

**BAT STUDIES
AT
EDWARDS AIR FORCE BASE, CALIFORNIA**

FINAL

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BAT STUDIES AT EDWARDS AIR FORCE BASE, CALIFORNIA

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Abstract: Surveys were conducted for bat species at Edwards Air Force Base (AFB), California. Seven areas were surveyed by diurnal inspections of potential roosts for bats or guano, acoustic monitoring of echolocation signals, inspection of roosting or foraging areas with night vision equipment, and mist-netting of water sources and potential roost entrances. The presence of five bat species was confirmed: California myotis (*Myotis californicus*), western pipistrelle (*Pipistrellus hesperus*), hoary bat (*Lasius cinereus*), pallid bat (*Antrozous pallidus*), and Mexican free-tailed bat (*Tadarida brasiliensis*). One additional species, the small-footed myotis (*Myotis ciliolabrum*) was possibly sighted, but not confirmed. Bats were detected acoustically in all survey areas and captured at the Flightline, Leuhman Ridge, Haystack Butte, and Branch Park survey areas. One maternity roost was detected in the Branch Park Survey Area. Bat activity was most evident at Leuhman Ridge. Management strategies to preserve the integrity of the Air Force Flight Test Center mission while preventing impacts to bats and their habitat are also described.

Surveys for bat species were conducted to provide baseline data for the Air Force Flight Test Center (AFFTC), Edwards AFB Integrated Natural Resources Management Plan. Three bat species, Mexican free-tailed bat (*Tadarida brasiliensis*), pallid bat (*Antrozous pallidus*), and western mastiff bat (*Eumops perotis*), have been previously identified on Edwards Air Force Base (AFB). All three bats are California Species of Special Concern (CSC). The western mastiff bat is also a Federal Species of Concern (FSC) (formerly Category 2 Candidate [C2]). Edwards AFB provides suitable habitat to support a number of other bat species.

A number of potential bat roosting and foraging areas occur throughout the installation. These areas include hangars, abandoned buildings, rock outcrops, test stands, light sources, and/or small bodies of water such as sewage and golf course ponds. Several additional bat species which could occur on Edwards AFB are state or federal species of concern and may receive legal protection in the future.

The current study was conducted to:

- Develop a list of bat species found at Edwards AFB with particular emphasis on species of special management concern;
- Identify critical roosting and foraging habitat during different seasons; and
- Recommend management strategies to minimize conflicts with the Edwards AFB mission.

STUDY AREA

Edwards AFB covers approximately 1,217 square kilometers (470 square miles) and is located in portions Kern, San Bernardino, and Los Angeles counties. The base is bounded roughly by Highway 14 on the west, Highway 395 on the east, Highway 58 on the north, and Avenue E on the south. The study area for these surveys roughly approximates the base boundaries (Figure 1).

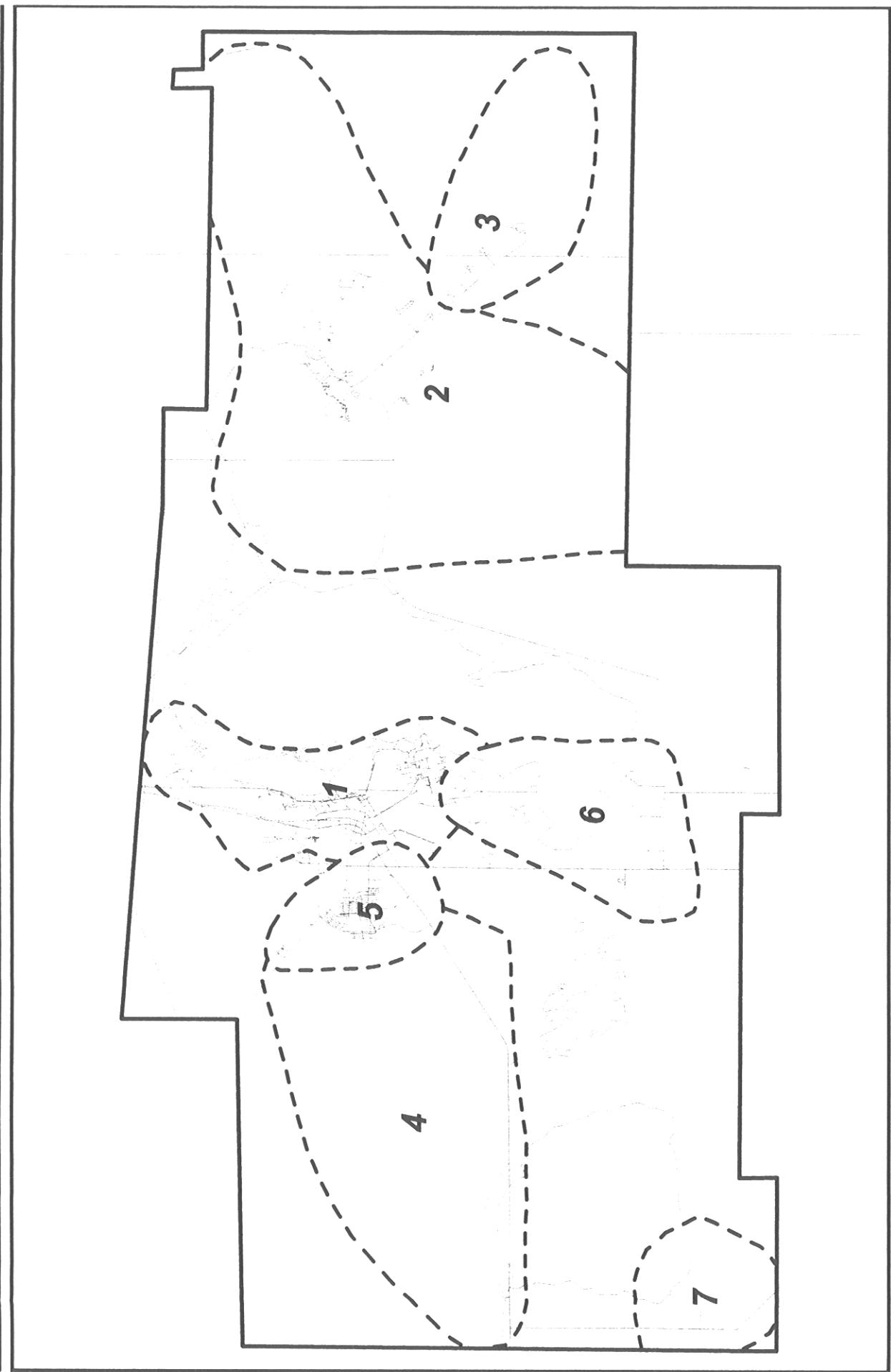
Elevation ranges from 692 to 1,038 meters (2,270 to 3,404 feet) at Edwards AFB. Rogers and Rosamond dry lakes represent the low elevation points. The base is roughly divided into east and west sides by Rogers Dry Lake. Leuhman Ridge is the major geomorphic feature on the east side. A portion of Kramer Hills runs through the northeastern corner of the base. Haystack Butte is the high point (1,030 meters) in the southeastern portion of the site. The Rosamond and Bissell Hills are oriented roughly east-west in the northwestern part of the base. The southwestern portion of the base is dominated by Rosamond Dry Lake, clay pan systems, and Piute Ponds, a large wetland maintained by effluent from the Lancaster Water Reclamation Plant located west of the base.

A relatively small portion of the base is currently developed. Main Base facilities and the flightline are located along the western shore of Rogers Dry Lake. The Phillips Laboratory facilities surround Leuhman Ridge on the south, southeast, and east sides. In addition, there are several ancillary facilities located throughout the base. A network of paved and dirt roads provides access to most areas.

The study area was subdivided into seven survey areas which encompass the major potential bat roosting and foraging habitats on the base. These survey areas include:

Flightline. This survey area includes occupied hangars and abandoned buildings along the Flightline and North Base, the granite boulders at Contractor's Hill, the stormwater retention pond located near the control tower, and the North Base sewage pond.

Leuhman Ridge and Vicinity. This survey area includes rock outcrops along Leuhman Ridge; active and inactive test stands; mine adits in the vicinity; the sewage treatment ponds south of the ridge; the granite hills located east of Rogers Dry Lake; buildings and other structures at Phillips Laboratory, such as tunnels, the fallout shelter, and missile silos; and Jackrabbit Hill. Mine shafts, the control tower, the "lunch pond", and rock outcrops were surveyed in the Downfall area, along with Mary's Well pond which is located approximately 6 kilometers due west of the Downfall range control tower. Other water sources surveyed at Phillips Laboratory include the ponds at the fire station, Building 8255, and Areas 1-30 and 1-40.



**Survey Area
Key Map**



Figure 1

Haystack Butte and Vicinity. This survey area includes the rock outcrops and structures at Haystack Butte, ponds located at Areas 1-42 and 1-52, and mines located at Area C-3.

Rosamond/Bissell Hills. This survey area includes cliffs and rock outcrops at the Rosamond, Red, and Bissell Hills; mines at Red Hill, the homestead site east of Red Hill; and C V Camp M-9.

Housing Area. This survey area includes occupied and abandoned buildings in the housing area, FamCamp, the Club Muroc pool, the golf course pond, and stables.

Branch Park and South Base. This survey area includes the Branch Park pond and the South Base sewage ponds, associated buildings and other structures, the survival school camp, and ephemeral ponds located along the test track.

Piute Ponds. This survey area includes Piute Ponds and the vicinity.

METHODS

A reconnaissance flight on April 17, 1994 was conducted to select survey areas that might contain bat roosting and foraging habitat. Surveys were conducted during 12 field trips between December 5, 1994 and April 3, 1996. Four trips were conducted during each of the four seasons (winter, spring, summer, and fall). Potential roosting areas include cliffs and rock outcrops like those found at Red Hill, Rosamond Hills, Leuhman Ridge, and Haystack Butte; abandoned buildings at Wherry Housing, Leuhman Ridge and Branch Park; and mine workings located east of Rogers Dry Lake and Downfall. Possible foraging areas include water sources such as Piute Ponds and sewage ponds at the southwest edge of Rogers Dry Lake, Branch Park pond, golf course ponds in the housing area, and small ponds near Leuhman Ridge; and light sources that attract insects.

Diurnal Inspection of Potential Roosts for Bats or Guano

Diurnal inspections of potential roosts were conducted for bats or guano. Mines, test stands, buildings, or other structures likely to support bats were inspected, as well as crevices in cliffs and large rock outcrops. If possible, bats were captured in hand nets for identification. If guano was discovered, but no bats were found in a roost, then visual checks were made at night and during all four seasons (winter, spring,

summer, and fall). Since hibernating bats do not produce guano, mines were inspected in the winter. All accessible buildings were checked for bats or guano.

Concurrent with roost inspections, interviews were also conducted with persons likely to come in contact with bats. When buildings were occupied, personnel were interviewed to identify bat occurrences, especially if a specimen or sightings of bats had been previously reported to the Environmental Management Office. The Housing Office, cleaning services, animal control, and base veterinarians were contacted for records containing bat documentation.

Acoustic Monitoring of Echolocation Signals with Bat Detectors at Night

Acoustic monitoring of echolocation signals was conducted using the broad-band ultrasonic AnabatTM detector from Australia, which is automatically activated by echolocation signals. Using the delay switch, the signal is stored with a time stamp on a cassette tape recorder for remote monitoring over extended periods. Hand-held mini-detectors (Ultrasound AdviceTM and PetterssonTM), tunable to different frequencies, were also employed. Only some species can be identified based on echolocation signals; most bat detectors do not receive signals below 20 kHz. However, even without specific identification, the detector can provide an index of areas of high bat activity which is helpful in directing mist netting efforts, and can record bat activity information when mist-netting is not effective. The recordings from the AnabatTM during this survey allowed identification to the generic level. Acoustic monitoring was conducted near water sources and potential roosting areas in boulders and cliff faces during all four seasons (winter, spring, summer, and fall). The number of sonic events detected on an AnabatTM or other detector does not necessarily equate the number of bats, but rather the number of bat passes. Even if a single bat continuously circles an area, nonstop activity will be recorded on a detector, indicating good foraging habitat. The following criteria were used to determine the level of bat activity recorded:

- One bat pass per minute during the first 2 hours after dark was considered high;
- An average of 5 to 59 passes per hour was considered moderate; and
- Less than 5 passes per hour was low.

Inspection of Roosting and Foraging Areas After Sunset with Night Vision Equipment

Roosting and foraging areas were inspected after sunset with night vision equipment. Once a bat roost was discovered, night vision equipment (NVEC model 7B goggles) was used to obtain an accurate census.

Potential bat roosts in inaccessible areas such as mines, large rock outcrops, and cliff faces were also observed in conjunction with acoustic monitoring.

Mist-netting of Water Sources and Roost Entrances

Mist-netting was conducted over water sources and at roost entrances. Because nets set over large bodies of water are typically unsuccessful, mist-netting was not performed at areas such as the sewage ponds and Piute Ponds. Small isolated ponds, such as those at Leuhman Ridge, were netted at least once each survey period. Because there were four survey periods per season, this methodology ensured that mist netting occurred at least once per season (winter, spring, summer, and fall). Captured bats were identified as to species, sex, reproductive condition, and age.

Global Positioning System and Geographic Information System Requirements

Trimble™ GeoExplorer Global Positioning System (GPS) technology was used to identify and record survey locations. Survey locations within active buildings did not require the use of GPS technology. Terminology used in data collection was consistent with the Edwards AFB GIS data dictionary.

RESULTS

The presence of at least 5 bat species on Edwards AFB was confirmed during the current survey: California myotis, Mexican free-tailed bat, western pipistrelle, pallid bat, and hoary bat (*Lasiurus cinereus*) (Table 1). A sixth species was possibly sighted when several bats with distinctive facial masks, a prominent feature of the small-footed myotis, were observed but not positively identified. Bats were detected acoustically in all survey areas, although occurrences varied both seasonally and during severe weather conditions. Generally, both the number of species and individuals declined during the cooler months (when temperatures dropped below 50 degrees farenheit [F]), and activity ceased when wind speeds exceeded 30 kilometers per hour regardless of the season. Mist-netting was only successful in capturing bats during brief windless periods in the warmer months, and only over small water sources (Table 2). Several day and night roosts were located in buildings, and no bats were found utilizing mines.

Table 1
Edwards Air Force Base Bat Studies Data Summary

Date	Transect ID	Species	Captured	Number Captured	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
3/20/95	B1		No				1830-2400	None	Contractor's Hill	3866900	417662	Very windy; no bats observed
6/22/95	B1		No				2300-0530	None	Contractor's Hill	3866900	417662	No bats recorded on Anabat
9/28/95	B1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown		1900-dawn	5 passes recorded	Contractor's Hill	3866900	417662	Cold and windy; too windy for mist netting; 5 bats recorded on Anabat
3/13/96	B1		No				1800-2301	None	Contractor's Hill	3866900	417662	Cold and windy; no bats observed or recorded
3/20/95	B2		No				Diurnal Observation	None	Building 1820	3865980.42	418902.532	No bats or guano found
3/20/95	B3		No				Diurnal Observation	None	Building 1207	3863765.25	417892.454	No bats or guano found
8/22/95	B3	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown		2045-2400	1 pass recorded	Hanger 1207	3863765.25	417892.454	1 pass recorded at 2245
3/20/95	B4		No				Diurnal Observation	None	Building 1210	3863851.54	418041.114	No bats or guano found
3/20/95	B5		No				Diurnal Observation	None	Building 1600	3864555.86	419072.067	No bats or guano found
4/20/95	B5	<i>Tadarida brasiliensis</i>	No	Unknown	Adult		Diurnal Observation	Guano	Building 1600	3864555.86	419072.067	Guano found in door hangar slops
3/20/95	B6		No				Diurnal Observation	None	Building 4820	3867778.92	419217.613	No bats or guano found
4/21/95	B6		No				Diurnal Observation	None	NASA Building 4820	3867778.92	419217.613	Diurnal observation due to previous bat sightings
4/21/95	B6	<i>Tadarida brasiliensis</i>	No	Unknown	Adult		1930-2400	Several bats observed	NASA Building 4820	3867778.92	419217.613	Slight breeze; several bats observed
4/21/95	B6	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown		1930-2400	Feeding buzzes heard	NASA Building 4820	3867778.92	419217.613	Slight breeze; feeding buzzes heard
11/30/95	B6		No				Diurnal Observation	None	NASA Building 4820	3867540	418920	Dead <i>Tadarida brasiliensis</i> found
3/22/95	B7	<i>Tadarida brasiliensis</i>	No	Female	Adult		Diurnal Observation	Dead individual found	NASA Building 4802	3867540	418920	Dead <i>Tadarida brasiliensis</i> found
4/21/95	B7	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown		1930-2400	Feeding buzzes heard	NASA Building 4802	3867540	418920	Slight breeze; feeding buzzes heard
4/21/95	B7	<i>Tadarida brasiliensis</i>	No	Unknown	Adult		1930-2400	Several bats observed	NASA Building 4802	3867540	418920	Slight breeze; several bats observed
6/26/95	B7	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown		1930-0530	4 passes recorded	NASA Hangar 4802	3867540	418920	Very little bat activity recorded; activity included 4 passes by <i>Tadarida brasiliensis</i>
3/22/95	B8	<i>Tadarida brasiliensis</i>	No	Unknown	Adult		Diurnal Observation	Guano	NASA Building 4826	3868183.93	419399.93	Guano found under crevice on east side of building; roosting bats have also been seen in Building 4826 vicinity by personnel
4/21/95	B8		No				Diurnal Observation	None	NASA Building 4826	3868183.93	419399.93	Diurnal observation due to previous bat sightings

Table 1, Page 2 of 14

Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
4/21/95	B8	<i>Tadarida brasiliensis</i>	No	Unknown				2000-2100	None	NASA Building 4826	3868183.93	419399.93	No bats observed
6/26/95	B8	<i>Tadarida brasiliensis</i>	No	Unknown				2000-2200	Guano	NASA Building 4826	3868183.93	419399.93	Fresh guano found under crevice at Building 4826; no bats observed after dark
11/8/95	B8	<i>Tadarida brasiliensis</i>	Yes	1	Male	Adult		1700-1730	Approximately 37 bats observed; capture	NASA Building 4826	3868183.93	419399.93	Observed approximately 37 <i>Tadarida brasiliensis</i> in roost; observed exit flight
11/30/95	B8		No					Diurnal Observation	None	NASA Building 4826	3868183.93	419399.93	No bats observed
2/9/96	B8	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Adult		1800-1900	Copious foraging activity recorded	NASA Building 4826	3868183.93	419399.93	Copious foraging activity recorded on Anabat
2/9/96	B8	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Adult		Diurnal Observation	12 bats observed	NASA Building 4826	3868183.93	419399.93	5 bats observed roosting; 7 bats emerged within one hour after dusk
3/13/96	B8	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Adult		1800-1900	Approximately 7 bats observed	NASA Building 4826	3868183.93	419399.93	Approximately 7 bats observed roosting in crevice in building
4/2/96	B8	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Adult		Diurnal Observation	9 bats observed	NASA Building 4826	3868183.93	419399.93	9 bats observed roosting in crevice in building
3/22/95	B9		No					1640-2300	None	Stormwater retention pond	3865460	419920	Very windy; no bats observed
4/28/95	B9	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			1900-dawn	18 bat passes recorded	Stormwater retention pond	3865460	419920	Windy, 18 bat passes recorded
7/23/95	B9	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown			2200-0600	2 passes recorded	Stormwater retention pond	3865460	419920	2 passes recorded
8/22/95	B9	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown			2045-2400	5 passes recorded	Stormwater retention pond	3865460	419920	5 passes recorded by 2400 over pond
11/8/95	B9		No					1700-2030	None	Stormwater retention pond	3865460	419920	No bats recorded on Anabat
2/13/96	B9	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			1800-2200	Copious foraging activity	Stormwater retention pond	3865460	419920	Copious foraging activity was detected with mini-detector
4/20/95	B10	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			Diurnal Observation	Guano	Building 1604	3864659.2	418916.463	Guano found in door hangar slots
4/20/95	B11	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			Diurnal Observation	Guano	Building 1635	3865430.57	419002.481	Guano found in door hangar slots
4/21/95	B12		No					Diurnal Observation	None	NASA Building 4801	3867580	418920	Diurnal observation due to previous bat sightings
4/21/95	B12	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Adult		1930-2400	Several bats observed	NASA Building 4801	3867580	418920	Slight breeze; several bats observed
4/21/95	B12	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Adult		1930-2400	Feeding buzzes heard	NASA Building 4801	3867580	418920	Slight breeze; feeding buzzes heard
4/21/95	B13		No					Diurnal Observation	None	NASA Building 4810	3867340	418980	Diurnal observation due to previous bat sightings
4/21/95	B13	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			1930-2400	Several bats observed	NASA Building 4810	3867340	418980	Slight breeze; several bats observed

Table 1, Page 3 of 14

Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
4/21/95	B13	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1930-2400	Feeding buzzes heard	NASA Building 4810	3867340	418980	Slight breeze; feeding buzzes heard
4/21/95	B14		No						Diurnal Observation	NASA Building 4833	3868445	49	419421.742
4/21/95	B15		No						Diurnal Observation	NASA Building 4837	386837.345	419400.279	Diurnal observation due to previous bat sightings.
4/21/95	B16		No						1945-2300	No	3867935.32	419302.674	Diurnal observation due to previous bat sightings.
4/25/95	B17		No						Diurnal Observation	Building 4840; canal with water by taxiway	3871427.38	421222.666	No sign of bats; personnel have observed bats in the past
6/26/95	B17		No					2400-0100	No	B-2 Complex	3862200	420400	No bat activity recorded
4/28/95	B18		No						Diurnal Observation	Building 4305	3871427.38	421222.666	No sign of bat activity
9/28/95	B19		No					1845-dawn	No	North Base sewage pond	3871000	420900	Cold and windy; too windy for mist netting; no bat passes recorded on Anabat
11/8/95	B20	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1930	Bats observed	Building 1830	3866221.57	418861.972	Bats observed flying over building
11/8/95	B20	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1930	Feeding buzzes heard	Building 1830	3866221.57	418861.972	Feeding buzzes heard
2/13/96	B20	<i>Tadarida brasiliensis</i>	No	Unknown	Adult	Unknown		1800-2200	Several bats observed	Hanger 1830	3866221.57	418861.972	Several bats observed flying over hangar 1830 at 2100
3/12/96	B20		No					1730-2115	No	Near hanger 1830	3866221.57	418861.972	Rain forced retrieval of Anabat; no bats observed or recorded
11/8/95	B21		No					2100-dawn	No	Animal control office (Building 49/6) pond	3869242.85	416603.566	Very windy; no bats recorded on Anabat
2/13/96	B21	Unknown	No	Unknown	Adult	Unknown		1830-2215	4 passes recorded	Animal control office (Building 49/6) pond	3869242.85	416603.566	4 passes recorded on Anabat; no bats captured in mist net.
3/13/96	B21		No					1800-2300	No	Animal control office (Building 49/6) pond	3869242.85	416603.566	Cold and windy; no bats observed or recorded
2/13/96	B22		No						No	Building 2450 (slated for demolition)	3865080	417380	No sign or bats observed
2/13/96	B23		No						Diurnal Observation	Building 2845 (slated for demolition)	3864840	418340	No sign or bats observed
2/13/96	B24		No						Diurnal Observation	Building 3522 (slated for demolition)	3865300	417580	No sign or bats observed
2/13/96	B25		No						Diurnal Observation	Building 3740 (slated for demolition)	3865680	418240	No sign or bats observed
2/13/96	B26		No						Diurnal Observation	Building 3615 (slated for demolition)	3866170	418340	No sign or bats observed
LEUHMAN RIDGE AND VICINITY													
3/23/95	E1				No			1900-2300	No	Phillips Lab pond by Building 8255	3865400	437040	Very windy; no bats observed

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
3/23/95	E2	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Deserted Phillips Lab Area 1-115 (Building 8431)	3865521.11	437555.539	Guano found
4/27/95	E2	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Area 1-21, Building 8431	3865521.11	437555.539	<i>Myotis</i> sp. guano found throughout the area
7/22/95	E2	<i>Myotis</i> sp.	No	(1) Female, Adults and Juvenile (1) Juvenile	Adult			Approximately 12 bats observed	Building 8431	Active <i>Myotis</i> sp.; observed a pup with approximately 10 <i>Myotis</i> sp. flying in gym and roosting in open stairwells	3865521.11	437555.354	
4/2/96	E2	<i>Myotis californicus</i>	No	Unknown	Adult			Diurnal Observation	Guano; 1 bat observed	Building 8431	3865521.11	437555.539	Individual was observed roosting; guano was observed in the stairwells
3/25/95	E3		No					Diurnal Observation	None	Mines at east side of Rogers Dry Lake	3866419.661	429096.992	Guano found throughout the area
4/18/95	E4	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Phillips Lab Tunnel "B" and Test Stand 1-B Fallout Shelter	3866669	437000	
4/18/95	E5	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Area 1-90 Abandoned Area	3867600	437800	<i>Myotis</i> sp. guano found throughout the area
7/21/95	E6	<i>Myotis californicus</i>	No	Unknown	Unknown			Diurnal Observation	Guano; dead individual found	Area I-120 Test Stand Tunnels 1A and 1B	3866650	436990	Guano and a mummified <i>Myotis californicus</i> found
4/19/95	E7	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Building 8694	3866650	436500	<i>Myotis</i> sp. guano found
4/19/95	E8	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Area 1-21, Building 8584	3865542.74	435845.312	<i>Myotis</i> sp. guano found
4/27/95	E8	<i>Myotis</i> sp.	No	Unknown	Adult			Diurnal Observation	Guano	Area 1-21, Building 8584	3865542.74	435845.312	<i>Myotis</i> sp. guano found throughout the area
4/19/95	E9		No					1800-2230	None	Phillips Lab Fire Station pond	3866000	436640	Very windy, no bats observed
4/27/95	E9		No					1830-0015	None	Phillips Lab Fire Station pond	3866000	436640	Very windy, no bats observed or caught in mist net
6/23/95	E9	Unknown	No	Unknown	Unknown			2230-0530	Copious passes recorded	Phillips Lab Fire Station pond	3866000	436640	Copious bat passes recorded on Arabat
6/24/95	E9	<i>Myotis californicus</i>	Yes	1	Unknown			2230-0530	Bats observed; capture	Phillips Lab Fire Station pond	3866000	436640	Observed <i>Myotis californicus</i> flying over pond; 1 escaped before sexing
6/24/95	E9	<i>Pipistrellus hesperus</i>	Yes	4	(3) Males, (1) Female	(3) Adults, (1) Juvenile	(1) pregnant	2230-0530	Capture	Phillips Lab Fire Station pond	3866000	436640	Captured in mist net
6/24/95	E9	Unknown	No					2230-0530	Over 100 passes recorded	Phillips Lab Fire Station pond	3866000	436640	Over 100 bat passes recorded on Arabat
7/22/95	E9	<i>Pipistrellus hesperus</i>	Yes	8	(5) Males, (3) Females	(6) Adults, (2) Juveniles		2030-0530	Capture	Phillips Lab Fire Station pond	3866000	436640	Captured in mist net
7/22/95	E9	<i>Myotis californicus</i>	No					2030-0530	Over 100 passes recorded	Phillips Lab Fire Station pond	3866000	436640	Over 100 passes recorded on Arabat
7/22/95	E9	<i>Myotis</i> sp.	No	Unknown	Unknown			0100-0600	Over 30 passes recorded	Phillips Lab Fire Station pond	3866000	436640	Over 30 bat passes recorded on Arabat

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
9/29/95	E9	<i>Pipistrellus hesperus</i>	Yes	14	(6) Male (8) Female	(2) Adults (12) Juveniles		1850-dawn	Capture	Phillips Lab Fire Station pond	3866000	436640	Favorable weather conditions
9/29/95	E9	<i>Myotis californicus</i>	Yes	1	Male	Adult		1850-dawn	Capture	Phillips Lab Fire Station pond	3866000	436640	Favorable weather conditions
9/29/95	E9	<i>Pipistrellus hesperus</i>	No					1850-dawn	Bat activity recorded	Phillips Lab Fire Station pond	3866000	436640	Favorable weather conditions; bat activity concentrated in the hour after dusk and the half hour before dawn
10/1/95	E9	<i>Pipistrellus hesperus</i>	Yes	3	(3) Males	(1) Adult, (2) Juveniles		1900-2400	Capture	Phillips Lab Fire Station pond	3866000	436640	Favorable weather conditions; bat activity concentrated in the hour after dusk
10/1/95	E9	<i>Pipistrellus hesperus</i>	No					1900-2400	Bat activity recorded	Phillips Lab Fire Station pond	3866000	436640	Favorable weather conditions; bat activity concentrated in the hour after dusk
11/11/95	E9	<i>Pipistrellus hesperus</i>	Yes	2	(1) Female, (1) Escaped- unidentified	Adult		1715-2300	Capture	Phillips Lab Fire Station pond	3866000	436640	Cool and calm weather; I escaped before sexing
11/11/95	E9	<i>Pipistrellus hesperus</i>	No					1715-2300	Bat activity recorded	Phillips Lab Fire Station pond	3866000	436640	Cool and calm weather; most activity in first hour; no activity after 2100
12/2/95	E9	<i>Pipistrellus hesperus</i>	Yes	3	(3) Males	Adult		1700-2300	Capture	Phillips Lab Fire Station pond	3866000	436640	Captured in mist net
12/2/95	E9	<i>Pipistrellus hesperus</i>	No					1700-2300	Over 50 passes recorded	Phillips Lab Fire Station pond	3866000	436640	Over 50 bat passes recorded
2/10/96	E9	<i>Myotis</i> sp.	No		Unknown	Adult		2230-dawn	12 passes recorded	Phillips Lab Fire Station pond	3866000	436640	12 passes recorded
2/11/96	E9	<i>Pipistrellus hesperus</i>	Yes	1	(1) Female	Adult		1800-2230	Capture	Phillips Lab Fire Station pond	3866000	436640	Captured in mist net
2/11/96	E9	<i>Tadarida brasiliensis</i>	No		Unknown	Adult		1800-2230	25 passes recorded	Phillips Lab Fire Station pond	3866000	436640	25 <i>Tadarida brasiliensis</i> passes recorded; all <i>Tadarida brasiliensis</i> were detected at least two hours after sunset
2/11/96	E9	<i>Myotis</i> sp.	No		Unknown	Adult		1800-2230	100 passes recorded	Phillips Lab Fire Station pond	3866000	436640	100 <i>Myotis</i> sp. passes recorded
3/30/96	E9	<i>Myotis californicus</i>	Yes	1	Male	Adult		1830-dawn	Capture	Phillips Lab Fire Station pond	3866000	436640	Captured in mist net
3/30/96	E9	<i>Myotis californicus</i>	No					1830-dawn	Over 100 passes recorded	Phillips Lab Fire Station pond	3866000	436640	Over 100 bat passes recorded on Anabat
4/26/95	E10	<i>Tadarida brasiliensis</i>	No					1900-dawn	None	Downfall Lunch pond	3862220	437180	Very windy; no bats heard or captured
3/14/96	E10	<i>Tadarida brasiliensis</i>	No		Unknown	Unknown		1800-2345	47 passes recorded	Downfall Lunch pond	3862220	437180	47 passes recorded on Anabat; no bats captured in mist net
3/15/96	E10	<i>Tadarida brasiliensis</i>	No		Unknown	Unknown		1815-2315	6 passes recorded	Downfall Lunch pond	3862220	437180	6 passes recorded; no bats captured in mist net
4/2/96	E10	<i>Myotis</i> sp.	No		Unknown	Unknown		1800-2045	1 pass recorded	Downfall Lunch pond	3862220	437180	1 pass recorded; no bats captured in mist net
4/26/95	E11	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No		Unknown	Adult		1900-dawn	Over 50 passes observed	Downfall sewage ponds	3862680.025	436344.84	Over 50 passes observed when winds abated

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes		
6/23/95	E11	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1930-0530	Copious activity recorded	3862680.025	436344.84	Copious bat activity recorded on mini-detector; no bats caught in mist net				
11/9/95	E11	<i>Myotis</i> sp.	No	None			1800-2100	None	3862680.025	436344.84	Very windy; no bats observed or recorded				
11/29/95	E11	Unknown	No	Unknown	Unknown	Unknown	1800-2100	Copious activity recorded	3862680.025	436344.84	Recorded copious bat passes on Anabat				
3/14/96	E11	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1830-dawn	237 passes recorded	3862680.025	436344.84	237 passes recorded on Anabat				
4/26/95	E12	<i>Myotis</i> sp.	No	Unknown	Adult				Phillips Lab Building 8419	3865328.54	437553.009	<i>Myotis</i> sp. guano found			
4/27/95	E12	<i>Myotis</i> sp.	No	Unknown	Adult				Area 1-21, Building 8419	3865328.54	437553.009	<i>Myotis</i> sp. guano found throughout the area			
11/9/95	E12	<i>Myotis</i> sp.	No	Unknown	Unknown				Phillips Lab Building 8419	3865328.54	437553.009	Guano found; no bats observed			
4/2/96	E12	<i>Myotis californicus</i>	No	Female	Adult				Abandoned Building 8419	3865328.54	437553.009	Individual was dead; no live bats were observed; skull will be analyzed for positive identification			
4/26/95	E13	<i>Myotis californicus</i>	No	Male	Adult				Bats observed	Area 1-115 Tunnel to Building 8668	3866407	436526	Bat observed roosting in crevice		
7/21/95	E13	<i>Myotis californicus</i>	Yes	5	(2) Females, (3) Adults, (1) Male, (2) Juveniles				Diurnal Observation	Area 1-115 Tunnel to Building 8668	3866407	436526			
7/21/95	E13	<i>Myotis californicus</i>	No	Female, Juvenile	Adults, Juvenile				Diurnal Observation	Area 1-115 Tunnel to Building 8668	3866407	436526			
7/22/95	E13	<i>Myotis californicus</i>	No	Unknown	Unknown				Diurnal Observation	Area 1-115 Tunnel to Building 8668	3866407	436526	Observed 7 <i>Myotis</i> sp. with at least 1 female and pup roosting in lower		
7/22/95	E13	<i>Pipistrellus hesperus</i>	No	Unknown	Unknown				Approximately 5 bats observed	Area 1-115 Tunnel to Building 8668	3866407	436526	Approximately 5 night-roosting <i>Myotis californicus</i> observed		
11/9/95	E13	Unknown	No	Unknown	Unknown				1 bat observed	Area 1-115 Tunnel to Building 8668	3866407	436526	1 night-roosting <i>Pipistrellus hesperus</i> observed		
12/29/95	E13	No							Diurnal Observation	Area 1-115 Tunnel to Building 8668	3866407	436526	Guano found; no bats observed		
3/30/96	E13	<i>Myotis californicus</i>	No	Unknown	Adult				Diurnal Observation	Area 1-115 Tunnel to Building 8668	3866407	436526	No bats observed		
4/27/95	E14	<i>Myotis californicus</i>	Yes	1	Male	Adult			1 bat observed	Area 1-115 Tunnel to Building 8668	3866407	436526	1 bat observed		
4/27/95	E14	<i>Myotis californicus</i>	No						1900-2400	Bat activity observed; capture Pond	3866180	438360	Breezy; bat activity also observed when wind subsided for 30 minutes		
4/27/95	E15	<i>Myotis</i> sp.	No	Unknown	Adult				1900-2400	18 passes recorded	3866180	438360	Breezy; 18 bat passes recorded		
6/24/95	E15	<i>Myotis californicus</i>	Yes	1	Female	Adult	Pregnant		Guano	Building 8020	3870140	431640	Copious bat guano found; possible <i>Myotis</i> sp. night roost location		
6/24/95	E15	<i>Myotis</i> sp.	No						Capture	Abandoned Building 8020	3870140	431640	4 to 5 night-roosting <i>Myotis</i> sp. also observed		

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes	
3/31/96	E15	<i>M. californicus</i> , <i>M. sp.</i>	No	Unknown	Unknown	Unknown		2330	Approximate 10 bats observed	Abandoned Building 8020	3870140	431640	Approximately 10 individuals were observed night roosting	
3/23/95	E16	<i>M. sp.</i>	No	Unknown	Adult				Diurnal Observation	Guano	3866304.14	436438.597	Bat guano found	
3/23/95	E17	<i>M. sp.</i>	No	Unknown	Adult				Diurnal Observation	Guano	3866406.88	436526.165	Bat guano found	
3/30/96	E17	<i>M. sp.</i>	No	Unknown	Unknown	Unknown			1845-dawn	Building 8668	3866406.88	436526.165	1.5 bat passes recorded	
7/22/95	E18	<i>M. sp.</i>	No	Unknown	Unknown	Unknown		2045-0330	Approximately 5 passes recorded	Area 1-40 pond	3866040	435600	Approximately 5 bat passes recorded	
7/22/95	E19	Unknown	No					2030-0530	Over 40 passes recorded	Building 8255 pond	3865400	437040	Over 40 bat passes recorded on Anabat near Building 8255 pond between 0100-0600	
9/29/95	E19	Unknown	No	Unknown	Unknown	Unknown		1900-dawn	Bat activity recorded	Building 8255 pond	3865400	437040	Favorable weather conditions; bat activity concentrated in the hour after dusk and the half hour before dawn	
10/1/95	E19	Unknown	No	Unknown	Unknown	Unknown		1900-2400	Bat activity recorded	Building 8255 pond	3865400	437040	Favorable weather conditions; no bats captured in mist net; bat activity concentrated in the hour after dusk	
2/11/96	E19	<i>M. sp.</i>	No	Unknown	Adult			1800-2230	23 passes recorded	Building 8255 pond	3865400	437040	23 <i>M. sp.</i> passes recorded	
2/11/96	E19	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			1800-2230	3 passes recorded	Building 8255 pond	3865400	437040	3 <i>Tadarida brasiliensis</i> passes recorded	
9/30/95	E20		No						Diurnal Observation	None	3852820	430120	No bats or guano found	
10/1/95	E21		No					1900-2400	None	Mines located south off base	3867740	441000	Favorable weather conditions; no bats detected on Anabat	
11/9/95	E22		No					1800-2100	None	Mary's Well pond	3862610	430800	Very windy, no bats observed or recorded	
11/29/95	E22	<i>Pipistrellus hesperus</i>	Yes	1	Male	Adult		1700-2115	Copious passes recorded; capture	Mary's Well pond	3862610	430800	Recorded copious bat passes on Anabat	
4/2/96	E22	<i>M. sp.</i>	No	Unknown	Unknown			1815-2045	147 passes recorded	Mary's Well pond	3862610	430800	147 passes recorded on Anabat; mist net not set due to wind	
2/11/96	E23	<i>Tadarida brasiliensis</i> , <i>M. sp.</i>	No	Unknown	Unknown				Diurnal Observation	Guano	Building 8025 (slated for demolition)	3870200	431760	Large quantities of <i>M. sp.</i> guano. <i>Tadarida brasiliensis</i> guano observed in several rooms; this warrants a spring or summer check for diurnal and nocturnal use
3/31/96	E23	<i>M. californicus</i>	Yes	1	Male	Adult		2345	Capture	Abandoned Building 8025		431760		
3/31/96	E23	<i>M. sp.</i>	No					2345	Bats observed	Abandoned Building 8025	3870200	431760	Individuals observed may have included small-footed bats (<i>M. ciliolatum</i>)	
4/2/96	E23		No						Diurnal Observation	None	3870200	431760	No bats observed	

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
2/11/96	E24	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown		Diurnal Observation	Guano	Building 8035 and unnumbered building on north side of lake (stated for demolition)	3870560	432260	Guano observed
2/14/96	E25		No					1500	None	Downfall: mine 1.5 km west of tower	3861832.892	436054.78	17 meter deep shaft contained barn owl sign, but no bats
4/2/96	E25		No					1830-1930	None	Downfall: mine 1.5 km west of tower	3861832.892	436054.78	Shaft was watched for 1 hour after sunset with night vision equipment; a barn owl emerged, but no bats
2/14/96	E26		No					1400	None	Downfall: mine east side of Jackrabbit Hill	3855043.17	435707.108	13 meter deep shaft contained barn owl sign, but no bats
12/1/95	E27	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		Diurnal Observation	Guano	Downfall rock outcrop northwest of tower	3862259.89	436011.302	<i>Tadarida brasiliensis</i> guano found
4/2/96	E27	<i>Pipistrellus hesperus</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown		1830-1930	Bats observed	Downfall: rock outcrop northwest of tower	3862259.89	436011.302	Area monitored with night vision equipment. <i>Myotis</i> sp. or <i>Pipistrellus hesperus</i> were observed at dusk
4/2/96	E27	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1830-1930	Bat activity recorded	Downfall: rock outcrop northwest of tower	3862259.89	436011.302	Area monitored with mini-detector; <i>Tadarida brasiliensis</i> activity was detected 30 minutes past dusk
3/31/96	E28	<i>Myotis californicus</i>	No	Unknown	Adult			Diurnal Observation	7 bats observed	Area 1-116 Tunnel to Building 8668	3866407	436526	All individuals were torpid and not disturbed
4/2/96	E29	<i>Myotis</i> sp.	No					Diurnal Observation	Guano	Building 8402	3865100	437300	Guano was observed in the stairwells
4/2/96	E30	<i>Myotis</i> sp.	No					Diurnal Observation	Guano	Building 8955	3867920	441060	Guano was observed in the stairwells
HAYSTACK BUTTE													
11/29/95	C1		No					Diurnal Observation	None	Mine at Area C-3	3856862.721	450536.099	No bats observed
2/14/96	C1		No					1300	None	Mine at Area C-3	3856862.721	450536.099	Approximately 40 meters down to water; no sign of bats
3/24/95	C2		No					1800-2200	None	1-52 Pond	3859280	442710	Very windy; no bats observed; mist net and Anabat set at 1-52 pond
6/24/95	C2	<i>Myotis californicus</i> , <i>Pipistrellus hesperus</i>	No					1930-0530	Continuous bat activity recorded	1-52 Pond	3859280	442710	Continuous bat activity recorded on Anabat
6/24/95	C2	<i>Myotis californicus</i>	Yes	8	(5) Females, (8) Adults (3) Males	(4) pregnant, (1) lactating		1930-0530	Capture	1-52 Pond	3859280	442710	
6/24/95	C2	<i>Myotis</i> sp.	No					1930-0530	Bats observed	1-52 Pond	3859280	442710	<i>Myotis</i> sp. avoiding mist net were observed with night vision goggles
6/24/95	C2	<i>Pipistrellus hesperus</i>	Yes	3	(3) Males	(2) Adults, (1) Juvenile		1930-0530	Bats observed; capture	1-52 Pond	3859280	442710	<i>Pipistrellus hesperus</i> avoiding mist net observed with night vision goggles
7/21/95	C2	<i>Myotis californicus</i>	Yes	1	Female	Adult		2015-0030	Bats observed; capture	1-52 Pond	3859280	442710	Net up 2000-0100; bats observed with night vision goggles
7/21/95	C2	<i>Myotis californicus</i>	No					2015-0030	Over 100 passes recorded	1-52 Pond	3859280	442710	Approximately 100 passes recorded on Anabat

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
9/30/95	C2	Unknown	No	Unknown	Unknown	Unknown	1900-2330	1-52 Pond	Bat activity recorded	3859280	442710	Favorable weather conditions; nets did not capture bats; bat activity concentrated in the hour after dusk	
12/1/95	C2	Unknown	No	Unknown	Unknown	Unknown	1700-2100	80 passes recorded	1-52 Pond	3859280	442710	Cold and windy weather; 80 bat passes recorded; no bats captured in mist net	
2/10/96	C2	<i>Tadarida brasiliensis</i>	No	Unknown	Adult	Unknown	1730-2200	Over 100 passes recorded	1-52 Pond	3859280	442710	Over 100 passes recorded	
2/11/96	C2	<i>Myotis californicus</i>	No	(1) Female, Adult (1) Escaped	1745-2245	None	1820-2245	Capture	1-52 Pond	3859280	442710	No bats captured	
3/31/96	C2	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	Yes	2	Unknown	Unknown	1820-2245	87 passes recorded	1-52 Pond	3859280	442710	<i>Myotis californicus</i> escaped before sexing	
4/18/95	C3	No	No	1900-2300	None	Below the butte; south	3857807.36	443635.879	Very windy; no bats observed				
4/18/95	C4	No	No	1900-2300	None	Below the butte; north	3857824.645	443232.901	Very windy; no bats observed				
4/19/95	C5	No	No	2055-2145	None	East side of butte	3857887.412	443879.811	Very windy; no bats observed or detected on Anabat				
7/21/95	C6	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-0100	Over 30 bat passes recorded	1-42 Pond	3861120	440920	Over 30 bat passes recorded on Anabat	
9/30/95	C6	Unknown	No	Unknown	Unknown	Unknown	1930-2400	Bat activity recorded	1-42 Pond	3861120	440920	Favorable weather conditions; nets did not capture bats; bat activity concentrated in the hour after dusk	
ROSAMOND/BISSELL HILLS													
4/22/95	G1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Adult	Unknown	1930-2145	2 passes recorded; feeding buzzes heard	Northwest of Red Hill	3858439.455	398001.312	Slight breeze; 2 bat passes and feeding buzzes heard	
4/22/95	G2	No	No	1930-2145	None	Sandstone formation; northwest of Red Hill	3858896.697	397876.246	No bats recorded				
7/20/95	G2	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Approximately 13 passes recorded	2030-dawn	Sandstone formation, northwest of Red Hill	3858896.697	397876.246			
4/23/95	G3	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Adult	Over 90 passes recorded; feeding buzzes recorded	1930-2200	Rosamond big cliffs; north	3859356.528	400786.776			
4/23/95	G4	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Adult	Over 90 passes recorded; feeding buzzes recorded	1930-2200	Rosamond big cliffs; south	3858747.047	397952.093			
6/22/95	G5	Unknown	No	Unknown	Unknown	1900-dawn	6 bats observed	Red Hill; top of hill	3859528.944	400379.614	6 bats observed with night vision goggles near top of hill		
7/20/95	G5	<i>Myotis</i> sp.	No	Unknown	Unknown	2230-2400	8 passes recorded	Red Hill; top of hill	3859528.944	400379.614	8 passes recorded on Anabat		
6/22/95	G6	No	Unknown	1900-dawn	None	Red Hill; southeast side	3862135.333	406861.877	No bats detected				
8/20/95	G6	<i>Pipistrellus hesperus</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	1930-0600	10 bats observed	Red Hill; southeast side	3862135.333	406861.877	10 bats observed flying at sunset		
8/20/95	G6	<i>Pipistrellus hesperus</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	1930-0600	12 passes recorded by dawn	Red Hill; southeast side	3862135.333	406861.877	12 passes recorded by dawn		

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Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
11/10/95	G6	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown		1700-2200	5 passes recorded	Red Hill; southeast side base of hill	3862135.333	406861.877	5 passes recorded on Anabat
11/30/95	G6	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1700-dawn	Approximately 20 passes recorded	Red Hill; southeast side base of hill	3862135.333	406861.877	Approximately 20 <i>Tadarida brasiliensis</i> passes recorded on Anabat
4/1/96	G6	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1700-dawn	1 pass recorded	Red Hill; southeast side base of hill	3862135.333	406861.877	Cold, rain threatening; 1 pass recorded
4/23/95	G7		No							Diurnal Observation			
6/22/95	G7	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown		1900-dawn	7 passes recorded	Granite rock outcrop	3862586.026	406929.419	No bats or guano found
7/20/95	G8	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown		2030-dawn	31 passes recorded	Homestead site east of Red Hill	3859561.245	400678.066	31 bat passes recorded on Anabat; Mist net set 2030-0030 but no bats captured
8/20/95	G9	<i>Antrozous pallidus</i>	No	Unknown	Unknown	Unknown		2015-2230	1 bat observed	Granite outcrop northeast side of Rosamond Hills	3863391.044	412075.622	<i>Antrozous pallidus</i> observed flying near rock with night vision goggles
8/20/95	G9	Unknown	No	Unknown	Unknown	Unknown		2015-2230	3 passes recorded	Granite outcrop northeast side of Rosamond Hills	3863391.044	412075.622	3 passes recorded on Anabat
2/14/96	G10	<i>Myotis</i> sp.	No	Unknown	Adult			1815-0130	46 passes recorded	Bissell Hills: Granite boulders approximately 0.4 mile north of ridge	3864963.041	410840.577	46 passes recorded
2/14/96	G11	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			1800-dawn	5 passes recorded	Bissell Hills: Ridge 1 mile west of hospital	3863798.541	411884.677	5 <i>Tadarida brasiliensis</i> passes recorded
10/1/95	G11	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Adult		1800-dawn	13 passes recorded	Bissell Hills: Ridge 1 mile west of hospital	3863798.541	411884.677	13 <i>Myotis</i> sp passes recorded
3/17/96	G13	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1830-dawn	Approximately 9 passes recorded	C V Camp M-9; west of Main Base near Rifle Range	3865840	413060	Fresh guano found
3/17/96	G13	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown		1830-dawn	Approximately 4 passes recorded	Bissell Hills: Graffiti rocks; north	3865200	410460	Approximately 9 <i>Tadarida brasiliensis</i> passes recorded
3/17/96	G14	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1830-dawn	1 pass recorded	Bissell Hills: Graffiti rocks; north	3865200	410460	Approximately 4 <i>Myotis</i> sp passes recorded
11/9/95	G15		No							Diurnal Observation			
12/5/94	D1	<i>Myotis</i> sp.	No	Unknown	Adult			1700-1900	1 pass recorded	Golf Course pond	3863000	414400	One bat pass recorded at 1800
3/19/95	D1	Unknown	No	Unknown	Adult			1730-dawn	1 pass recorded	Golf Course pond	3863000	414400	One bat pass recorded at 0113
4/17/95	D1		No					1900-dawn	None	Golf Course pond	3863000	414400	Raining and very wimky; no bats observed
4/24/95	D1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Adult			2000-2230	Approximately 60 passes recorded	Golf Course pond	3863000	414400	Light winds, approximately 60 bat passes recorded
6/22/95	D1	<i>Myotis</i> sp.	No	Unknown	Unknown			0230-dawn	8 passes recorded	Golf Course pond	3863000	414400	8 echolocation passes detected on Anabat

Table 1, Page 11 of 14

Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
7/25/95	D1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2030-2400	Approximately 10 passes recorded	Golf Course pond	3863000	414400	Approximately 10 echolocation passes recorded on Anabat	
8/24/95	D1	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-2330	10 passes recorded	Golf Course pond	3863000	414400	10 passes recorded on mini-detector	
9/27/95	D1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1930-2400	12 passes recorded	Golf Course pond	3863000	414400	Weather was breezy and cool; no bats captured in mist net; 12 passes recorded on mini-detector	
11/7/95	D1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1730-2300	47 passes recorded	Golf Course pond	3863000	414400	Cold; no bats caught in mist net; 47 passes recorded; heard <i>Tadarida brasiliensis</i> and <i>Myotis</i> sp.	
11/27/95	D1	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1630-2200	1 pass recorded	Golf Course pond	3863000	414400	Cold weather; 1 <i>Tadarida brasiliensis</i> pass recorded at 1750	
2/8/96	D1	<i>Myotis</i> sp.	No	Unknown	Adult	Unknown	1730-2215	22 passes recorded	Golf Course pond	3863000	414400	22 passes recorded; cool but no wind	
3/16/96	D1	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1815-2240	2 passes recorded	Golf Course pond	3863000	414400	Cold with 6-11 km/h winds; 2 <i>Tadarida brasiliensis</i> passes recorded; no bats captured in mist net	
3/16/96	D1	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1815-2240	24 passes recorded	Golf Course pond	3863000	414400	Cold with winds 6-11 km/h; 24 <i>Myotis</i> sp. passes recorded; no bats captured in mist net	
3/29/96	D1		No				1830-midnight	None	Golf Course pond	3863000	414400	Cold with 20-28 km/h winds; no bats detected	
3/19/95	D2		No				1730-dawn	None	FamCamp	3864200	415540	No bats observed or recorded	
3/21/95	D2		No				1800-2400	None	FamCamp	3864200	415540	Raining and windy; no bats recorded	
4/17/95	D2		No				1900-dawn	None	FamCamp	3864200	415540	Raining and very windy; no bats observed	
4/25/95	D2		No				2000-dawn	None	FamCamp	3864200	415540	Too windy; no bat pass recorded	
6/22/95	D2		No				0200-dawn	None	FamCamp	3864200	415540	No passes recorded	
8/24/95	D2	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2400-0600	1 pass recorded	FamCamp	3864200	415540	1 bat detected with Anabat	
11/7/95	D2		No				2330-dawn	None	FamCamp	3864200	415540	No bats detected by Anabat	
11/10/95	D2		No				2330-dawn	None	FamCamp	3864200	415540	No bats recorded or observed	
11/27/95	D2		No				2200-dawn	None	FamCamp	3864200	415540	No bats recorded	
2/8/96	D2	<i>Tadarida brasiliensis</i>	No	Unknown	Adult	Unknown	2230-dawn	18 passes recorded	FamCamp	3864200	415540	18 passes recorded	
3/16/96	D2		No				2245-dawn	None	FamCamp	3864200	415540	No bats recorded on Anabat	
3/29/96	D2		No				1830-dawn	None	FamCamp	3864200	415540	No bats detected	
4/23/95	D3		No				2300-0030	None	Stables	3866760	413360	Slight breeze; no bats observed	
4/23/95	D4		No				2300-0030	None	Community Center	3864000	415540	Slight breeze; no bats observed	
6/22/95	D5		No				2300-0030	None	Housing area around lights	3865000	414000	No bats observed	
9/27/95	D6	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1930-2300	1 pass recorded	Club Muroc pool	3863680	414380	1 bat pass recorded on Anabat	
11/7/95	D6	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	2045-2200	15 passes recorded; feeding buzzes recorded	Club Muroc pool	3863680	414380	15 bat passes with feeding buzzes recorded on Anabat	

Table 1, Page 12 of 14

Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
3/16/96	D6	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown		1830-2230	227 passes recorded	Club Muroc pool	3863680	414380	227 <i>Tadarida brasiliensis</i> passes recorded
3/16/96	D6	<i>M. lyotis</i> sp.	No	Unknown	Unknown	Unknown		1830-2230	10 passes recorded	Club Muroc pool	3863680	414380	10 passes recorded
2/13/96	D7		No					Diurnal Observation	None	Building 7209 (slated for demolition)	3865155.44	414361.29	No sign or bats observed
2/13/96	D8		No					Diurnal Observation	None	Buildings 7038-7056 (slated for demolition)	3864383.63	414917.283	No bat sign detected; "cupola" atop Building 7038 is a potential roost site
4/3/96	D8		No					Dusk	None	Building 7038	3864383.63	414917.283	No bats observed
2/13/96	D9		No					Diurnal Observation	None	Near landfill: Building 7994 (slated for demolition)	3868240	412560	Not suitable for bats
2/13/96	D10		No					Diurnal Observation	None	Near landfill: Building 7997 (slated for demolition)	3868187.86	412546.374	Not suitable for bats
Branch Park													
12/7/94	A1		No					1730-dawn	None	Pond	3853740	415760	Windy, no bats observed
3/26/95	A1	Unknown	No	Unknown	Adult			1830-2200	1 pass recorded	Pond	3853740	415760	Low wind; 1 bat pass recorded at 1915
6/25/95	A1	<i>M. lyotis</i> sp.	No	Unknown	Unknown			2000-530	Over 100 passes recorded	Pond	3853740	415760	Sporadic bat activity; including over 100 bat passes recorded on Anabat
7/19/95	A1	<i>M. lyotis</i> sp.	No	Unknown	Unknown			2030-0100	Over 50 passes recorded	Pond	3853740	415760	Over 50 bat passes recorded on Anabat
8/19/95	A1	<i>M. lyotis</i> sp.	No	Unknown	Unknown			2330-0600	20 passes recorded	Pond	3853740	415760	20 bat passes recorded on Anabat throughout evening
9/25/95	A1	<i>M. lyotis</i> sp.	No	Unknown	Unknown			2400-dawn	Approximately 40 passes recorded	Pond	3853740	415760	Approximately 40 bat passes recorded on Anabat; too windy for mist netting
11/12/95	A1	Unknown	No	Unknown	Unknown			1700-2200	Approximately 30 passes recorded	Pond	3853740	415760	Sporadic activity; approximately 30 passes concentrated in the hour after dark
12/3/95	A1	Unknown	No	Unknown	Adult			1700-2200	34 passes recorded	Pond	3853740	415760	34 bat passes recorded
2/9/96	A1	<i>Tadarida brasiliensis</i>	No	Unknown	Adult			1730-dawn	11 passes recorded	Pond	3853740	415760	11 passes recorded; no bats captured in mist nets set between 1730-2200
3/10/96	A1		No					1830-dawn	None	Pond	3853740	415760	Wind; no bat passes recorded on Anabat; no bats captured in mist nets
4/3/96	A1	<i>M. lyotis</i> sp.	No	Unknown	Unknown			1900-2145	125 passes recorded	Pond	3853740	415760	125 passes recorded on Anabat; no mist nets set due to 30 km/h winds
4/20/95	A2		No					1930-2300	None	North side of pond	3853840	415760	Very windy, no bats observed
4/20/95	A3		No					1930-2300	None	South side of pond	3853660	415760	No evidence of bats
4/22/95	A4		No					Diurnal Observation	None	Survival School Scout Camp	3853020	419900	Approximately 5 bat passes recorded on Anabat
7/23/95	A4	<i>M. lyotis</i> sp.	No	Unknown	Unknown			2020-0600	Approximately 5 passes recorded	Survival School Scout Camp	3853020	419900	No bat activity detected with Anabat
7/23/95	A5		No					2100-2130	None	South Base sewage ponds	3857890	418980	

Table 1, Page 13 of 14

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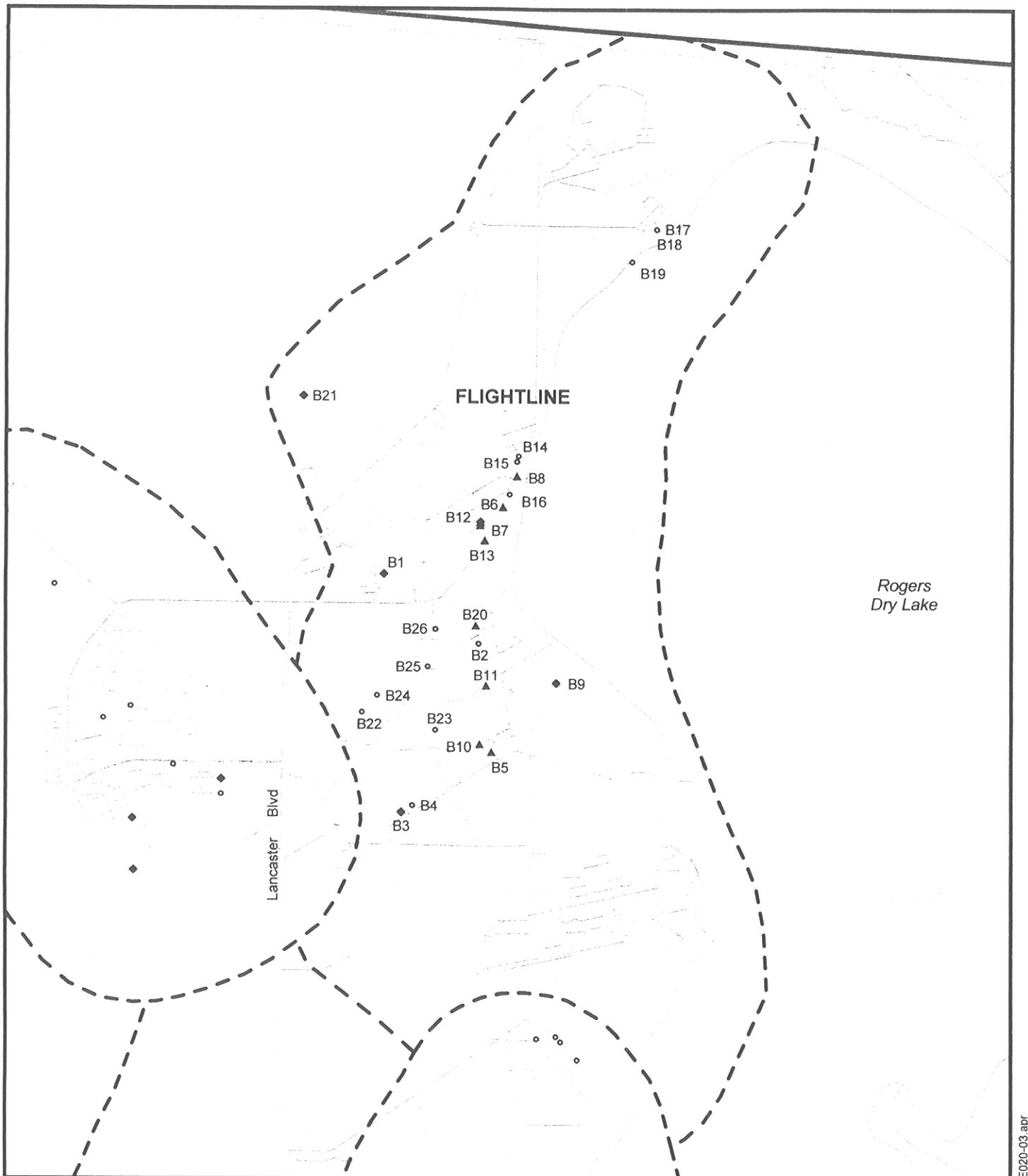
Date	Transect ID	Species	Captured	Number Captured	Sex	Age	Reproductive Condition	Time	Detections	Location Description	UTM Northing	UTM Easting	Notes
6/27/95	F1	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-0100	2 passes recorded	South pond	3849113.031	396710.375	Very little wind and little bat activity; 2 passes recorded on Anabat	
8/21/95	F1	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1930-2345	1 pass recorded	South pond	3849113.031	396710.375	1 bat recorded on Anabat	
9/26/95	F1	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-dawn	20 passes recorded	South pond	3849113.031	396710.375	20 passes recorded on Anabat; no bats captured with mist net	
11/28/95	F1		No				1700-2145	None	South pond	3849113.031	396710.375	10 passes recorded	
3/25/95	F2	Unknown	No	Unknown	Adult	Unknown	1800-2200	10 passes recorded	North pond; north side	3850277.709	398368.938	10 bat passes recorded in first 2 hours before wind increased	
6/27/95	F2	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-0100	14 passes recorded	North pond; north side	3850277.709	398368.938	14 passes recorded on Anabat; although copious insects were present	
7/24/95	F2	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-0600	Approximately 10 passes recorded	North pond; north side	3850277.709	398368.938	Approximately 10 bat passes recorded on Anabat	
8/21/95	F2	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1930-2400	12 passes recorded	North pond; north side	3850277.709	398368.938	12 passes recorded on Anabat; copious mosquitoes present	
9/26/95	F2	<i>Tadarida brasiliensis</i> , <i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-dawn	9 passes recorded	North pond; north side	3850277.709	398368.938	9 passes detected on Anabat	
2/12/96	F2	<i>Tadarida brasiliensis</i>	No	Unknown	Adult	Unknown	1750-2030	1 pass recorded	North pond; north side	3850277.709	398368.938	1 pass recorded; cold and very windy conditions, rain terminated field work	
3/11/96	F2	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1830-dawn	52 passes recorded	North pond; north side	3850277.709	398368.938	Cold and windy; 52 passes recorded on Anabat, all before 2100	
4/1/96	F2	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1830-dawn	1 pass recorded	North pond; north side	3850277.709	398368.938	Cold, very windy, sporadic rain; 1 pass recorded on Anabat	
3/25/95	F3	Unknown	No	Unknown	Adult	Unknown	1800-2200	10 passes recorded	Spillway	3850329.693	398717.61	10 bat passes recorded in first 2 hours before wind increased	
4/22/95	F3		No				2145-2345	None	Spillway	3850329.693	398717.61	Slight breeze, no bats observed	
7/24/95	F3	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-0600	Approximately 7 passes recorded	Spillway	3850329.693	398717.61	Recorded on Anabat	
11/10/95	F3	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1730-2130	3 passes recorded	Spillway	3850329.693	398717.61	Recorded on Anabat	
11/10/95	F3	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1730-2130	7 passes recorded	Spillway	3850329.693	398717.61	Recorded on Anabat	
11/28/95	F3	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1600-dawn	5 passes recorded	Spillway	3850329.693	398717.61	5 <i>Tadarida brasiliensis</i> recorded	
2/12/96	F3		No				1750-2030	None	Spillway	3850329.693	398717.61	No bats recorded on Anabat	
3/11/96	F3	<i>Tadarida brasiliensis</i>	No	Unknown	Unknown	Unknown	1830-dawn	166 passes recorded	Spillway	3850329.693	398717.61	Cold and windy; 166 passes recorded on Anabat, all before 1930	
3/24/95	F4		No				1800-2200	None	North Pond Avenue C	3850342.345	397645.395	Very windy; no bats observed or recorded	
6/24/95	F4		No				2100-2300	None	North Pond Avenue C	3850342.345	397645.395	No bats recorded on Anabat	
7/21/95	F4	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	2000-0100	4 passes recorded	North Pond Avenue C	3850342.345	397645.395	4 passes recorded on Anabat	
12/1/95	F4	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1630-2030	1 pass recorded	North Pond Avenue C	3850342.345	397645.395	1 <i>Myotis</i> sp. pass recorded on Anabat	
2/10/96	F4	<i>Myotis</i> sp.	No	Unknown	Adult	Unknown	1745-2145	2 passes recorded	North Pond Avenue C	3850342.345	397645.395	2 passes recorded	
3/31/96	F4	<i>Myotis</i> sp.	No	Unknown	Unknown	Unknown	1815-2230	1 pass recorded	North Pond Avenue C	3850342.345	397645.395	1 pass recorded on Anabat	

Table 2
Edwards Air Force Base Bat Studies Capture Summary

Survey Area and Transect ID	Specific Location	Date	<i>Myotis californicus</i>	<i>Pipistrellus hesperus</i>	<i>Tadarida brasiliensis</i>
Flightline					
B8	NASA Building 4826	11/8/95			1 Male Adult
Leuhman Ridge					
E9	Phillips Lab Fire Station pond	6/24/95	1 Unknown*		
E9	Phillips Lab Fire Station pond	6/24/95		1 Pregnant 2 Male Adults 1 Male Juvenile	
E9	Phillips Lab Fire Station pond	7/22/95		3 Female Adults 3 Male Adults 2 Male Juveniles	
E9	Phillips Lab Fire Station pond	9/29/95		1 Female Adult 1 Male Adult 7 Female Juveniles 5 Male Juveniles	
E9	Phillips Lab Fire Station pond	9/29/95	1 Male Adult		
E9	Phillips Lab Fire Station pond	10/1/95		1 Male Adult 2 Male Juveniles	
E9	Phillips Lab Fire Station pond	11/11/95		1 Female Adult 1 Unknown Adult*	
E9	Phillips Lab Fire Station pond	12/2/95		3 Male Adults	
E9	Phillips Lab Fire Station pond	2/11/96		1 Female Adult	
E9	Phillips Lab Fire Station pond	3/30/96	1 Male Adult		
E13	Area 1-115 Tunnel to Building 8668	7/21/95	2 Female Adults 1 Male Adult 2 Juveniles		
E14	Phillips Lab Area 1-30 pond	4/27/95	1 Male Adult		
E15	Abandoned Building 8020	6/24/95	1 Pregnant		
E22	Mary's Well pond	11/29/95		1 Male Adult	
E23	Abandoned Building 8025	3/31/96	1 Male Adult		
Haystack Butte					
C2	1-52 Pond	6/24/95	4 Pregnant 1 Lactating 3 Male Adults		
C2	1-52 Pond	6/24/95		2 Male Adults 1 Male Juvenile	
C2	1-52 Pond	7/21/95	1 Lactating		
C2	1-52 Pond	3/31/96	1 Female Adult 1 Unknown Adult*		
Branch Park					
A7	Abandoned Building 0502 pond	8/23/95	1 Post-lactating		
* individual escaped before sexing		TOTALS:			
		Female Adults	11	7	0
		Male Adults	8	13	1
		Adults, Unknown Sex	2*	1*	0
		Female Juveniles	0	7	0
		Male Juveniles	0	11	0
		Juveniles, Unknown Sex	2	0	0
		TOTAL:	23	39	1

Flightline. The Flightline was surveyed for a total of 14 nights, and 10 diurnal observations were conducted (Figure 2). Evidence of bats was found in 5 buildings (4802, 4826, 1600, 1604, and 1635), including a mummified Mexican free-tailed bat in NASA Hangar 4802 on March 22, 1995. On the same day, a roost was detected in the crevice between the outside wall and the roof of Building 4826. Fresh guano was also observed under the roost during monthly checks. On November 8, 1995, 37 Mexican free-tailed bats were observed exiting Building 4826, and Mexican free-tailed bats were observed foraging around the lights at Building 1830. The crevice at Building 4826 did not shelter bats on November 30, 1995, but at least 7 were present on February 9, 1996 and 7 to 9 bats were present through early April. On April 20, 1995, guano was found in the door hangar slots at Buildings 1600, 1604, and 1635. Anabat™ monitoring was conducted at the stormwater retention pond near the control tower on 6 occasions between March 22, 1995 and February 13, 1996. Only low levels of Mexican free-tailed bat activity were recorded. Mexican free-tailed bats were the only species recorded near the Flightline, although on September 28, 1995, low *Myotis* sp. activity was detected by an Anabat™ positioned at Contractor's Hill.

Leuhman Ridge and Vicinity. The Leuhman Ridge and Vicinity was surveyed for a total of 23 nights, and 15 diurnal observations were conducted (Figure 3). All accessible buildings were surveyed for bats or guano. Bats or guano were discovered in 14 buildings, most of them abandoned. The hangar-like buildings (8419, 8430, and 8431) had guano in the stairwells, and cleaning personnel reported seeing bats flying in the buildings at night. A night inspection of Building 8431 on July 22, 1995, confirmed an active night roost of California myotis, including a female nursing a volant (capable of flying) juvenile. A mummified female California myotis was found in Building 8419, and a live individual was observed day roosting in Building 8431 on April 2, 1996. The largest day roost for bats observed in all survey areas was located in Building 8668 and the associated tunnel leading to the abandoned test stand at area 1-115. During the summer months, this area also supports a maternity colony of 20 to 30 resident California myotis and scattered western pipistrelle which roost in the control tower section, the light fixtures, and other crevices. The building is also used as a night roost by both species. Two abandoned buildings (8020 and 8025) located at the granite hills west of Leuhman Ridge serve as night roosts for California myotis and possibly the small-footed myotis. California myotis were captured in both buildings. On March 31, 1996, several bats with distinctive facial masks, a prominent feature of the small-footed myotis, were observed in Building 8025. They eluded capture and positive identification was therefore not established. On December 1, 1995, Mexican free-tailed bat guano was found under several crevices in a boulder pile located approximately 1.5 kilometers northwest of the Downfall range control tower. No bats were observed in mine shafts located at Jackrabbit Hill, C-3, and west of the Downfall range control tower.

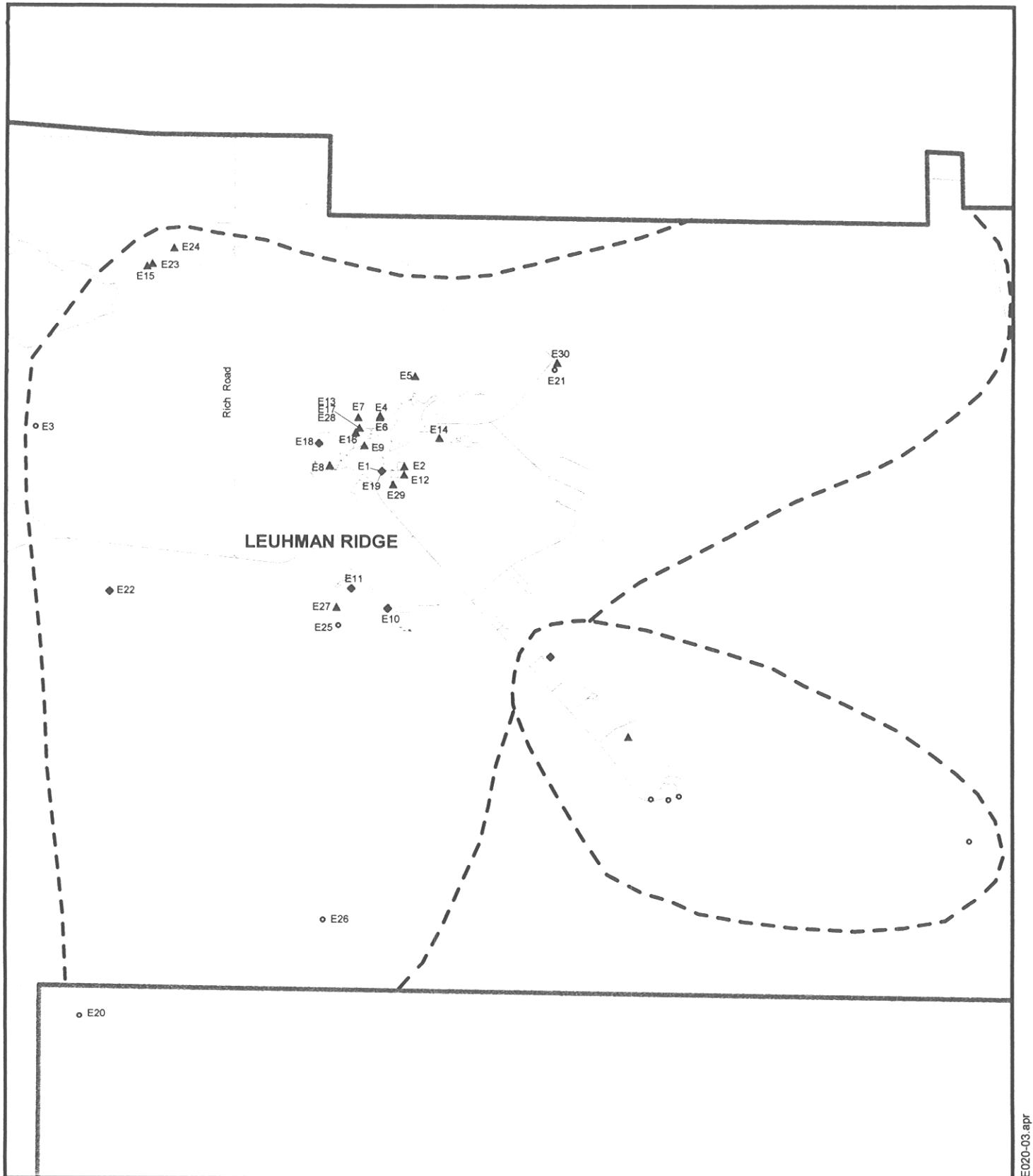


Flightline Survey Area

1000 0 1000 Meters



Figure 2



— Base Boundary / Study Area
- - - Survey Area Boundary

- ◆ Bats Detected
- ▲ Bats Observed
- Not Detected

2000 0 2000 Meters



**Leuhman Ridge and
Vicinity Survey Area**

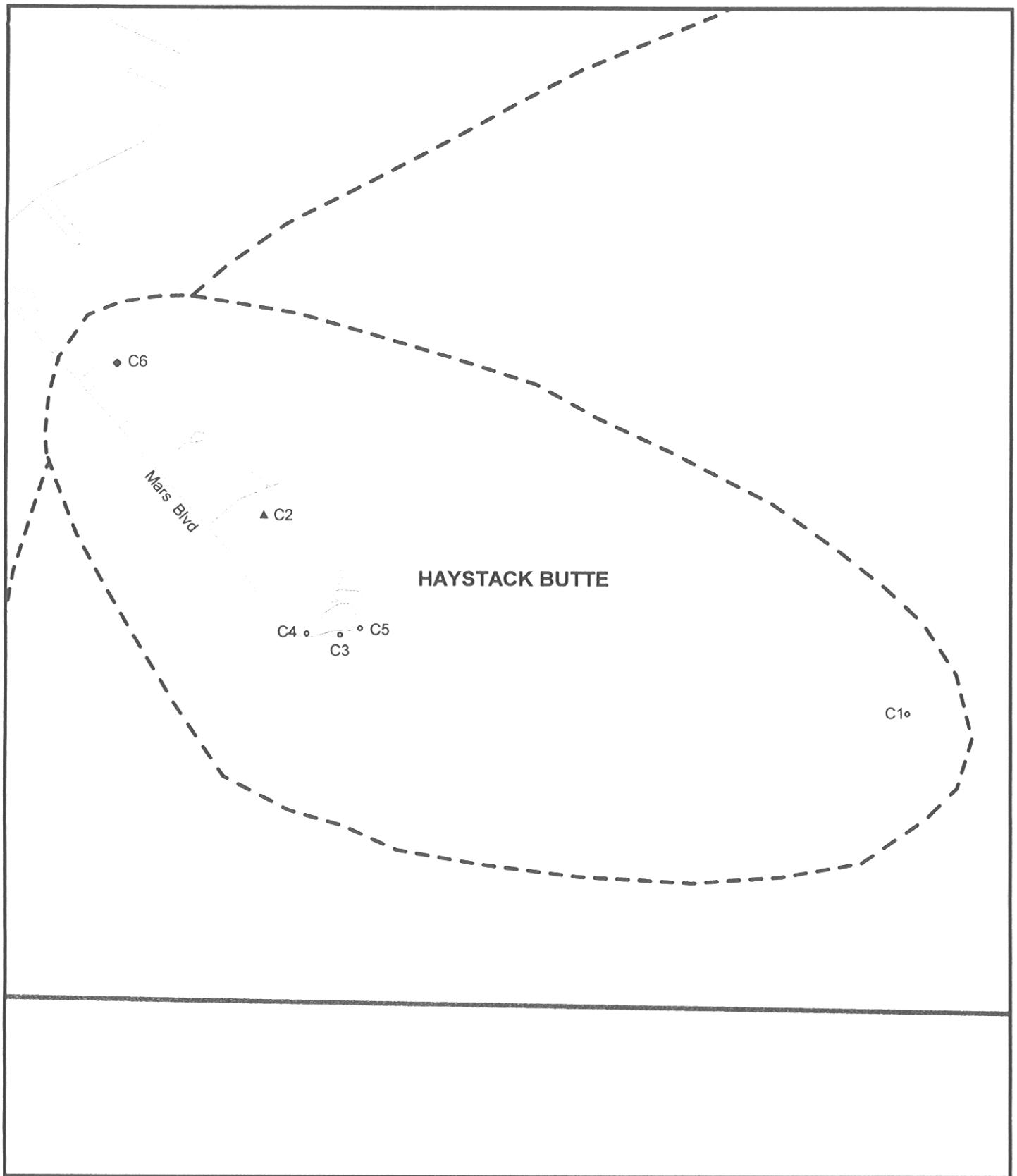
Figure 3

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The only bats captured in mist nets in the Phillips Laboratory and Leuhman Ridge Survey Area were taken at the ponds at Phillips Laboratory Fire Station, Areas 1-30 and 1-52, and Mary's Well pond. In 7 nights between June 1995 and March 1996, 5 California myotis individuals and 35 western pipistrelle individuals, including adult and juvenile males and females, were captured at the fire station ponds. One male California myotis was netted at Area 1-30 pond and a male western pipistrelle was netted at Mary's Well pond. Nets set at the pond near Building 8255, the Downfall range control tower, and sewage ponds failed to capture bats, although acoustic data showed high levels of bat activity. The bat activity was continuous during the warmer months over the water areas at Phillips Laboratory and Downfall. Both Mexican free-tailed bat- and *Myotis* sp.- like calls were identified from Anabat™ recordings.

Haystack Butte and Vicinity. The Haystack Butte was surveyed for 10, nights and 2 diurnal observations were conducted. Anabats™ were set below the rocky butte on all nights except for September 30, 1995 and February 11, 1996 (Figure 4). The winds around Haystack Butte were consistently stronger than in adjacent areas. Anabats™ typically detected low bat activity, and no bats were observed exiting from the rocks. However, continuous bat activity was recorded during favorable weather conditions each night surveyed between June 24, 1995 and March 31, 1996 over the Area 1-52 pond, located approximately 1.5 kilometers northwest of the butte. During cool weather, Mexican free-tailed bats were the most frequently recorded species, while the smaller Vespertilionids dominated the warmer months. Mist nets over the Area 1-52 pond captured 3 western pipistrelle and 8 California myotis, including adults and juveniles of both sexes, on June 24, 1995. Nets over the Area 1-42 pond failed to capture bats, although moderate bat activity was recorded.

Rosamond/Bissell Hills. The Rosamond and Bissell Hills were surveyed for a total of 10 nights, and 3 diurnal observations were conducted (Figure 5). Both *Myotis* sp. and Mexican free-tailed bat were detected, with most activity occurring shortly after sunset. Although crevices in the cliffs potentially provide roosting habitat, observations with night vision goggles did not reveal bats exiting from the rocks at Rosamond and Bissell Hills. A pallid bat, however, was observed with night vision goggles flying around a large granite outcrop on the northeast side of Rosamond Hills on August 20, 1995. Mexican free-tailed bat signals were common in the cooler months, and *Myotis* spp. on warmer evenings. The sonar activity was low to moderate throughout the Bissell and Rosamond Hills, with the maximum amount of activity of 90 passes recorded during a 2.5 hour period on April 23, 1995. The minimum number of passes recorded was one



E020-03.apr

— Base Boundary / Study Area
- - - Survey Area Boundary

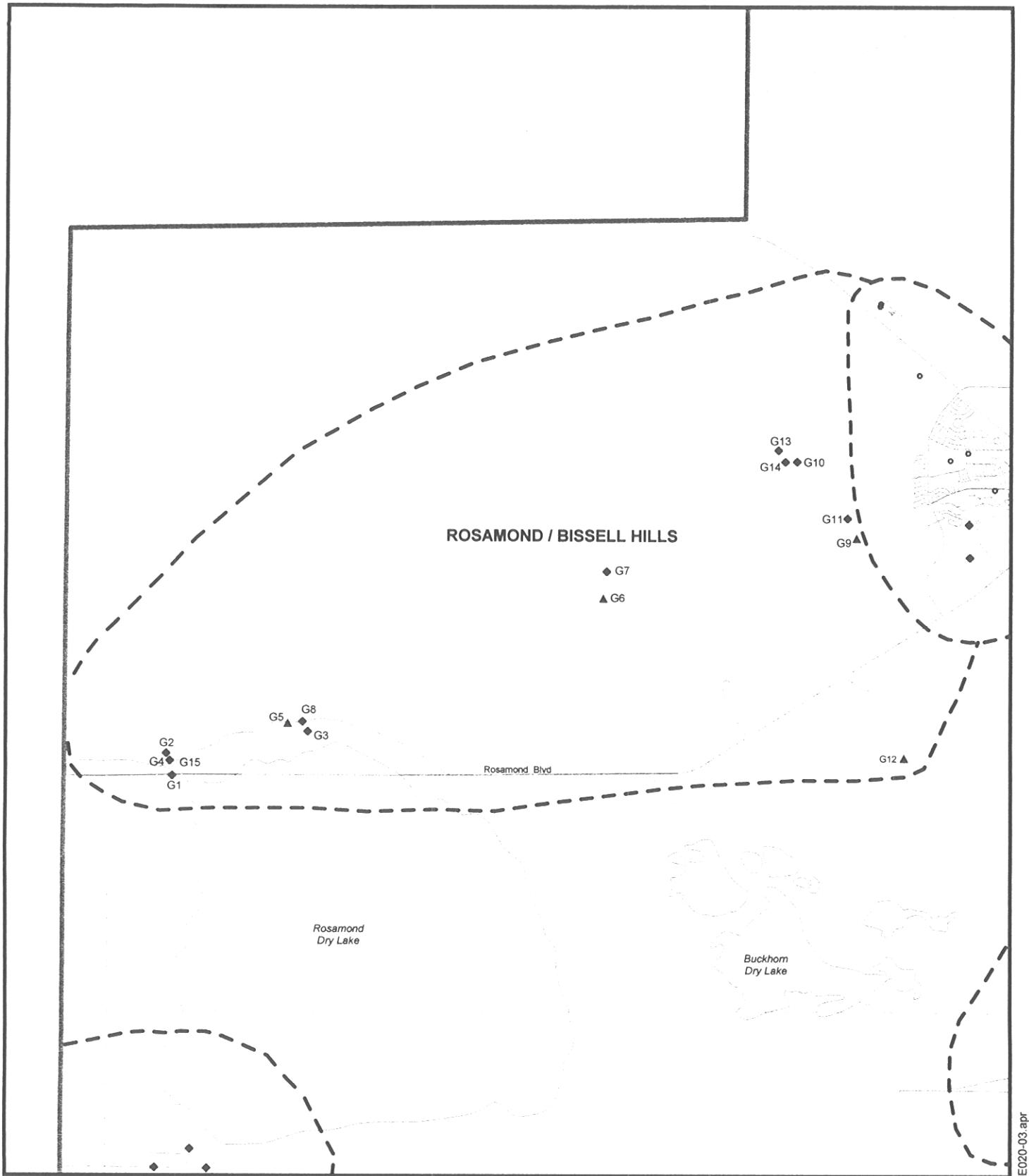
- ◆ Bats Detected
- ▲ Bats Observed
- Not Detected

1000 0 1000 Meters



Haystack Butte Survey Area

Figure 4



Rosamond / Bissell Hills Survey Area

2000 0 2000 Meters

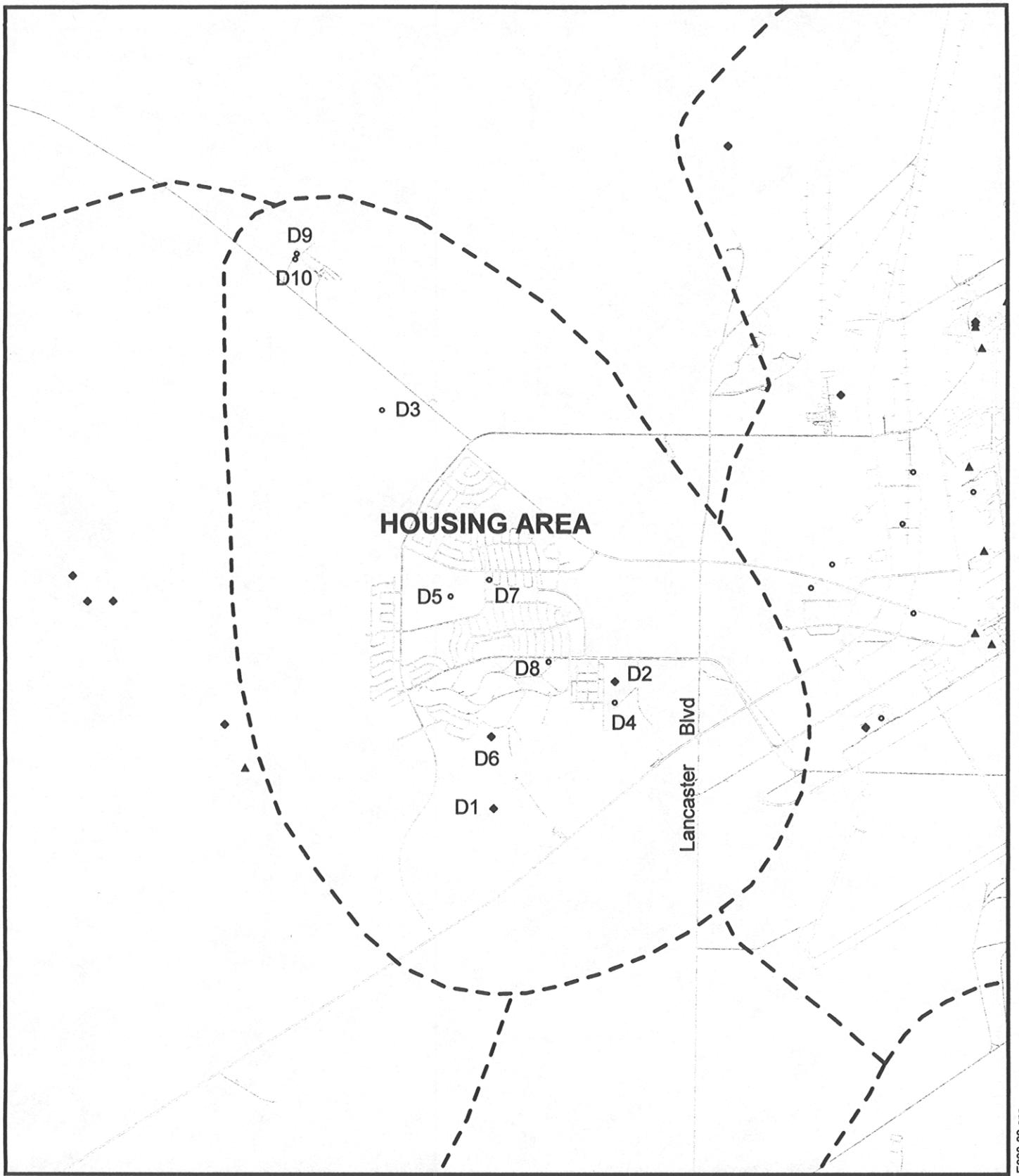


Figure 5

pass on a cold, rainy night on April 1, 1996. A Mexican free-tailed bat was observed roosting by Edwards AFB personnel at CV Camp M-9 (the building located nearest to Rosamond Hills) in May 1995 (Wixted, personal communication, 1995), and a scattering of *Myotis* sp. and Mexican free-tailed bat guano was confirmed on October 1, 1995 during a diurnal inspection. On August 20, 1995 *Myotis* sp. or western pipistrelle were observed flying at sunset and also recorded by an Anabat™ positioned at the southeast side of Red Hill.

Housing Area. The housing area was surveyed for 18 nights, and 1 diurnal observation was conducted (Figure 6). Bats were not captured at the housing area; however, Mexican free-tailed and *Myotis* sp. were recorded with activity ranging from low to moderate. During the coolest monitoring periods in the winter, only Mexican free-tailed bats were detected. Anabats™ positioned at FamCamp recorded low Mexican free-tailed and *Myotis* sp. activity. During 3 different sessions between September 1995 and March 1996, Anabats™ positioned by the Club Muroc pool detected low to moderate activity. In October 1995, a dead male hoary bat was found impaled on a cactus in the housing area.

Branch Park/South Base. The Branch Park/South Base area was surveyed for 15 nights, and 5 diurnal observations were conducted (Figure 7). Bat activity varied from none to high depending on the season and the weather. Only *Myotis* sp. was detected during the warmer months. However, both *Myotis* sp. and Mexican free-tailed bats were present in the winter. Bats were not captured in nets set across the small ephemeral ponds which form on the pan and dune system at South Base, although moderate levels of *Myotis* sp. activity and occasional single Mexican free-tailed bat passes were recorded throughout the entire survey. Bats were not detected at the South Base sewage ponds, and low *Myotis* sp. activity was recorded among the mesquite bushes at Scout Camp. Evidence of bats was found in abandoned Buildings 0261, 0502, 0503, 0545, and an associated unmarked building. On April 3, 1996, a single *Myotis* sp. was observed roosting in the unmarked building associated with Building 0545. Buildings 0502, 0503, and 0261 sheltered night-roosting *Myotis* sp. even during the warmer nights in winter 1995/1996. A maternity colony of at least 20 California myotis was observed on August 23, 1995 in Building 0503. On August 23, 1995, an adult female California myotis was captured in Building 0502.

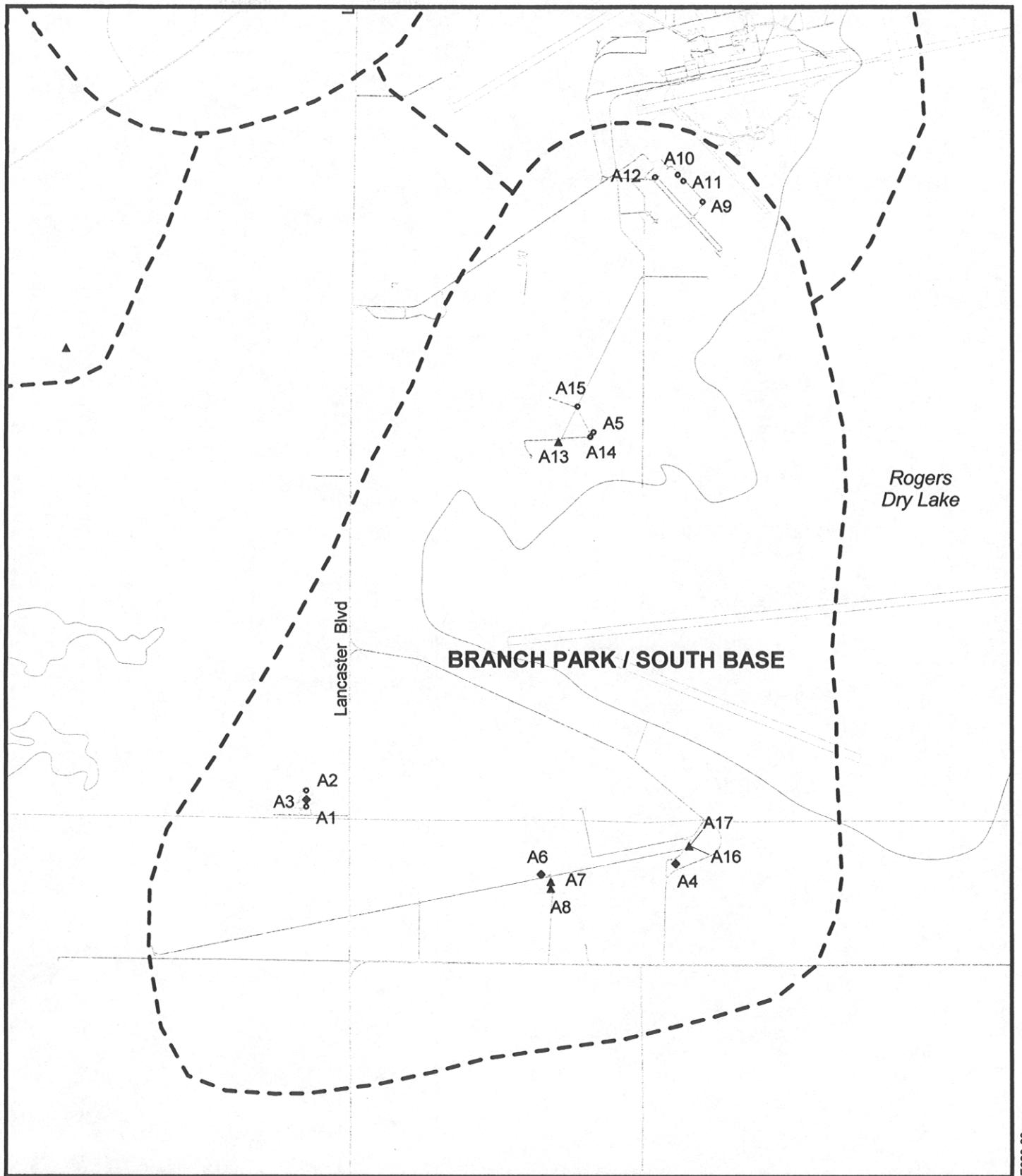


**Housing Area
Survey Area**

500 0 500 1000 Meters



Figure 6



Branch Park/South Base Survey Area

1000 0 1000 Meters



Figure 7

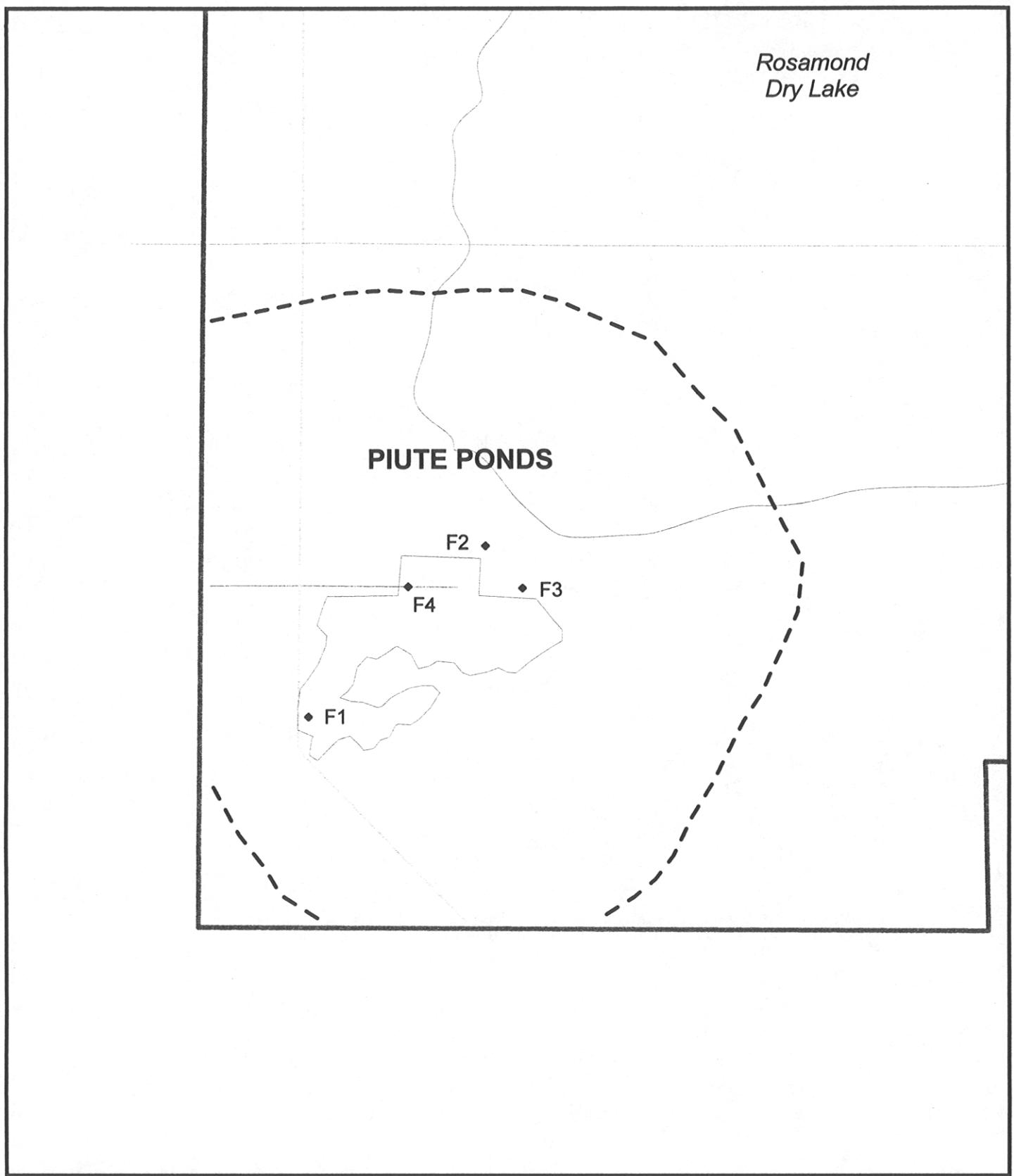
Piute Ponds. Piute Ponds were surveyed for a total of 18 nights (Figure 8). During calm warm weather, moderate Mexican free-tailed bat and *Myotis* sp. activity was recorded over the northern areas of Piute Ponds. The southern ponds, however, had low activity although insects appeared abundant at all locations. During the winter months, only Mexican free-tailed bats were detected over the ponds. Mist nets set at several locations around the edge of the ponds on multiple occasions failed to capture bats.

DISCUSSION

Basic habitat requirements for bats are diurnal retreats, nocturnal foraging areas, and for some species, available water sources. Bats can day roost in crevices associated with buildings, bridges, rocks, cliffs, mines, and trees; in hollow areas associated with caves, mines, and buildings; and among foliage or on tree trunks. During the warmer months, bats may congregate between foraging periods in night roosts where they deposit guano. The night roosts are usually near foraging areas. Some smaller species, such as *Myotis* spp. and western pipistrelles, require foraging areas close to day roosts, while Mexican free-tailed bats may travel 40 kilometers between day roosts and feeding sites. Seasonally, bats will change areas where they roost and forage. Migratory species, such as Mexican free-tailed bats and hoary bats, are most frequently encountered in the desert during spring and fall migrations. Many Vespertilionids hibernate during the winter, where the length of hibernation is determined by the duration of cold weather. Actual hibernation sites of most species are difficult to determine.

An initial search of literature and museum records revealed a paucity of specimens on Edwards AFB. This survey, however, confirmed the presence of five species of bats, at least two of which also breed on Edwards AFB. A sixth species, the small-footed myotis, was possibly sighted, but not confirmed during this survey. One other species, the western mastiff bat, was documented on the base by Environmental Management prior to this survey. Several other species may occur on Edwards AFB, but were not detected during the current study (Barbour and Davis 1969; Hall 1981) (Table 3).

The western pipistrelle is a solitary crevice-roosting species found throughout the desert, and is frequently captured over isolated water sources. This species was captured in mist nets over ponds near Leuhman Ridge, but probably also occurs near rocky areas on the base. Although most activity is concentrated during the warmer months, western pipistrelles can be observed foraging even during daylight hours during mild winter temperatures. The echolocation signals of this species cannot be differentiated from those of



E020-03.apr

Piute Ponds Survey Area

500 0 500 1000 Meters



Figure 8

Myotis spp. on the Anabat™ recordings, and therefore, were probably detected in most of the survey areas with the possible exception of the Flightline.

Table 3

Bat Species Confirmed or Potentially Occurring on Edwards Air Force Base

Scientific Name	Common Name	Probability of Occurrence	USFWS Status	CDFG Status
VESPERTILIONIDAE	Plain-nosed bats			
<i>Myotis yumanensis</i>	Yuma myotis	H	FSC (C2)	-
<i>Myotis californicus*</i>	California myotis	C	-	-
<i>Myotis ciliolabrum (= leibii)</i>	Small-footed myotis	H	FSC (C2)	-
<i>Myotis volans</i>	Hairy-winged myotis	L	FSC (C2)	-
<i>Lasionycteris noctivagans</i>	Silver-haired bat	H	-	-
<i>Pipistrellus hesperus*</i>	Western pipistrelle	C	-	-
<i>Eptesicus fuscus</i>	Big brown bat	L	-	-
<i>Lasiurus blossevillii (= borealis)</i>	Red bat	M	-	-
<i>Lasiurus cinereus*</i>	Hoary bat	C	-	-
<i>Eudermma maculatum</i>	Spotted bat	M	FSC (C2)	CSC
<i>Corynorhinus (Plecotus) townsendii</i>	Townsend's big-eared	L	FSC (C2)	CSC
<i>Antrozous pallidus*</i>	Pallid bat	C	-	CSC
MOLOSSIDAE	Free-tailed bats			
<i>Tadarida brasiliensis*</i>	Mexican free-tailed bat	C	-	-
<i>Eumops perotis</i>	Western mastiff bat	C	FSC (C2)	CSC

Notes: USFWS = U.S. Fish and Wildlife Service

CDFG = California Department of Fish and Game

CSC = California Species of Concern

FSC = Federal Species of Concern

C2 = Recent Category 2 Candidate

Probability of occurrence at EAFB

H=high M=medium L=low C=Confirmed

*Bats detected during current survey

The California myotis is also found throughout the California desert and could therefore occur in all of the survey areas. This species roosts alone or in relatively small colonies (Bogan 1973; Simpson 1993). Maternity and night roosts were discovered in abandoned buildings at Phillips Laboratory and South Base, and males, juveniles, and reproductive females were captured in mist nets over ponds near Phillips Laboratory. Echolocation signals attributable to *Myotis* sp. or western pipistrelle were detected in most

areas, and were more common during the warm months. During cold weather or high winds, the bats enter torpor. During warm periods in the winter, the bats may arouse from hibernation and forage.

The small-footed myotis closely resembles the California myotis in appearance and habitat preferences (Bogan 1974). Even in the hand they may be difficult to distinguish. An examination of the skull is the best diagnostic feature. Where the species are sympatric, the small-footed myotis typically has a darker facial mask, longer thumbs, and a cranium that slopes more gently from the rostrum than that of the California myotis. The closest geographic record for the small-footed myotis is from Willow Springs which is located approximately 25 kilometers from the west boundary of Edwards AFB. However, several individuals appearing to have darker facial masks were observed on the base night roosting in abandoned Building 8025, but the only bats captured were confirmed California myotis. Skeletons of mummified *Myotis* sp. from the base were sent to experts at the University of New Mexico. Bogan (personal communication, 1996) identified them as California myotis, although several skull characteristics resembled the small-footed myotis. The California State University Long Beach museum specimen of small-footed myotis collected from Willow Springs could be inspected to verify identification.

In addition to the California myotis, the pallid bat could also breed on the Edwards AFB. Environmental Management records indicate that a pallid bat was removed from a jet engine by base personnel prior to this study. Although this individual could have originated from offbase, a pallid bat in flight near a rocky outcrop at Rosamond Hills was confirmed during this study. This species roosts in crevices in rocks, buildings, mines, and bridges; and will form maternity colonies of 10 to 100 individuals, while males will usually roost singly (Orr 1954; Hermanson and O'Shea 1983; Vaughan and O'Shea 1976). Night roosts are often in exposed areas located in buildings and mines. Such habitat exists throughout Edwards AFB; however, foraging remains nor the distinctive guano of the pallid bat were not discovered in any of the surveyed buildings. Additionally, the characteristic communication signal of this species was not identified (Brown 1976).

The Mexican free-tailed bat, a Molossidae, has been previously identified by Environmental Management to occur on Edwards AFB and were the most frequently heard species during this study. Mexican free-tailed bats seasonally migrate over 1,600 kilometers, although movements of individual populations in the California desert are not thoroughly documented (Wilkins 1989). During migration, the Mexican free-tailed bat may temporarily roost in structures and buildings, as well as crevices in cliffs and boulders. This may account for their presence in the hangars on the base, especially during the fall. In the fall, doors are

frequently left open until late evenings, inviting bats to enter the hangar. They are consequently trapped once the doors are closed. The only permanent roost on the base was discovered in Building 4826, where bats were observed roosting in late fall through early spring. Fresh guano was also typically found beneath the crevice of Building 4826 during summer. Molossids do not enter deep torpor in the winter, and are always active at night, except during extremely cold temperatures. They may forage hundreds of meters above ground (McCracken, 1996) and can be detected by their relatively low-frequency echolocation signals.

Another Molossid, the western mastiff bat, was documented by Environmental Management to occur on the base but was not detected during this study. It is capable of traveling over long distances both nightly and seasonally and its distinctive human-audible sonar pulses are heard year-round in coastal Southern California. They have been heard occasionally during surveys at Naval Air Weapons Station (NAWS) China Lake, Ft. Irwin, and the Panamint Valley, as well as in the Bakersfield region. They prefer to roost in crevices in large granite boulders cliffs, such as those found at Leuhman Ridge and Red Hill, and can fly in a 75-kilometers radius per night while foraging (Krutzsch 1948; Vaughan, 1959). This species is expected to travel over Edwards AFB during migration.

The hoary bat also travels long distances during migration, and will typically seek temporary shelter in trees (Vaughan and Krutzsch 1954). Most records for this species in Southern California occur in the spring and fall. The male hoary bat specimen found in the housing area in October 1995 was most likely in transit. Since Edwards AFB potentially occurs within migration corridors, additional bat sightings are expected to occur in the future.

Species potentially occurring on the base, but not identified from past records or this survey, include the hairy-winged myotis (*Myotis volans*), silver-haired bat (*Lasionycteris noctivagans*), red bat (*Lasiurus blossevillii*), big brown bat, Yuma myotis (*Myotis yumanensis*), Townsend's big-eared bat, and spotted bat.

The hairy-winged myotis migrates along the eastern side of the Sierra Nevada Mountains in the spring and fall, and could occur at Edwards AFB during this period. Pregnant hairy-winged myotis have been captured at NAWS China Lake and Owens Lake during the spring. Other potential migratory species are the silver-haired and red bats, although their occurrence is rare in desert areas.

Big brown bats were not confirmed during this survey. This species typically roosts in buildings (often in proximity to human activity), but also lives in rock crevices and trees. They occur in almost every habitat

in the 48 contiguous states, where they consume a wide variety of prey. Because Edwards AFB provides potential habitat for this species, the big brown bat is likely to be observed in the future. Another potential resident species is the Yuma myotis, which is frequently observed flying low over water sources where it forages on mosquitoes and aquatic insects. Bats exhibiting this foraging behavior were not observed during the current survey. Yuma myotis roosts occur generally close to foraging areas, such as in buildings, bridges and dams, and may contain hundreds of individuals, especially during the maternity season. The flume below Little Rock Dam, located approximately 25 kilometers from the south boundary of Edwards AFB, shelters a large colony of Yuma myotis during the warmer months. Although adequate foraging areas, such as Piute, Branch Park, and sewage ponds exist on the base, the lack of adequate roosting habitat in proximity to these areas may explain their absence.

The lack of preferred roosting habitat may also account for the absence of Townsend's big-eared bat. This species typically roosts in caves or cave-like structures such as mines and some buildings with suitable temperatures (Kunz and Martin 1982; Pierson and Rainey 1994). With the exception of areas in some of the abandoned test stands at Leuhman Ridge, potential diurnal shelters or its characteristic guano were not discovered during this survey. Although this species emits low intensity echolocation signals which are difficult to detect, and is not commonly captured in mist nets, it may be observed on the base in the future.

The spotted bat could also occasionally occur on the base. Environmental Management records indicate a spotted bat sighting at Red Rock Canyon which is located approximately 45 kilometers north of Edwards AFB. Although previously rare in museum records (Handley 1959), this species is now being captured in mist nets over meadows in the Sierra Nevada range. The spotted bat can also be confirmed by distinctive audible echolocation signals. This species, however, was not detected during this survey. The preferred roosting habitat for the spotted bat is in high cliff faces. The south side of Red Hill is, therefore, possible habitat, although it may be too close to human activity.

The relatively limited distribution of bat fauna observed during this survey could be due to several different factors. For some species, such as Townsend's big-eared bat and Yuma myotis, appropriate roosting habitat may be a limiting factor. The predominant winds at Edwards AFB may affect aerial insect availability, which is especially critical to bats in the spring prior to their maternity season.

The results of this study provide baseline data for the AFFTC, Edwards AFB Integrated Natural Resources Management Plan. The following management strategies are recommended to prevent impacts to bats and their habitat while preserving the integrity of the Base mission.

1. Immediately prior to the demolition or renovation of buildings at Edwards AFB, a survey should be conducted for bats. If bats are discovered, buildings should not be demolished during hibernation or maternity.
2. Abandoned buildings with documented bat roosts should be preserved if possible. Barriers should be installed to restrict entry by humans, but allow bat access.
3. The erection of approved "bat boxes" near Piute Ponds may increase bat use of the area by providing closer roosting habitat.
4. If Mexican free-tailed bats become a problem in the hangars on the Flightline, the hangar doors should be kept closed at night, especially during the migratory periods. In general the migratory periods are March and October.
5. Conduct further studies for those species (Yuma myotis, hairy-winged myotis, spotted bat, and Townsend's big-eared bat) that have not been confirmed as present during this study but could potentially occur on Edwards AFB.

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