus*): This slightly larger relative of the Mexican free-tailed bat differs from that species by having its ears joined at the midline (Constantine 1958; Kumirai and Jones 1990). A shallow fold of skin or "pocket" on the uropatagium, near the knee, is usually difficult to locate, and is not a good distinguishing field characteristic. Pocketed free-tailed bats are found at lower elevations in a variety of plant associations (Barbour and Davis 1969; Easterla 1973), and in proximity to roosting habitat in granite boulders, cliffs or rocky canyons. In California, it is associated primarily with creosote bush and chaparral habitats of Lower and Upper Sonoran life zones (Krutzsch, 1948). This crevice-dwelling species has occasionally been found in caves (Dalquest and Hall 1947), and in buildings under roof tiles (Gould 1961). All roosts in California have been in crevices in cliff faces or granite boulders located at least 10 feet (3.5 meters) above the ground (Pierson and Rainey 1996b; K. Miner, pers. comm.; P. Brown, pers. obs.). At one site the, pocketed free-tailed bats share a larger crevice with western mastiff bats, although they appeared to be roosting separately. With only a limited number of records for pocketed free-tailed bats from California, it is a CDFG Species of Concern. Krutzsch (1948) documented their occurrence in California from March through August, however recent records from late November suggests the species over-winters in San Diego County (Pierson and Rainey 1996b; K. Miner pers. comm.).

When emerging from their roosts in the evening, this species frequently makes audible "chattering" communication signals (Krutzsch 1944, 1948; Pierson and Rainey 1996b; K. Miner pers. comm.; P. Brown pers. obs.). They emit a relatively low constant frequency echolocation signal (~17 KHz) that is audible to people with good low frequency hearing. This species has been recorded at Joshua Tree National Park where it roosts in crevices in the granite boulders. Although not detected during the current survey, it could forage over the Project Area.

## IMPACTS

The construction of the project will reduce vegetation and insects in the area and decrease foraging habitat for several bat species. There could also be direct mortality of bats (i.e., canyon bats and pallid bats) that may roost in small rocks, tree crevices or burrows on the project site during site preparation and construction activities. Construction equipment and vehicles could cause the collapse of burrows that are often clustered around creosote bush roots. If the bats are not killed, they can be injured and/or evicted from a roost. Bats are attracted to relatively flat surfaces that have acoustic reflectivity resembling water (Greif and Siemers 2010). Bats may attempt to “dip” on heliostats when near horizontal, mistaking them for reflective water surfaces, and may injure themselves in the process. Bats and other organisms may also be attracted to any water- like surfaces (potentially containing injurious chemicals) associated with operations of the project (e.g., Krutzsch 1948).

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| | | BLM | CDFW |
|---|---|---|---|
| **Phyllostomatidae** (American leaf-nosed bats) | | | |
| *Macrotus californicus* | California leaf-nosed bat | BLMS | CSC |
| | | | |
| Vespertilionidae (Vesper bats) | | | |
| ***Antrozous pallidus*** | Pallid bat | BLMS | CSC |
| *Corynorhinus townsendii* | Townsend's big-eared bat | BLMS | CSC |
| *Lasiurus xanthinus* | Western yellow bat | | CSC |
| *Lasiurus cinereus* | Hoary bat | | |
| ***Myotis californicus*** | California myotis | | |
| *Myotis velifer* | Long-legged myotis | BLMS | CSC |
| *Myotis yumanensis* | Yuma myotis | BLMS | |
| ***Parastrellus hesperus*** | Canyon bat | | |
| | | | |
| Molossidae (free-tailed bats) | | | |
| *Eumops perotis* | Western mastiff bat | BLMS | CSC |
| *Nyctinomops femorosaccus* | Pocketed free-tailed bat | | CSC |
| ***Tadarida brasiliensis*** | Mexican free-tailed bat | | |

**BOLD** = detected in current survey
Red = Special status species present or potentially present
CDFW=California Dept. of Fish and Game, Species of Special Concern 2011
BLM=Bureau of Land Management Sensitive Species 2010

**Table 1. Bats detected or potentially occurring near the Palen Solar Project.**

| Map | N latitude | W longitude | Elev (m) | Site description | mic type |
|---|---|---|---|---|---|
| 1 | 33.6764 | 115.20794 | 179 | N of S margin track nr E bndry, creosote | lo |
| 2 | 33.6782 | 115.21481 | 185 | No of track, scattered trees, creosote | lo |
| 3 | 33.6804 | 115.22462 | 194 | Wash ctr nr pwrline, woodland | std |
| 4 | 33.6851 | 115.21948 | 181 | creosote scrub | std |
| 5 | 33.6853 | 115.20245 | 161 | N of Unit 2 twr, creosote bush | lo |
| 6 | 33.6901 | 115.21383 | 168 | S of track, nr lg PV in wash | std |
| 7 | 33.6984 | 115.22481 | 163 | N of Unit 1 Twr site | lo |
| 8 | 33.7058 | 115.21187 | 145 | N of NNE track | std |
| 9 | 33.7036 | 115.23421 | 170 | Sparse creosote | lo |
| 10 | 33.7102 | 115.22118 | 150 | NNW solar field, wash by lg PV | lo |
| 11 | 33.6978 | 115.23813 | 181 | E of track S of palm plantation | std |
| 12 | 33.6846 | 115.22995 | 193 | E margin Common Area | std |

**Table 2. Acoustic monitor locations and microphone type.**

| Map | Night | Pahe | M50 | Anpa | Tabr | Q25 | Sum by night | Sum All nights | First bat | Delay after sunset |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5/11/13 | 1 | | | | | 1 | | Pahe | 1:04 |
| 1 | 5/12/13 | 3 | 1 | | | | 4 | | Pahe | 0:39 |
| 1 | 5/13/13 | 1 | | | | | 1 | | Pahe | 7:50 |
| 1 | 5/14/13 | 2 | 1 | | | 2 | 5 | 11 | Pahe | 2:16 |
| 2 | 5/11/13 | | 1 | | | | 1 | | M50 | 6:52 |
| 2 | 5/12/13 | 2 | 1 | | | | 3 | | Pahe | 1:17 |
| 2 | 5/13/13 | 5 | | | | | 5 | | Pahe | 0:36 |
| 2 | 5/14/13 | 1 | | | | | 1 | 10 | Pahe | 5:32 |
| 3 | 5/11/13 | 3 | 8 | | | 1 | 12 | | Pahe | 0:42 |
| 3 | 5/12/13 | 4 | 10 | | | | 14 | | Pahe | 0:29 |
| 3 | 5/13/13 | 7 | 12 | 1 | | | 20 | | Pahe | 1:04 |
| 3 | 5/14/13 | 3 | 32 | | | | 35 | 81 | M50 | 1:02 |
| 4 | 5/11/13 | 4 | 8 | | 1 | | 13 | | Pahe | 0:35 |
| 4 | 5/12/13 | 5 | 6 | | | | 11 | | Pahe | 0:38 |
| 4 | 5/13/13 | 3 | 9 | | | | 12 | | Pahe | 1:28 |
| 4 | 5/14/13 | | 20 | | | | 20 | 56 | M50 | 1:21 |
| 5 | 5/11/13 | 2 | | | | | 2 | | Pahe | 1:04 |
| 5 | 5/12/13 | 1 | 1 | | 1 | | 3 | | Pahe | 0:47 |
| 5 | 5/13/13 | 3 | 2 | | | | 5 | | Pahe | 0:46 |
| 5 | 5/14/13 | 2 | 1 | | | | 3 | 13 | Pahe | 0:35 |
| 6 | 5/11/13 | 3 | 8 | | | | 11 | | Pahe | 0:42 |
| 6 | 5/12/13 | 5 | 14 | | | | 19 | | Pahe | 0:30 |
| 6 | 5/13/13 | 9 | 17 | | | | 26 | | M50 | 1:06 |
| 6 | 5/14/13 | 5 | 10 | | | | 15 | 71 | M50 | 1:13 |
| 7 | 5/11/13 | 5 | 1 | | | | 6 | | Pahe | 0:25 |
| 7 | 5/12/13 | 4 | 1 | | | | 5 | | Pahe | 0:30 |
| 7 | 5/13/13 | 6 | 3 | | | 2 | 11 | | Pahe | 0:52 |
| 7 | 5/14/13 | 10 | 1 | | | | 11 | 33 | Pahe | 1:07 |
| 8 | 5/11/13 | 28 | 7 | | | | 35 | | Pahe | 0:26 |
| 8 | 5/12/13 | 14 | 11 | 2 | 1 | | 28 | | Pahe | 0:30 |
| 8 | 5/13/13 | 17 | 22 | | | | 39 | | M50 | 1:35 |
| 8 | 5/14/13 | 11 | 5 | | | 1 | 17 | 119 | Pahe | 1:04 |
| 9 | 5/11/13 | 4 | 2 | | | | 6 | | Pahe | 1:17 |
| 9 | 5/12/13 | 10 | 1 | | | | 11 | | Pahe | 0:29 |
| 9 | 5/13/13 | 14 | 2 | | | 2 | 18 | | Pahe | 0:18 |
| 9 | 5/14/13 | 24 | 2 | 1 | | | 27 | 62 | Pahe | 0:42 |
| 10 | 5/11/13 | 39 | 60 | | 2 | | 101 | | Pahe | 0:26 |
| 10 | 5/12/13 | 38 | 48 | | | | 86 | | Pahe | 0:30 |
| 10 | 5/13/13 | 46 | 93 | | | 4 | 143 | | Pahe | 0:44 |
| 10 | 5/14/13 | 48 | 46 | 3 | | 6 | 103 | 433 | Pahe | 0:36 |
| 11 | 5/11/13 | 13 | 4 | | | | 17 | | Pahe | 0:41 |
| 11 | 5/12/13 | 16 | | 1 | | | 17 | | Pahe | 0:26 |
| 11 | 5/13/13 | 25 | 1 | | | 1 | 27 | | Pahe | 0:32 |
| 11 | 5/14/13 | 24 | 3 | | | | 27 | 88 | Pahe | 0:28 |
| 12 | 5/11/13 | 3 | | 1 | | | 4 | | Pahe | 0:39 |
| 12 | 5/12/13 | 2 | | | | | 2 | | Pahe | 0:28 |
| 12 | 5/13/13 | 3 | | | | | 3 | | Pahe | 0:59 |
| 12 | 5/14/13 | 3 | | | | | 3 | 12 | Pahe | 1:19 |
| | **Sum** | 481 | 475 | 9 | 5 | 19 | | 989 | | |

**Table 3. Minutes per night of acoustic activity by site & species or acoustic category**. (Pahe=*P. hesperus*, **M50**=*M. californicus*,, **Anpa**=*A. pallidus* , **Q25**=non-diagnostic 25-35 kHz sequences). Identification and delay after sunset (hr:min) of the first bat are the rightmost columns.

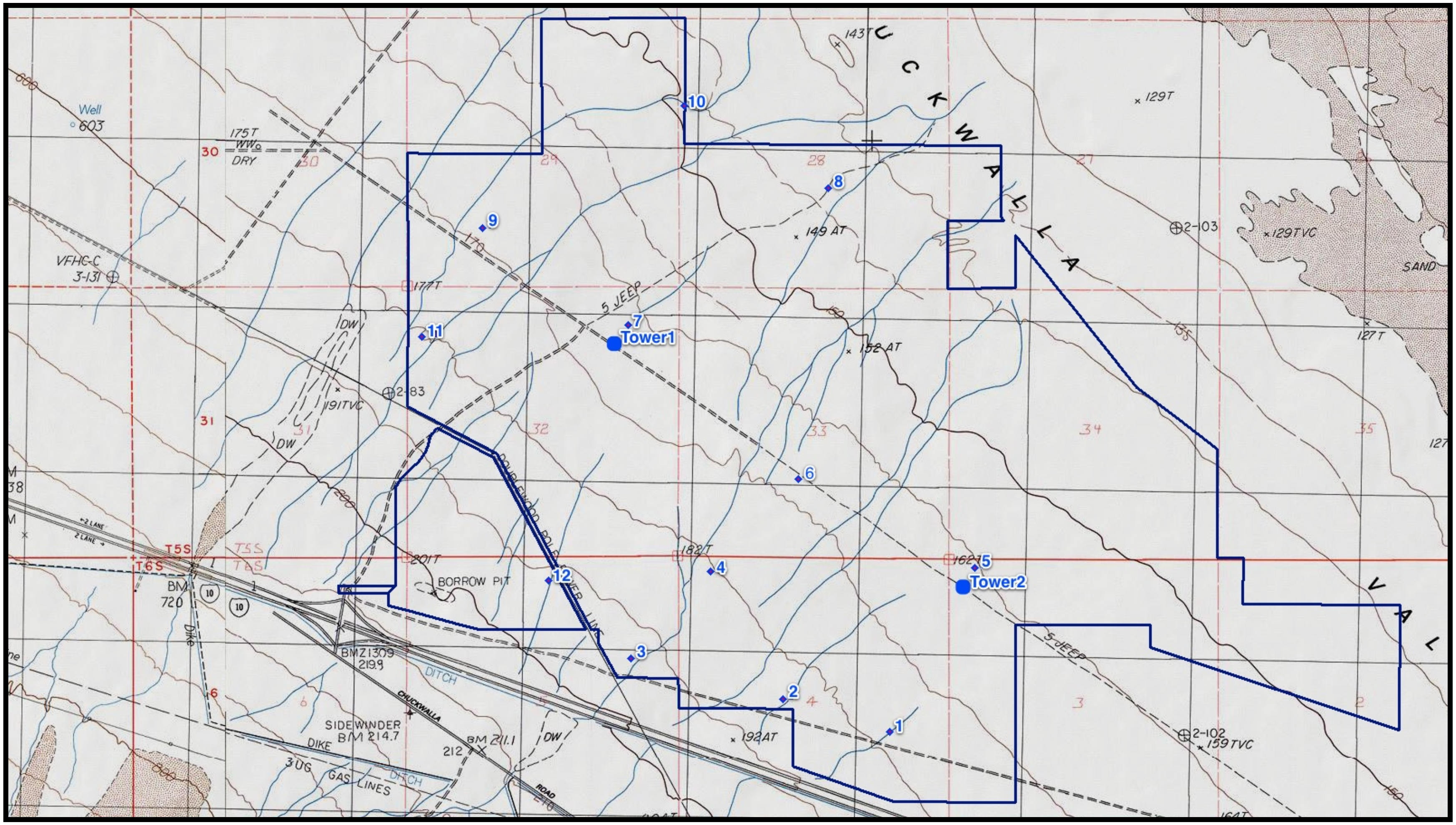


**Figure 1. Detector sites shown as blue diamonds, 1-12, with project perimeter also in blue.**

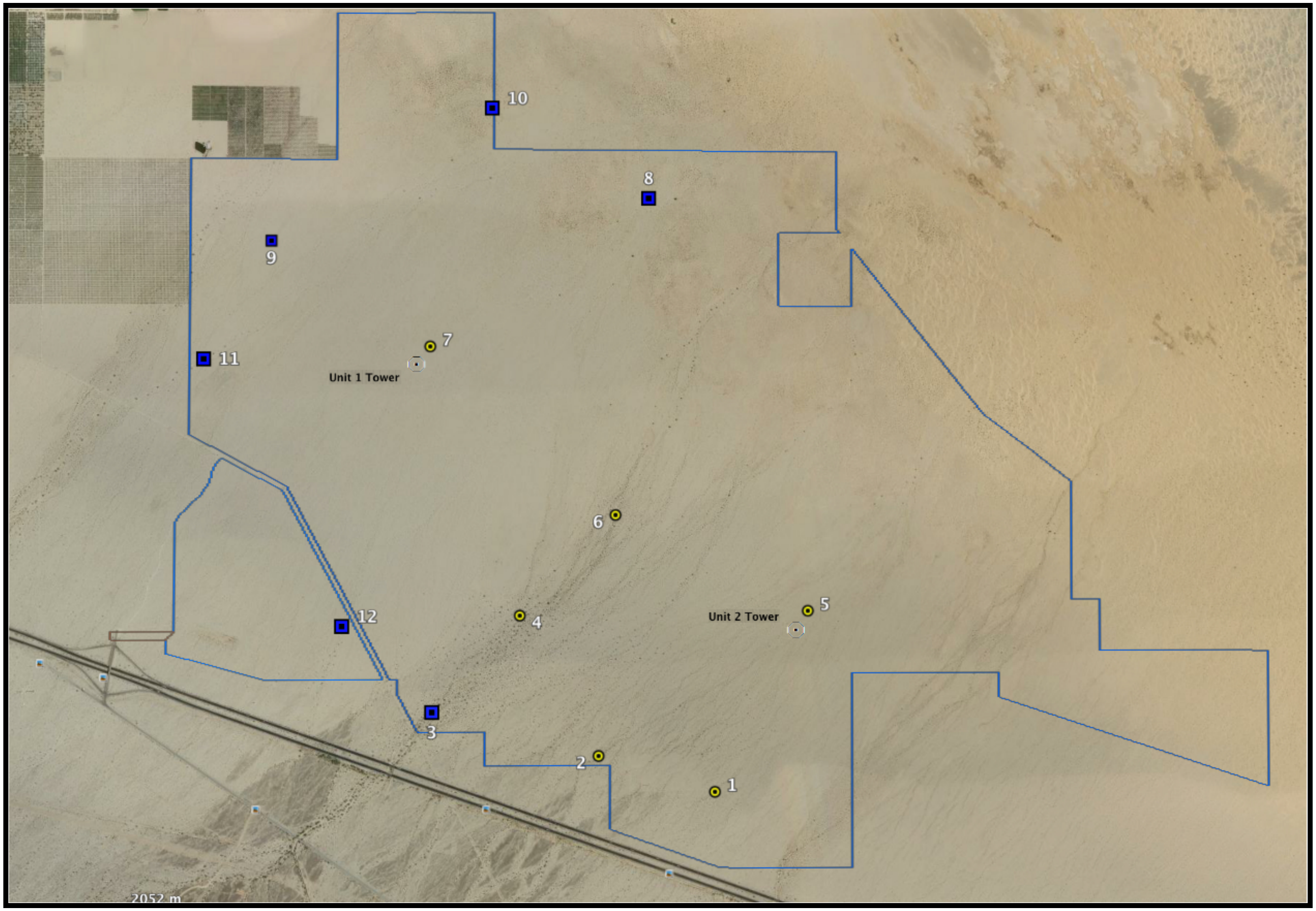


**Figure 2. Detector sites are numbered as in Fig.1 Detections of pallid bats at sites with blue squares.**

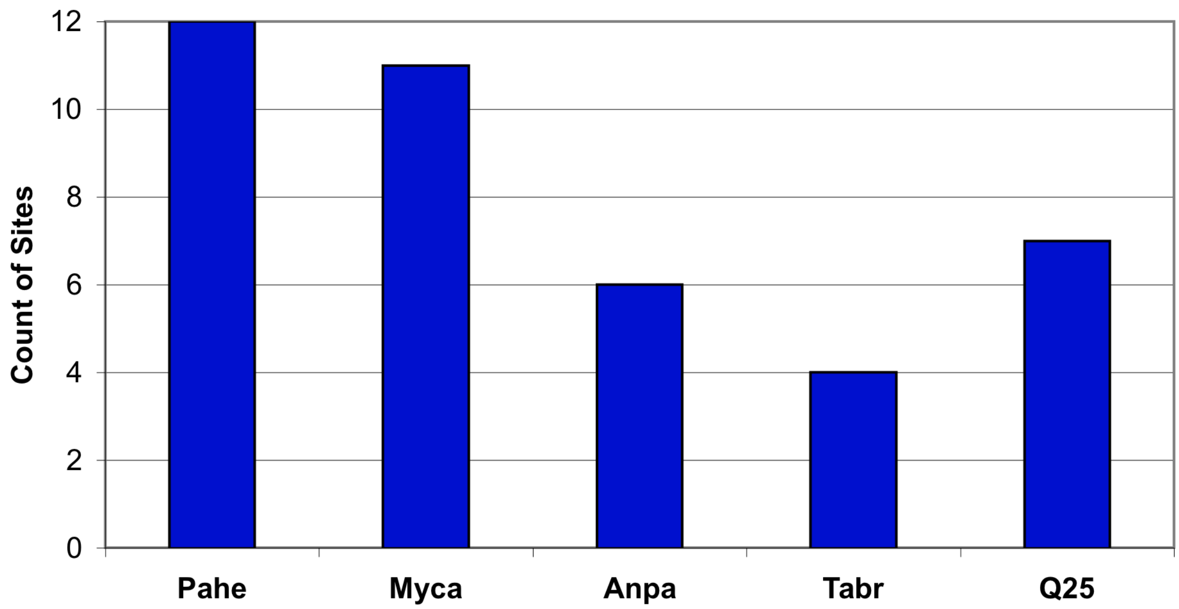


**Figure 3. Counts of sites with detections for species or sonotype (5/11-14/2013).**

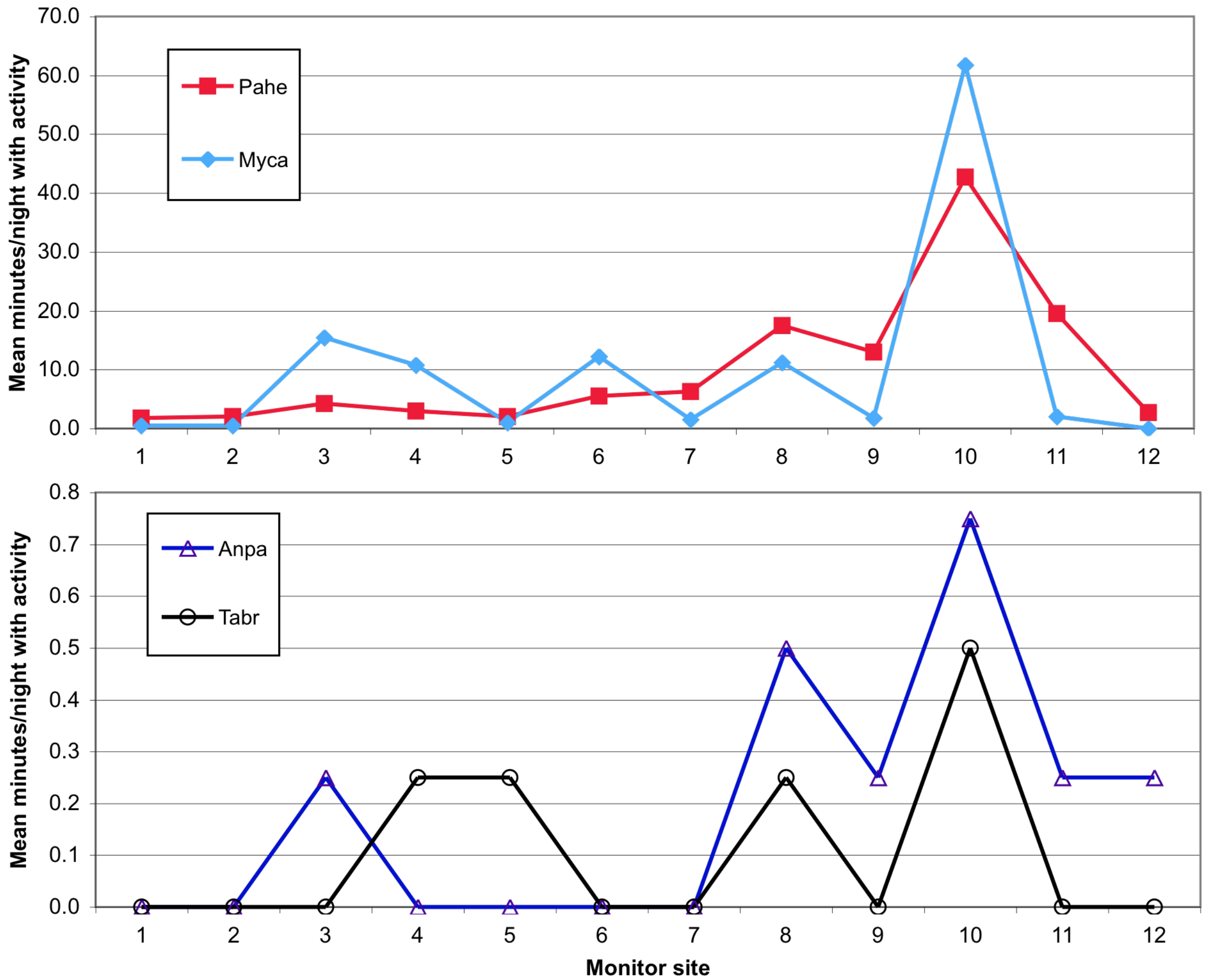


**Figure 4. Mean minutes/night with acoustic activity by species across stations. Note different Y axis values between plots.**


**Figure 5. Palen detector site 3, woodland wash vegetation.**


**Figure 6. Palen detector site 4, woodland wash vegetation.**


**Figure 7. Palen detector site 5, low density creosote bush.**

**Figure 8. Palen detector site 9, open creosote bush.**


**Figure 9. Palen detector site 10, wash channel, large palo verde, low density creosote bush.**

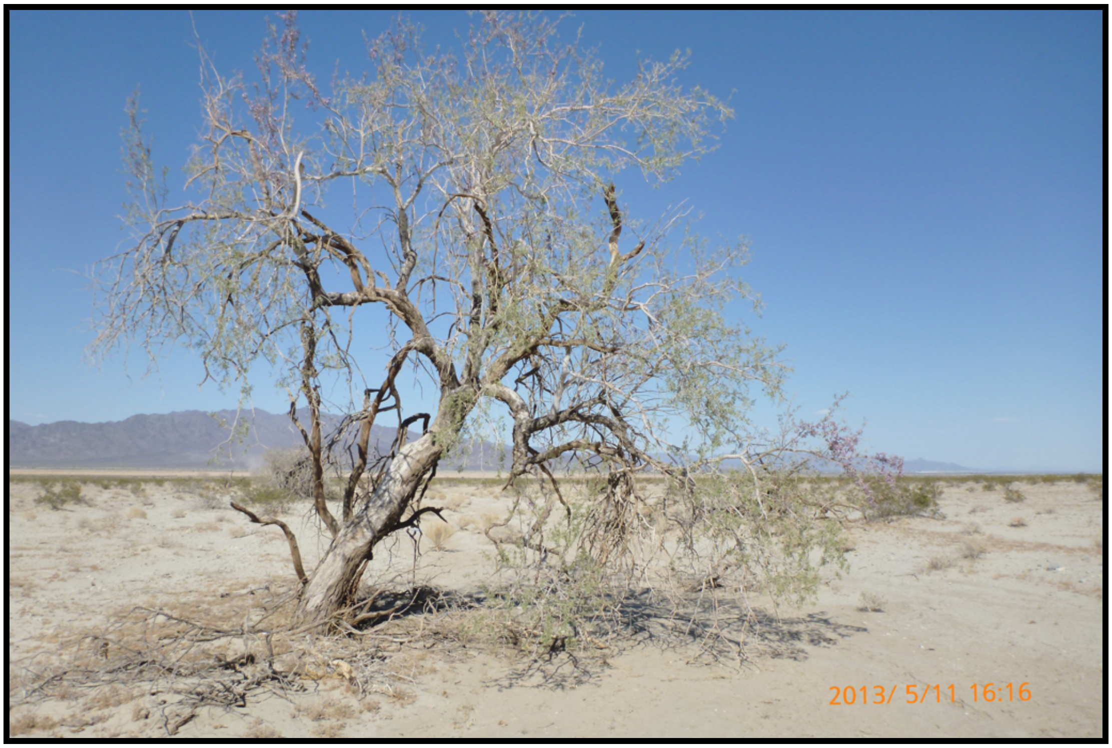


**Figure 10. Palen detector site 11, ironwood bole crevices and partially detached bark provide potential bat roost sites.**

**BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA**
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***PALEN SOLAR ELECTRIC GENERATING SYSTEM AMENDMENT***

**Docket No. 09-AFC-07C**
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**(Revised 07/09/2013)**

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## DECLARATION OF SERVICE

I, Marie Fleming declare that on July 22, 2013, I served and filed copies of the attached PALEN SOLAR HOLDINGS, LLC'S BAT HABITAT ASSESSMENT, dated July 20, 2013. This document is accompanied by the most recent Proof of Service, which I copied from the web page for this project at: http://www.energy.ca.gov/sitingcases/palen/compliance/.

The document has been sent to the other persons on the Service List above in the following manner:

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For service to all other parties and filing with the Docket Unit at the Energy Commission:

__X__ I e-mailed the document to all e-mail addresses on the Service List above and personally delivered it or deposited it in the U.S. mail with first class postage to those parties noted above as "hard copy required";

OR

___ Instead of e-mailing the document, I personally delivered it or deposited it in the U.S. mail with first class postage to all of the persons on the Service List for whom a mailing address is given.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I am over the age of 18 years.

Dated: July 22, 2013

Marie Fleming