# BAT SURVEYS OF THE PROPOSED WHITTIER MATRIX OIL PROJECT

**Whittier, California**

May-October 2011

Final Report

Prepared for

**THE PUENTE HILLS HABITAT PRESERVATION AUTHORITY**

7702 Washington Avenue, Suite C
Whittier, CA 90602

by

**STEPHANIE REMINGTON**
P.O. Box 12383
Costa Mesa, CA 92627
stremington@earthlink.net

*28 December 2011*

# TABLE OF CONTENTS

# EXECUTIVE SUMMARY

All ten bat species previously documented on the Puente Hills Preserve (PHP) were detected during the 2011 survey period within the Whittier Matrix Oil Survey Area. An eleventh species (pallid bat (*Antrozous pallidus*), detected in the eastern Puente Hills in 2004 was not recorded during this survey. A twelfth species (big free-tailed bat, *Nyctinomops macrotis*) possibly occurs onsite, but was not confirmed.

Five species, including two sensitive (MSSC), foliage-roosting species, appeared to be day-roosting in the immediate vicinity of the survey area. A sixth species roosted nearby, but possibly off site. No roost structures were located. There was no evidence of the existence of a large maternity colony in the project area during this survey period.

Most bats appeared to be using the Whittier Matrix Oil Survey Area primarily for foraging, although the timing of the activity – later at night – does not preclude their use of night roosts onsite.

At least two migratory species used the survey area for roosting and foraging. One of the migratory species (the hoary bat, *Lasiurus cinereus*) was present on site throughout the summer, which is unusual for this species in this region.

A progress report was issued on October 5, 2011, documenting the initial survey results from May through August 2011. The primary additions to the final report from the progress report are:

1) The addition of a new species to the list (western mastiff bat, *Eumops perotis*)(MSSC);
2) Potential evidence of another molossid (*N. macrotis*) – a migratory species – foraging on site;
3) Evidence of increased foraging and roosting of lasiurines, particularly *L. cinereus* and western yellow bat, *L. xanthinus*) during the fall months;
4) The absence of confirmed activity in the fall of the second-most commonly recorded species (big brown bat, *Eptesicus fuscus*) in the spring and summer, indicating that this species may be hibernating and/or migrating.

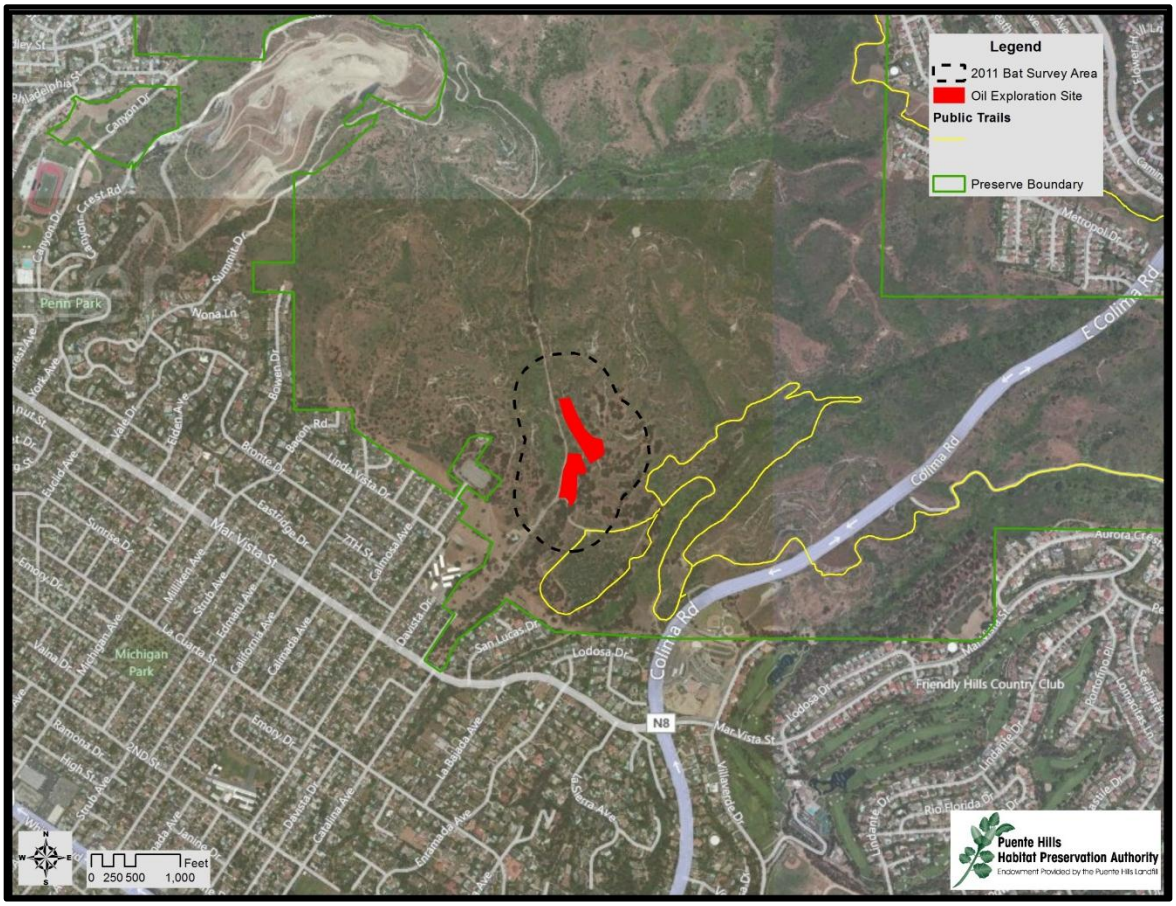
Strategies for mitigating impacts to bats are included at the end of this report.

# INTRODUCTION/BACKGROUND

The Puente Hills Preserve consists of over 3,800 acres of varied habitat types and topography surrounded by urbanization to the north, west, and south. The Preserve, containing native and introduced vegetation and numerous vertebrate species, is fragmented by urban developments and several major roads.

In November 2011, the City of Whittier has approved conducting oil exploration on a 7-acre portion of the Preserve (Figure 1). Bat surveys of the site were requested by the City to assess potential impacts to bat species by the project, and were conducted within a 60-acre study area around the project oil exploration site [Whittier Matrix Oil Survey Area (WMOSA)].

**Figure 1. The Whittier Matrix Oil Survey Area.**




State and federal land management agencies officially recognize over two-thirds of the south coast ecoregion's 24 bat species as sensitive, and three additional species have been proposed to become California Species of Special Concern in the latest draft of the California Department of Fish and Game's (CDFG) "Mammal Species of Special Concern in California (MSSC)." Eleven of the 16 species most likely to occur in the area have been detected in the Puente Hills (Table 1) during previous surveys conducted by Brown, Berry, and Remington (2004) and Remington (2005-06).

**Table 1. Bat Species Documented in the Puente Hills from 2004-2006.**

| Family Phyllostomidae | Leaf-nosed bats | 2004 | 2005-06 |
|---|---|---|---|
| *Choeronycteris mexicana* [1,2] | Mexican long-tongued bat | | |
| **Family Molossidae** | **Free-tailed bats** | | |
| *Eumops perotis* [1,2] | Western mastiff bat | | X |
| *Nyctinomops femorosaccus* [1] | Pocketed free-tailed bat | | X |
| *Nyctinomops macrotis* [1,2] | Big free-tailed bat | X | |
| *Tadarida brasiliensis* | Mexican free-tailed bat | | X |
| **Family Vespertilionidae** | **Mouse-eared bats** | | |
| *Antrozous pallidus* [1] | Pallid bat | X | |
| *Corynorhinus townsendii* [1,2] | Townsend's big-eared bat | | |
| *Eptesicus fuscus pallidus* | Big brown bat | X | X |
| *Lasiurus blossevillii* [1] | Western red bat | | X |
| *Lasiurus cinereus* | Hoary bat | | X |
| *Lasiurus xanthinus* [3] | Southern yellow bat | | X |
| *Myotis californicus* | California myotis | X | X |
| *Myotis ciliolabrum* [2] | Small-footed myotis | | |
| *Myotis evotis* [2] | Long-eared myotis | | |
| *Myotis yumanensis* [2] | Yuma myotis | X | X |
| *Parastrellus hesperus* | Western pipistrelle | | X |

[1] California Department of Fish and Game, Mammal of Special Concern or Sensitive Species
[2] Former Candidate (Category 2) for listing under U.S. Endangered Species Act; Species of Concern
[3] Proposed for addition to CDFG, MSSC list

The 2004 surveys included the Puente Hills, east of the Puente Hills Preserve. The 2005-06 surveys involved monthly surveys at five major sites within the Puente Hills Preserve, including the Whittier Hills, Hacienda Heights, and La Habra Heights. The combination of riparian habitat, woodland, scrub, cliff and rock features, and seasonal water sources in these areas are important – especially in combination – to bats.

Habitat loss, roost disturbance, and vegetation modification and removal pose major threats to bat populations in the south coast ecoregion. Fire suppression practices, pest control operations, and recreational activities can also negatively impact bats. Bats are exposed to all of these impacts in and near urban areas, and the cumulative effects on local populations can be substantial, but difficult or impossible to measure.

The objectives of the Bat Monitoring program are the following:

1) Update the species list from the 2004 and 2005-06 surveys;
2) Locate roosting and foraging areas;
3) Recommend mitigation strategies for potential impacts to bats.

This report reviews the data from the entire survey, from May through October, 2011.

# METHODS

Acoustic monitoring was the primary survey method used to monitor bats at this site. Two acoustic sampling methods and three types of detectors were used to record bat calls. Bat activity was monitored actively by three observers, two with Anabat detectors and one with a Pettersson D240 detector for three hours, once a month, beginning at sunset. Active monitoring involved walking transects, primarily on current and old roads, but also off road. Passive monitoring involved the deployment of 1-2 Anabats and one SM2 detector for extended periods at five locations (Figure 2, Table 2, Table 2a).

The microphone of the Anabat detects sounds in both the upper range of human hearing and the ultrasonic range (4-200 kHz). A Zero-Crossing Meter paired with the Anabat stores detected bat calls on a compact flash card for later retrieval and download onto a laptop computer, where they can be viewed and analyzed as sonograms. The SM2 detector picks up calls up to 100 kHz. All local bat species can be detected within the frequency range of both detectors. The detection range of the detectors depends on a variety of factors, including the frequency range and intensity of the bat call, air temperature, habitat, relative humidity, and altitude. The SM2 is more sensitive than the Anabat.

The detectors were programmed to begin monitoring ½ hour before sunset and end monitoring ½ hour after sunrise. In both survey methods, bat calls were stored on flash cards in the detectors and downloaded onto laptop computers for later analysis.

**Table 2. Active survey dates at the WMOSA in 2011.**

| | | | | | |
|---|---|---|---|---|---|
| 22 May | 21 June | 20 July | 22 August | 19 September | 19 October |

**Table 2a. Number of nights of passive acoustic monitoring at each site.**

| Site | May | June | July | August | Sept | Oct | TOTAL |
|---|---|---|---|---|---|---|---|
| House | 7 | 10 | | | | | 17 |
| Creek Edge | 9 | 10 | | | | | 19 |
| Oil Post South | | 7 | 27 | | | | 34 |
| Oil Post North | | | 7 | 22 | 10 | 9 | 48 |
| Tier 1 | 3 | 9 | 6 | | | | 18 |
| **TOTAL** | **19** | **36** | **40** | **22** | **10** | **9** | 136 |

**Figure 2. Passive acoustic monitoring stations in the Whittier Matrix Oil Survey Area**


Differences in survey effort reflect variations in equipment functioning and availability, as well as human interference with deployed equipment.

Active monitoring also involved the search, by each of the three observers, for bats emerging early in the evening (within one-half hour of sunrise). The end of civil twilight – the limit at which twilight illumination is sufficient, under clear weather conditions, for terrestrial objects to be clearly distinguished – occurs at approximately 30 minutes after sunset), meaning that there is still ambient light from the sun during this period. Therefore, bats detected during this period are assumed to have emerged very recently from their day roosts, which would indicate that these structures are located in the very near vicinity. If bats were observed flying low during the period within one-half hour of sunset, the approximate location of the inferred roosting location would be mapped; if possible, a search for the roost would be conducted to confirm the location. Roost proximity was also inferred from the timing of calls recorded on passive detectors (within one-half hour of sunrise or sunset), with the early calls indicating nearby roosts.

Calls recorded within an hour of sunset indicate that the bats producing them likely emerged relatively recently, but have probably been foraging for some period of time. The roosts of bats recorded during this period may be onsite, but since the survey area is relatively small, they may also be nearby, but out of the survey area.

# SUMMARY OF RESULTS

## *Species List*

From May through October, all 10 bat species detected during the 2005-06 surveys were recorded in the Whittier Matrix Oil Project area (Table 3). A total of 2,007 call files were recorded over 100 nights at the five passive acoustic survey sites. The four active surveys generated 53 additional call files.

- The acoustically dominant species recorded was *Tadarida brasiliensis* (Mexican free-tailed bat) at all monitoring sites, followed by *Eptesicus fuscus* (big brown bat). These two species comprised 83% of identified detections (Figures 3a-b, Table 4).
- The foliage-roosting bats – *Lasiurus blossevillii* (Western red bat), *L. cinereus* (hoary bat)*, L. xanthinus* (western yellow bat) – comprised 9% of detections.
- Four California Mammal Species of Special Concern (MSSC) were detected: *L. blossevillii* (western red bat), *L. xanthinus* (western yellow bat), *Eumops perotis* (western mastiff bat) and *Nyctinomops femorosaccus* (pocketed free-tailed bat).
- Activity of lasiurines was greatest in spring and fall; activity of big brown bats was recorded exclusively in spring and summer.

**Table 3. Species composition at passive monitoring sites in the WMOSA.**

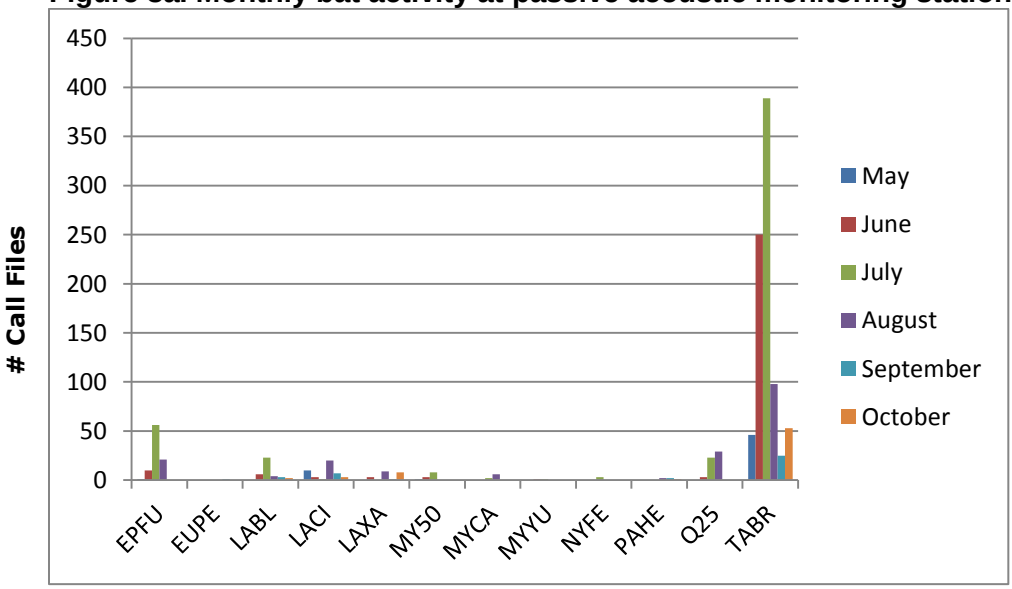
| Family Phyllostomidae | Leaf-nosed bats | Acronym | 2004 | 2005-06 | 2011 |
|---|---|---|---|---|---|
| *Choeronycteris mexicana* [1,2] | Mexican long-tongued bat | CHME | | | |
| **Family Molossidae** | **Free-tailed bats** | | | | |
| *Eumops perotis* [1,2] | Western mastiff bat | EUPE | | X | X |
| *Nyctinomops femorosaccus* [1] | Pocketed free-tailed bat | NYFE | | X | X |
| *Nyctinomops macrotis* [1,2] | Big free-tailed bat | NYMA | | | ? |
| *Tadarida brasiliensis* | Mexican free-tailed bat | TABR | X | X | X |
| **Family Vespertilionidae** | **Mouse-eared bats** | | | | |
| *Antrozous pallidus* [1] | Pallid bat | ANPA | X | | |
| *Corynorhinus townsendii* [1,2] | Townsend's big-eared bat | COTO | | | |
| *Eptesicus fuscus pallidus* | Big brown bat | EPFU | X | X | X |
| *Lasiurus blossevillii* [1] | Western red bat | LABL | | X | X |
| *Lasiurus cinereus* | Hoary bat | LACI | | X | X |
| *Lasiurus xanthinus* [3] | Southern yellow bat | LAXA | | X | X |
| *Myotis californicus* | California myotis | MYCA | X | X | X |
| *Myotis ciliolabrum* [2] | Small-footed myotis | MYCI | | | |
| *Myotis evotis* [2] | Long-eared myotis | MYEV | | | |
| *Myotis yumanensis* [2] | Yuma myotis | MYYU | X | X | X |
| *Parastrellus hesperus* | Western pipistrelle | PAHE | | X | X |

[1] California Department of Fish and Game, Mammal of Special Concern or Sensitive Species (MSSC)
[2] Former Candidate (Category 2) for listing under U.S. Endangered Species Act; Species of Concern
[3] Proposed for addition to CDFG, MSSC list

Mexican free-tailed bats (TABR) were, by far, the most commonly detected species at all sites and during each month, comprising 76% of total calls that were identified (Table 4). When Mexican free-tailed bat activity is removed from the chart (Figure 3b), the relative dominance of the other species is apparent. Big brown bats (EPFU) were the second most dominant species recorded, comprising 8% of total call files, although this species was not recorded during the fall. This indicates that they may be hibernating onsite or nearby, migrating, or both. Big brown bats activity is typically low or absent from recordings in southern California. This species has been observed hibernating in the same structure used for roosting in the summertime in southern California. Western red bats (LABL)(MSSC listed), hoary bats (LACI)(in consideration for MSSC listing), and western yellow bats (LAXA)(MSSC listed) comprised 3, 4, and 2%, respectively, of the total. The 50-kHz myotis (MY50, MYCA, and MYYU) (Figure 3b) comprised 2%. Pocketed free-tailed bats (NYFE)(MSSC listed) and canyon bats (PAHE) each comprised less than 1% of total calls. Western mastiff bats (EUPE)(MSSC listed) were confirmed only once during the survey period, in September.

Big free-tailed bats (NYMA)(MSSC listed) were not confirmed during this survey period, but are listed as possibly occurring on-site ("?" in Table 3) because calls recorded in September containing characteristics of this species contained too much ambient noise to be positively identified. Big free-tailed bats are migratory and are recorded sporadically in southern California.

**Figure 3a. Monthly bat activity at passive acoustic monitoring stations in the WMOSA.**




**MY50** 50 kHz calls that could be either MYCA or MYYU
**Q25** 25 kHz calls that could be either EPFU OR TABR

Variation in detection rates from month to month is influenced by a variety of factors, including seasonal activity patterns, natural history, acoustic factors – both natural and equipment-related – and sampling effort.

Bat pups are born in late spring or early summer and are volant (able to fly) within several weeks. The higher rates of detections in June and July in many species reflect the increased numbers of newly-volant bats joining the adults in foraging. Mexican free-tailed bats are also among the most detectable bats, acoustically, of any species, because they produce high-intensity, relatively low-frequency echolocation calls (~20-30 kHz). The higher the frequency of calls, the more quickly they attenuate. Below that frequency range, particularly in the range of the western mastiff bat, calls are more difficult to detect because of the detectors' low frequency filter (designed to prevent insect-produced sounds from dominating the recordings.

**Figure 3b. Monthly bat activity at passive acoustic monitoring stations excluding TABR**

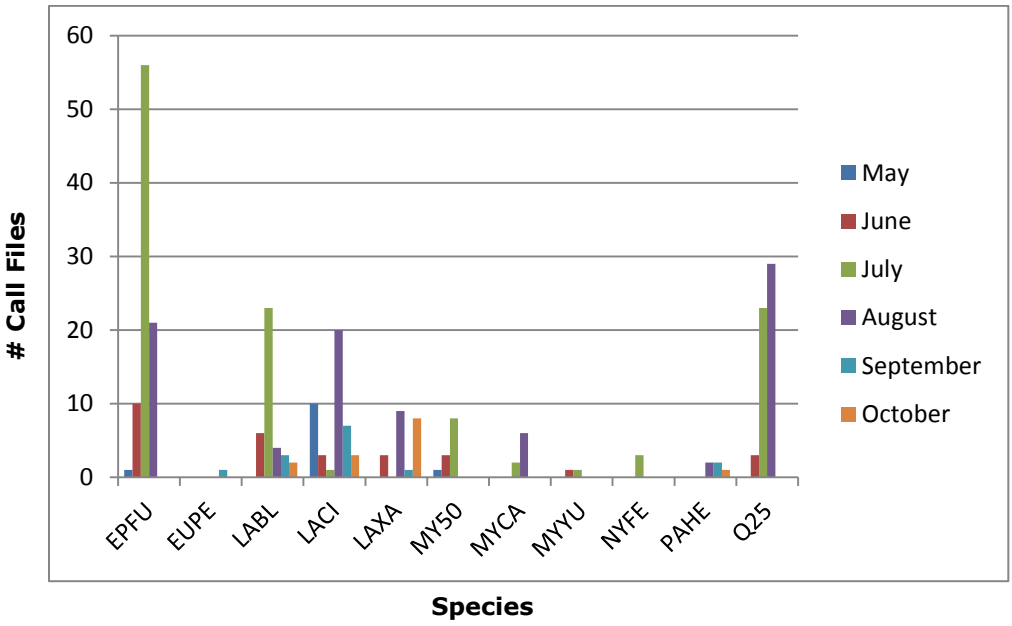



**Table 4. Bat species activity expressed as a percentage of total identifiable calls.**

| Species | Acronym | # Call Files | % |
|---|---|---|---|
| Big brown bat | EPFU | 88 | 9 |
| Western mastiff bat | EUPE | 1 | < 1 |
| Western red bat | LABL | 38 | 3 |
| Hoary bat | LACI | 44 | 3 |
| Western yellow bat | LAXA | 21 | 1 |
| 50 kHz Myotis (California & Yuma Myotis) | MY50 | 22 | 2 |
| Pocketed free-tailed bat | NYFE | 3 | < 1 |
| Canyon bat | PAHE | 5 | < 1 |
| 25 kHz bats (mostly EPFU & TABR) | Q25 | 55 | 5 |
| Mexican free-tailed bat | TABR | 861 | 77 |
| | **Grand Total** | **1138** | **100** |

The drop-off in detection rates from July to August most likely represents, at least in part, mortality of first-year bats.

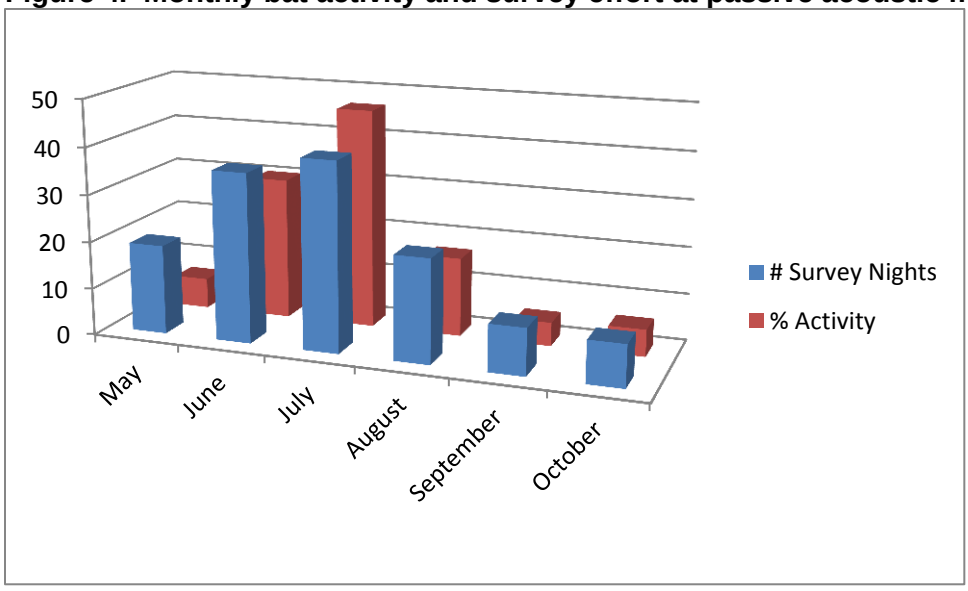
The different monthly pattern exhibited by hoary bats (LACI) and western yellow bats (LAXA) are related to their migratory habits. Hoary bats typically begin arriving in coastal southern California in the fall and are present (as a species, although possibly not the same individuals) throughout winter and spring, and are gone from the region by summer.

The August peak in numbers of this species is atypical for the region, which usually has the highest detection rates in fall or spring. The higher rates in August could represent an earlier-than-typical migratory wave, but the lower detection numbers in September and October are likely more strongly related sampling effort and equipment.

July had the greatest number of monitoring nights (40). June had 36, August had 22, and May had 19). The lowest levels, recorded in September and October, are due to equipment failures. This resulted in the lowest sampling effort, with 10 and 9 days sampled, respectively, with Anabat only, which is less sensitive than the SM2. Recorded activity levels roughly corresponded with survey effort (Figure 4).

Species diversity varied from four to seven species recorded each month, with the fewest species recorded in May and October (four and five, respectively). Both sampling effort and natural history influence the total. In the fall, detections were almost exclusively lasiurines (including migratory foliage-roosting bats) and molossids (free-tailed bats), which are long-distance flyers, including migratory species. The species recorded in fall are those expected for this site and season. All molossids except Mexican free-tailed bats are MSSC, and two of the three lasiurines are MSSC (western red bats and western yellow bats). A proposal to include hoary bats on the MSSC list is currently under consideration.

**Figure 4. Monthly bat activity and survey effort at passive acoustic monitoring sites.**



Comparing species activity by site, nearly 50% of activity was recorded at Oil Post South, at least partly due to the greatest survey effort occurring there in July (Figure 5a, Figure 6). Mexican free-tailed bats were the dominant species recorded at all sites. Figure 5b shows the distribution of recordings of the other species, by site. Big brown bats comprised nearly 9% of total calls and were the second most dominant species recorded at Oil Post North and South and at Tier 1. Hoary bats were the second most dominant species at the House and Creek Edge. Half of total hoary bat and western yellow bat activity was recorded in September and October, indicating a migratory wave of these two species. Hoary bats were recorded during all months of this study, but more frequently recorded in spring and fall. They are known migrants, typically absent during the summer in coastal southern California.

**Figure 5a. Bat activity by site at passive acoustic monitoring stations in the WMOSA.**

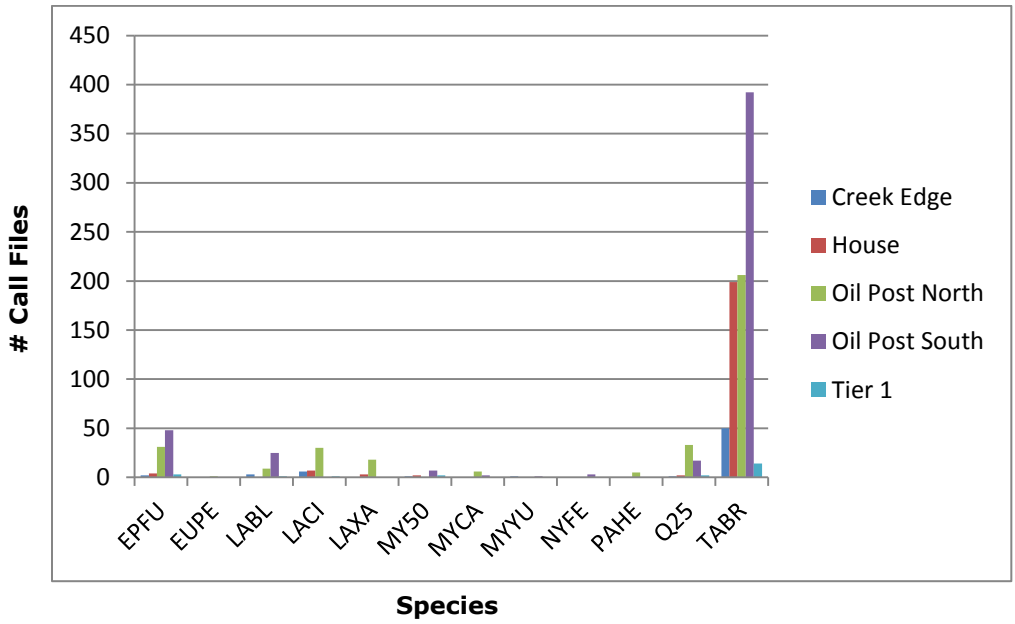



**Figure 5b. Site bat activity at passive acoustic monitoring stations, excluding TABR.**

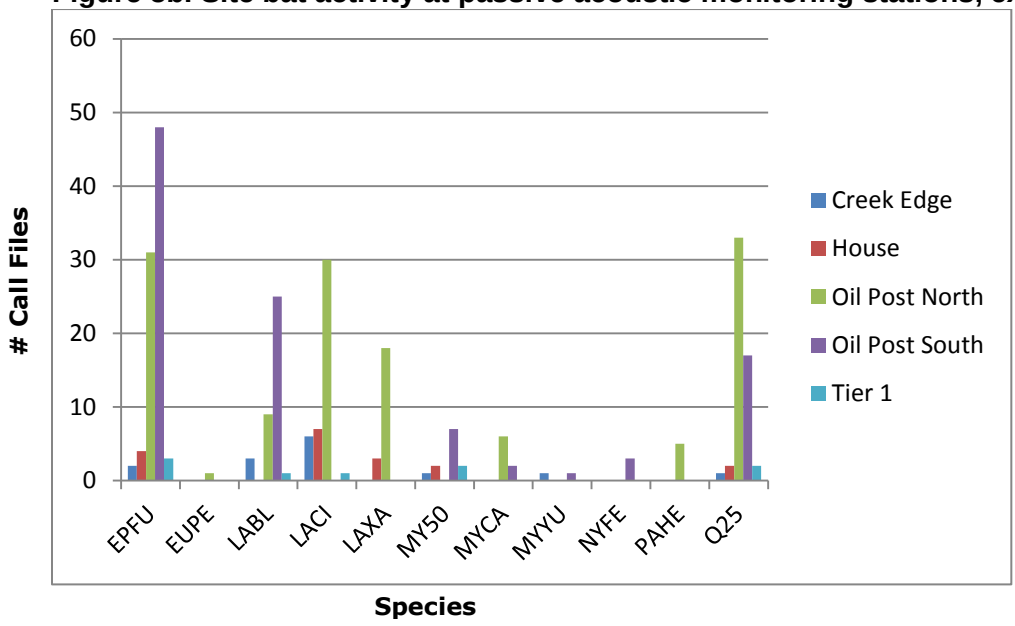
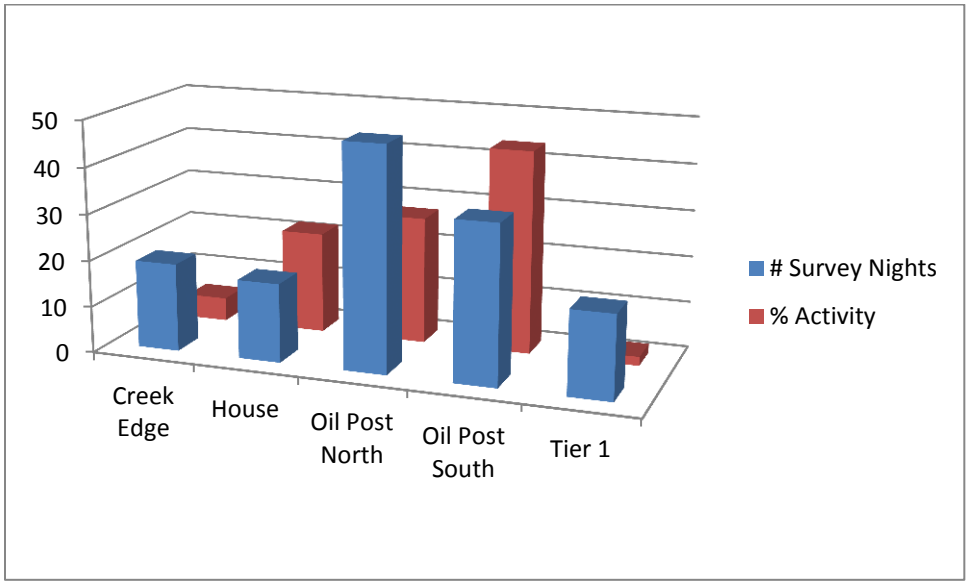


**Table 5. Bat activity by site expressed as a percentage of total call files.**

| Site | # Call Files | % |
|---|---|---|
| Creek Edge | 102 | 5 |
| House | 440 | 22 |
| Oil Post North | 551 | 27 |
| Oil Post South | 875 | 44 |
| Tier 1 | 39 | 2 |
| **Grand Total** | **2007** | **100** |

**Figure 6. Monthly bat activity by site and survey effort at passive acoustic monitoring sites.**




Survey effort does not explain all variation in measured activity levels. The Creek Edge, House, and Tier 1 sites had nearly identical survey effort (19, 17, and 18 nights, respectively), but the house had higher recorded activity. This is probably due, at least in part, to the greater sensitivity of the SM2 detector at the House. The Creek Edge and Tier 1 were monitored by Anabat detectors. The differences in recorded activity between Oil Post North and South were probably due to the primary type of detector deployed at the site. Oil Post North was monitored for two weeks longer than Oil Post South, but had lower recorded activity. Oil Post South was monitored exclusively with the SM2. Oil Post North was monitored, alternately, with the Anabat and SM2 – exclusively with the Anabat in September and October.

Overall bat activity during the survey period was relatively low at all sites and seasons probably because insect activity was uniformly low across habitats at ground level in the survey area.

## *Foraging and Roosting*

Bat activity at passive acoustic monitoring stations in the Matrix Oil Survey Area varied substantially, both nightly and by site. Activity early in the evening tended to be low, with the occasional exception of Mexican free-tailed bats (TABR), indicating that most of the bats foraging later in the evening had day-roosts elsewhere.

Bat nightly foraging distances vary by species, gender, individual bat, forage quality and distribution, and season. Mexican free-tailed bats may travel 25 miles or more, round trip, in a night. Nursing females may forage within a few hundred meters of a roost. They may travel farther when it is not maternity season. Low forage quality requires greater travel distances, but if the distance required exceeds the energy gained from foraging, a bat may not be able to reproduce, migrate, or survive the winter. If high quality foraging habitat exists a few miles from a high quality roost, an individual bat may choose to fly the distance.

There is no evidence of exceptional quality foraging opportunities at the acoustic monitoring stations used in this study. The survey area likely represents a regular portion of the foraging rounds for at least five species detected this season, and at least two others seasonally.

Four bat species [Mexican free-tailed bat (TABR), big brown bat (EPFU), hoary bat (LACI), and western yellow bat (LAXA)] were detected within a half-hour of sunset on at least one night during the survey period, indicating that they roosted nearby at that time; the canyon bat was detected within one hour of sunset and western red bat, (LABL), was detected within one hour of sunrise, also indicating roosting within the general vicinity (Table 6).

**Table 6. Bat species inferred to be day-roosting onsite from the timing of recorded calls.**

| FAMILY/SPECIES | COMMON NAME | Day-roosting on site |
|---|---|---|
| **Family Molossidae** | **Free-tailed bats** | |
| *Eumops perotis* [1,2] | Western mastiff bat | |
| *Nyctinomops femorosaccus* [1] | Pocketed free-tailed bat | |
| *Nyctinomops macrotis* [1,2] | Big free-tailed bat | |
| *Tadarida brasiliensis* | Mexican free-tailed bat | Y |
| **Family Vespertilionidae** | **Mouse-eared bats** | |
| *Eptesicus fuscus pallidus* | Big brown bat | Y |
| *Lasiurus blossevillii* [1] | Western red bat | * |
| *Lasiurus cinereus* | Hoary bat | Y |
| *Lasiurus xanthinus* [3] | Southern yellow bat | Y |
| *Myotis californicus* | California myotis | |
| *Myotis yumanensis* [2] | Yuma myotis | |
| *Parastrellus hesperus* | Canyon bat | * |

[1] California Department of Fish and Game, Mammal of Special Concern or Sensitive Species

[2] Former Candidate (Category 2) for listing under U.S. Endangered Species Act; Species of Concern

[3] Proposed for addition to CDFG, MSSC list

Y Detected within one half hour of sunset or sunrise

* Detected within one hour of sunset or sunrise

On four occasions, early-recorded bats of two species (Mexican free-tailed bat and hoary bat) were simultaneously observed flying. When bats are observed flying around sunset, it is possible to locate the roost by examining appropriate roosting structures in the direction from which the bat(s) came.

This technique is most productive when multiple bats are observed at a relatively low altitude. The observations in this survey period were of individual bats flying at a high altitude. May and August had the highest numbers of early recorded bat calls. No roosts were located in the survey period.

Mexican free-tailed bats appeared to roost in the vicinity of all sites, except Tier 1, where they were recorded within an hour of sunset. Mexican free-tailed bats were recorded multiple times early in the evening at all other sites. Big brown bats, hoary bats, and western yellow bats were detected within a half-hour of sunset at Oil Post North; hoary bats were also detected within the same time frame at Oil Post South. Three of these four species (all but western yellow bats, which were only detected at two sites) were detected at multiple sites within one hour of sunset. Canyon bats (PAHE) were detected once within an hour of sunset near Oil Post South.

This indicates that although at least half the species known to occur in the area appear to roost in the vicinity of the survey area, at least occasionally, the majority of individuals of these species recorded foraging onsite may roost outside the survey area.

Appropriate roosting habitat varies by species. Table 6a indicates the primary roosting habitat associated with the species in the Puente Hills.

**Table 6a. Primary roosting habitat of bats occurring* in the Puente Hills.**

| FAMILY/SPECIES | COMMON NAME | PRIMARY ROOSTING HABITAT | | | |
|---|---|---|---|---|---|
| | | Tree | Cliff | Cave | MH |
| **Family Phyllostomidae** | **Leaf-nosed bats** | | | | |
| *Choeronycteris mexicana* [1,2] | Mexican long-tongued bat | | | X | |
| **Family Molossidae** | **Free-tailed bats** | | | | |
| *Eumops perotis* [1,2] | Western mastiff bat | | X | | |
| *Nyctinomops femorosaccus* [1] | Pocketed free-tailed bat | | X | | |
| *Nyctinomops macrotis* [1,2] | Big free-tailed bat | | X | | |
| *Tadarida brasiliensis* | Mexican free-tailed bat | | | | X |
| **Family Vespertilionidae** | **Mouse-eared bats** | | | | |
| *Antrozous pallidus* [1] | Pallid bat | | | | X |
| *Corynorhinus townsendii* [1,2] | Townsend's big-eared bat | | | X | |
| *Eptesicus fuscus pallidus* | Big brown bat | | | | X |
| *Lasiurus blossevillii* [1] | Western red bat | X | | | |
| *Lasiurus cinereus* | Hoary bat | X | | | |
| *Lasiurus xanthinus* [3] | Southern yellow bat | X | | | |
| *Myotis californicus* | California myotis | | | | X |
| *Myotis ciliolabrum* [2] | Small-footed myotis | | | | X |
| *Myotis evotis* [2] | Long-eared myotis | | | | X |
| *Myotis yumanensis* [2] | Yuma myotis | | | | X |
| *Parastrellus hesperus* | Canyon bat | | X | | |

* Confirmed or potentially occurring in the Puente Hills

[1] California Department of Fish and Game, Mammal of Special Concern or Sensitive Species

[2] Former Candidate (Category 2) for listing under U.S. Endangered Species Act; Species of Concern

[3] Proposed for addition to CDFG, MSSC list

MH = Multiple Habitats

There are significant variations in these trends. For example, western mastiff bats – known to predominantly roost in cliffs – have been found roosting in buildings (and, recently, in a palm tree). Townsend's big-eared bat, often categorized as a cave-roosting species, also roosts in mines and other structures (including buildings) that mimic the internal shape of a cave. Canyon bats typically roost in rocky outcrop habitat, both natural and of human construction (e.g. rip rap), as well as cliffs.

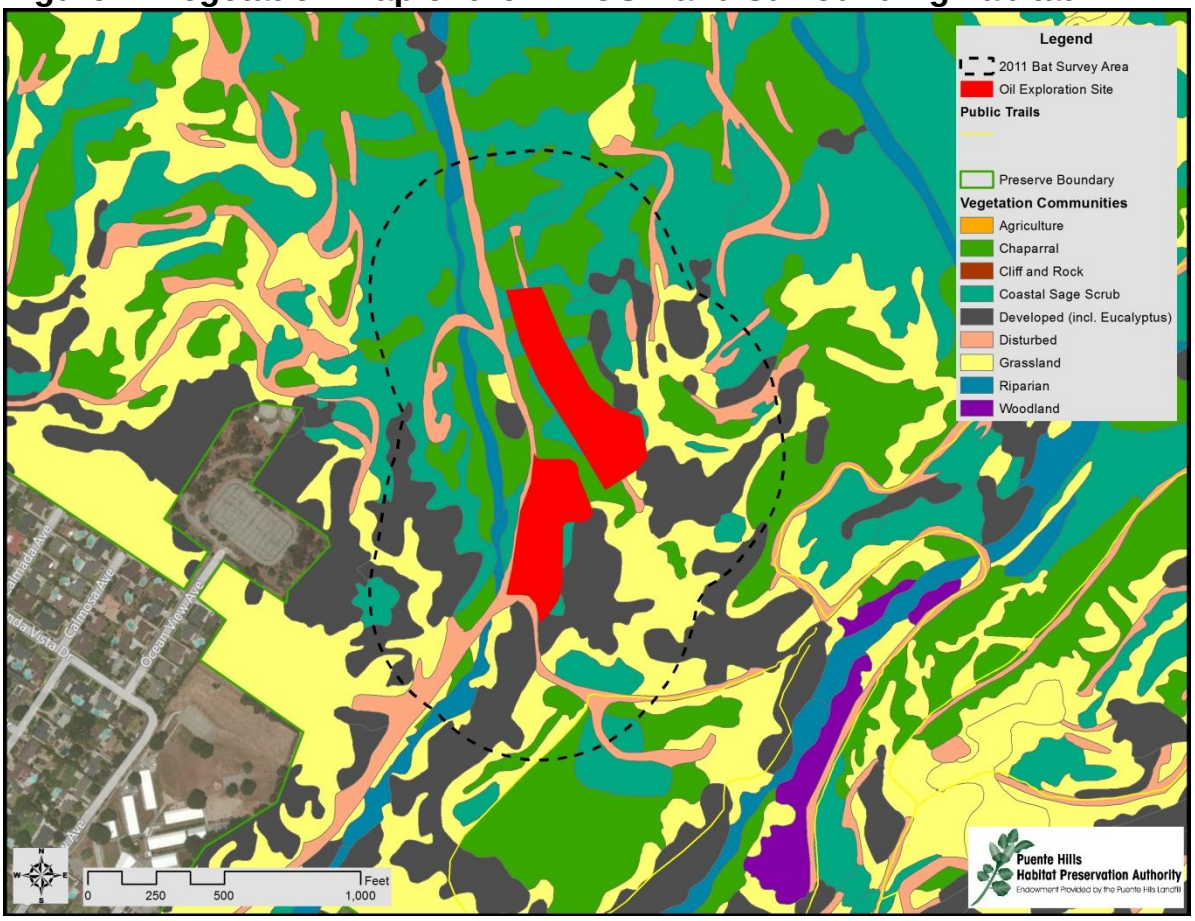
The lasiurines (western red bats, hoary bats, and western yellow bats) are obligate foliage-roosting species and are known to switch roosts often, even nightly. This is likely to reduce mortality from predation, because bats roosting in foliage are highly exposed and completely unable to defend themselves against predators when in torpor.

Big brown bats and Mexican free-tailed bats are more flexible in their roosting requirements, and are known to use a variety of natural and human-made structures, such as cliffs, rock crevices, buildings, and bridges. In southern

California, big brown bats also commonly use trees for roosting. They also may switch roosts from season to season, or even multiple times within a season, but are not known to switch nightly.

Although most habitats are used to some degree by foraging bats, the vegetation map in Figure 7 can indicate which sites may have greater foraging potential for bats.

**Figure 7. Vegetation map of the WMOSA and surrounding habitat.**




The woodland and riparian areas often have high insect diversity and abundance and tend, especially in dry years, to concentrate insect – and therefore – bat activity. Many species use these habitats extensively for both roosting and foraging, and western red bats (MSSC listed) require riparian habitats, particularly mature riparian, for both uses.

Scrub habitats are also used extensively for foraging by some bat species, such as the molossid family (free-tailed bats – including three MSSC). Some bat species also roost in scrub habitat. Pallid bats (MSSC listed) are known to forage in grassland, as well as oak woodland.

Several species use agricultural areas for foraging, at least occasionally.

Cliff and rock habitat is a major bat roosting habitat type. Any bridges, buildings, rip-rap, or other human constructions located in "Disturbed Areas" may be used by bats for roosting. The Eucalyptus included in the "Developed" habitat on the vegetation map (Figure 7) are known to provide roosting habitat for lasiurines and, when exfoliating bark is present, may house individuals and maternity colonies of other species.

There are three main types of roosts used by bats:

1) Day roosts (where bats spend the daylight hours – this includes maternity roosts);
2) Night roosts (where bats may stop periodically in between foraging rounds;
3) Hibernacula (where bats that hibernate spend the winter in torpor).

A type of day roost that is crucial for the reproductive success of bats is the maternity roost. The females of certain bat species gather in the spring to give birth and raise young. The structure used by these female bats and their young are called maternity roosts, and – in this area – may house anywhere from a few individuals to a few thousand. They disband in the fall. Most species recorded in this survey period (except the lasiurines and canyon bats) form maternity colonies.

Loss of any one of these types of roosts involves a cost to the bats using them. The cost may be longer foraging distances or survival, depending on the nature of the roost and the availability of other potential good-quality sites in the vicinity.

Bats appeared to be using the Whittier Matrix Oil Survey Area primarily for foraging, although the timing of the activity – later at night – does not preclude their use of night roosts onsite.

In summary, a few individuals of five species, including two* sensitive species (the western red bat and western yellow bat), appeared to be roosting in the immediate vicinity during the survey period. Most bats appeared to be using the Whittier Matrix Oil Survey Area primarily for foraging, although the timing of the activity – later at night – does not preclude their use of night roosts onsite. There was no evidence of the existence of a large maternity colony in the project area during this survey period. The study area is used by migratory species for both roosting and foraging.

The data described in this report represent conditions present during the survey period. The results cannot be used to predict bat activity or distribution during other times of year or in future seasons. Long-term (multi-year) datasets provide better grounds for prediction and extrapolation.

* Recently, hoary bats have been proposed for listing as a sensitive species due to the high mortality observed at wind farms of this species.

## *Potential Mitigation Measures*

The following measures will minimize negative impacts to bats and/or enhance existing bat habitat:

1) Avoid impacts to trees and riparian areas (to minimize damage to potential roosting habitat – particularly of lasiurines).
2) Conduct additional surveys of specific trees, structures, and other potential roosting habitat features* that cannot be avoided and will be altered, removed, or impacted by construction activities. Bats may switch tree roosts frequently.
3) Use a two-step process for tree removal that cannot be avoided (to avoid direct mortality of roosting bats). This involves removing all branches less than two inches in diameter from trees that will be removed (to create a disturbance that will encourage bats to choose another roosting site after foraging that night). The following day the tree is completely removed. If the tree is small enough so that zero occupancy can be verified by a bat biologist, then the tree may be removed in one step.
4) Create artificial roosting habitat (to minimize the travel distance – energy expense – from roost to foraging grounds that may be decreased in quality due to habitat loss). Bat boxes are one type of artificial roost. If this option is chosen, a bat biologist should recommend type and placement.
5) Consider enhancing foraging habitat by placing and maintaining water sources for drinking (which can be critical during maternity season) and attracting insects. This could be a water trough or an artificial pond. If a water trough is chosen, it should be kept full and include an escape ramp to avoid trapping wildlife.
6) Restrict construction activities involving impacts to bat habitat to the fall, if possible (to avoid direct impacts to maternity colonies or hibernating bats). Fall was the period of greatest activity for the lasiurines (foliage-roosting bats, 2 of 3 are MSSC), but impacts to roosting individuals of these species can be minimized by adhering to the first three recommendations.
7) If it is not possible to avoid maternity season (approximately March through August), conduct additional surveys of the impact area immediately before construction begins. Discovery of a maternity colony would necessitate an exclusion (creating a one-way door that allows bats to leave, but not re-enter). The exclusion could be performed properly in September. Conducting exclusions earlier than September may trap flightless young inside.
8) Have a biological monitor present during construction-related activities.