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Survey Results for the Arroyo Toad (*Bufo californicus*) in the San Bernardino National Forest, 2001

Final Report

Arroyo Toad Metamorph, Little Horsethief Canyon

Prepared for:

U.S. Department of Agriculture
U.S. Forest Service
Steve Loe

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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INTRODUCTION

The arroyo toad (*Bufo californicus*) had historic populations throughout many of the river and river wash systems in Southern California (U.S. Fish and Wildlife Service, 1999; Jennings and Hayes, 1994; Cunningham, 1961). For breeding, this species has specific habitat requirements consisting of sandy low gradient open wash habitat with slow moving or pooling water. Historically, these sandy washes were abundant in the foothills and lowland regions of Southern California. Urban development and riparian modification (water diversion, impoundment, channelization) have destroyed much of this habitat. Because of this habitat loss and due to its decline throughout much of its original range this species was designated a Federal Endangered Species in 1994 (U.S. Fish and Wildlife Service, 1999).

In the San Bernardino National Forest, the US Forest Service and various contractors have monitored the arroyo toad for several years (Beaman et al, 1995; Brown et al, 2001). In 2000, the US Geological Survey in conjunction with the USFS began monitoring several known populations of the arroyo toad and examined other stream systems for suitable habitat and for presence of the arroyo toad at these new study sites. These surveys continued in 2001 at many of the same study sites as well as some previously unexamined reaches of stream. Summaries of the 2001 surveys are presented in tables 1 and 2 (including survey dates, coordinates, species observations and notes). Arroyo toad observations are summarized in table 3, including demographics and coordinates of the individuals. Figure 1 contains a regional map of the general locations of the survey reaches. Detailed maps of individual survey reaches and site photos are included as figures 2a through 12b.

METHODS

Each stream or river system was examined to determine the reach of suitable habitat for the arroyo toad, including both riparian and upland features

prior to conducting surveys for arroyo toads. Habitat suitability surveys were conducted in accordance with US Fish and Wildlife standards at each study site (U.S. Fish and Wildlife Service, 1999). Representative photos of each study site were taken. Nighttime surveys were conducted for arroyo toads following USFS and USFWS protocols (U.S. Fish and Wildlife Service, 1999b). The presence of other vertebrates observed within the survey reach was also recorded. Arroyo toad locations and start and end points were recorded by GPS for each survey reach. Points of interest, including possible breeding pools, beaver dams, stream obstructions or other unique features, were recorded by GPS and photographed for seasonal and annual comparisons. Because of the remote and unknown nature of some of the study sites, relatively more effort was expended investigating the reaches for suitable habitat (including Whitewater and San Jacinto River). The results of these surveys are presented by study site. Representative specimens of arroyo toads and other vertebrate species were photographed.

RESULTS AND DISCUSSION

Twelve study sites were examined in the San Bernardino National Forest. Arroyo toads were found at five study sites. In total, 42 adult arroyo toads were individually recorded. In addition, at Little Horsethief Canyon (see Fig. 7), several arroyo toads were heard calling and four arroyo toad metamorphs were observed. Larval arroyo toads were observed at two of the study sites (Little Horsethief Canyon and Mojave Forks Dam, see Fig. 7 and 9a). No arroyo toads were heard calling where adults were not visually observed.

A summary of the 2001 surveys including survey dates, arroyo toad observations and other species observations is presented in Table 1. Coordinates for the survey sites are included in Table 2. A summary of arroyo toad observations, including coordinates and morphometrics, is included as Table 3.

San Bernardino National Forest (see Fig. 1)

Within the San Bernardino National Forest, the study sites were spread throughout three mountain ranges: the San Gabriel, San Bernardino and San Jacinto Mountains. Arroyo Toads were observed in the San Bernardino and San Jacinto Mountain Ranges at the following study sites: Bautista Canyon, Deep Creek Hot Springs, Grass Valley, Little Horsethief Canyon and Mojave Forks Dam and incidentally observed in Summit Valley. Descriptions of the study sites including visible disturbances and threats are listed below. Referenced figures include maps of each study site including arroyo toad locations where observed, aerial photographs of study sites and photographs of points of interest. Photos of representative herpetofauna observed at the study sites are included as Appendix A.

Bautista Canyon (see Fig. 2a and 2b)

Survey Results and Comments

The most downstream third of the Bautista Canyon survey site, which begins at the USFS boundary line and heads south (upstream) to Hixon Trail was dry during the 2000 surveys, and was subsequently not surveyed in 2000. In 2001, water persisted for approximately 0.2 miles below Hixon Trail. This area was surveyed and one arroyo toad was observed in this section. The portion of the reach below this has small boulders present in sandy alluvium along with coastal sage scrub interspersed with cottonwoods (*Populus* spp.) and mulefat (*Baccharis* spp.) and thus may support arroyo toads in relatively wet years.

On the first survey (5/16/01), seven arroyo toads were observed including four individuals that were found on the roadway (Fig. 2a). In addition to these individuals, several western toads (*B. boreas*), Pacific treefrogs (*Hyla regilla*), a western spadefoot toad (*Spea hammondii*) and a banded gecko (*Coleonyx variegatus*) were observed at the study site. Five arroyo toads were observed on the second visit (5/31/01) within the stream channel, none being observed on the roadway. On 6/1/01, a road riding survey was undertaken to help assess arroyo toad utilization of the reach of highway adjacent to this reach of Bautista Creek,

three arroyo toads and one red diamond rattlesnake (*Crotalus ruber*), were observed on the roadway (Fig. 2a). The third survey (7/10/2001) produced no arroyo toads. Throughout all the surveys, no calling arroyo toads or arroyo toad larvae were observed. Focused surveys should be undertaken to determine location and timing of breeding activities. This reach of Bautista Canyon consists of low gradient sandy streambed with slow moving water suitable for arroyo toads.

Visible Disturbances/Threats

Amphibian mortality due to traffic may present a problem in Bautista Canyon as Bautista Canyon Road parallels the creek bed and at several locations comes within 50 meters. Incidental to conducting the 2001 surveys, several Arroyo Toads were observed on the nearby roadway while traveling to and from the study site (four of which were observed on the roadway in the vicinity of Bautista Spring). Hixon Trail, which intersects Bautista Creek approximately 1 km south of the forest boundary, supports off highway vehicles and provides easy access for such vehicles to the creek. Although no vehicles were observed on Hixon Trail during these surveys, fresh tire tracks were observed.

Cajon Wash and Lone Pine Valley (see Fig. 3a-3c)

Survey Results and Comments

Even with the disturbances, the habitat in Cajon wash is in very good health. The vegetation is for the most part intact, with minimal incidences of non-native plants. The stream has no sign of invasive species; mosquito fish, sunfish, crayfish, bullfrogs and other common invasive species appear to be absent from the drainage. Pacific treefrogs (*Hyla regilla*), California treefrogs (*H. cadaverina*), Western toads (*Bufo boreas*) and Speckled Dace (*Rhinichthys osculus*) are abundant throughout the wash. Much of the stretch is sandy/cobble wash with a moderate gradient, the lowest gradients being at the southern

regions of the wash. The region of the wash near and above Blue Cut and in the vicinity of the confluence with Lone Pine Valley appear to have some of the best habitat with relatively more sandy banks and shallow pools and slower moving water than elsewhere. No arroyo toads were observed during the 2001 surveys in Cajon Wash and Lone Pine Valley. The reach of Cajon Wash from Cajon Campground to Keenbrook and Lone Pine Valley from the railroad crossing to the confluence with Cajon Wash contain moderate to low gradient sandy streambeds with several shallow and slow moving pools suitable for arroyo toads. The upper region of Cajon Wash, from the confluence with Crowder Canyon to Cajon Campground is in general steeper and narrower with occasional sandy pools and sections of sandy streambed of low gradient.

Visible Disturbances/Threats

The disturbances and threats to the Cajon Wash and Lone Pine Valley are numerous and significant. The region is bisected by a railroad, which then parallels Cajon Wash, and multiple roadways pass through the region as well (figures 3a and 3b). There are impacts from recreational usage including off highway vehicles in the lower sections of the Cajon Wash (below Blue Cut, fig. 3b) and Lone Pine Valley above the railroad culvert. Each visit fresh tire tracks were observed in the wash, and several people were encountered during the surveys. There is heavy visitation to the region of the wash near Swarthout Canyon Rd., mostly hiking, bathing and gold-panning. People often modify the stream channel in order to create larger and deeper pools for bathing.

Cucamonga Creek (Fig. 4a and 4b)

Survey Results and Comments

Cucamonga Creek was surveyed from the Forest Service property boundary to approximately 0.6 miles upstream. This reach of the stream consists of moderate to low gradient sandy wash strewn with medium to large boulders and open canopy. Water was flowing (though underground at some points) throughout the surveys, indicating resources substantial enough to

support arroyo toads. The upper reaches of Cucamonga Creek were not surveyed, and should be investigated thoroughly for presence of suitable habitat for the arroyo toad. During the surveys, western toads (*B. boreas*), pacific treefrogs (*H. regilla*) and arboreal salamanders (*Aneides lugubris*) were observed. No arroyo toads were observed during the 2001 surveys in Cucamonga Creek. This reach of Cucamonga Creek contains low gradient streambed with several shallow sandy pools suitable for arroyo toads.

Visible Disturbances/Threats

The principal threats to this reach of Cucamonga Creek consist of recreational usage. At the lower end of the survey reach is a cleared out area with a fire ring, litter, discarded building materials and signs of recent visitation. At several points along the survey reach, wood and plastic were placed in the stream channel to create large, deep pools, possibly for recreation. Below the reach, off of Forest Service land, residential developments abut the stream channel and Cucamonga Creek ultimately drains into a percolation basin and becomes channelized (Fig. 4b).

Deep Creek Hot Springs (Fig. 5a and 5b)

Survey Results and Comments

This season, with warmer summer temperatures and greater winter rainfall than the previous year, yielded quite suitable conditions for detecting the arroyo toad. A total of five adult arroyo toads were observed from two of the three visits. On the second visit (6/20/01), one female toad was observed approximately one-half mile upstream from the main hot springs bathing area (DC1 on Fig. 5a) near a large, shallow pool (Fig. 5b). On the third visit (7/18/01), four adult toads (three females and one undetermined) were observed in close proximity approximately one-quarter mile upstream from the main hot springs bathing area (DC5 on Figure 5a)

Deep Creek Hot Springs region is home to a large and unique faunal and floral assemblage combining coastal, desert and mountain influences. During

the surveys from 2001, two rarely encountered snakes were observed, the western blind snake (*Leptotyphlops humilis*) and the western patch nose snake (*Salvadora hexalepis*). As well, western toads (*B. boreas*) and California treefrogs (*H. cadaverina*) were observed this season. The surveys in 2000 also recorded western whiptails (*Cnemidophorus tigris*), Western Fence Lizards (*Sceloporus occidentalis*), zebra-tailed lizards (*Callisaurus draconoides*) side-blotched lizards (*Uta stansburiana*) and Pacific treefrogs (*H. regilla*). This reach of Deep Creek contains moderate to low gradient stream that later in the season (middle of June through August) contains shallow and slow moving sandy pools with large sand bars suitable for arroyo toads.

Visible Disturbances/Threats

The principal threats to the Deep Creek Hot Springs region consist primarily of recreational usage and non-native introductions. The immediate vicinity of the hot springs receives a great amount of visitation and bathing. However, access to this region involves a fair amount of hiking, either from Bowen Ranch, or from the Pacific Crest Trail. This ensures that much of the visitation is from relatively ecologically-minded individuals and occasional large groups on holiday weekends. Interpretive signage describing the toad, its habitat requirements, other anurans and brief history of the toad in the drainage has been placed at the trailhead in Bowen Ranch. Most people who were encountered during the surveys had observed the signage and were conscious of the Arroyo Toad and inquired further about them. However, continued high-intensity bathing could affect water-quality and impact shoreline habitat by stirring up silt and altering the sandy banks. All arroyo toads observed this season were from upstream of the main hot springs bathing area.

The other threat, introduced species, consists primarily of introduced catfish at the present time. Catfish typically are non-selective bottom feeders. The effects of catfish on amphibian populations in this region are unknown, but would probably affect only eggs and larvae. Upstream from Warm Springs (see Fig. 5a), trout are prevalent but appear to be restricted to the cooler waters.

Downstream, towards Mojave Forks dam, Sunfish and Bullfrogs (*Rana catesbeiana*) become prevalent. These more aggressive species may have a larger impact on the toad populations should they enter the Hot Springs/Warm Springs region. Barriers restricting sunfish and bullfrogs to the lower reaches of Deep Creek should be identified in order to better track the spread of these invasive species.

Grass Valley (Fig. 6a through 6c)

Survey Results and Comments

Grass Valley wash, primarily downstream from USFS land, merges with the West Fork of the Mojave River in Summit Valley northeast from Cedar Springs Dam (see figures 6a and 13). This reach of the Grass Valley has abundant sand bars and shallow sandy pools and a low gradient (see Fig. 6c). Traveling upstream to the USFS reach of Grass Valley, only a few sandy pools exist and the stream channel is narrower and has a steeper gradient. The first (most downstream) 0.2 miles of Grass Valley on forest service property does contain sandy shoulders and suitable upland habitat, though on all observations the stream channel has been narrow and not as sandy. On the first survey (5/8/01), one arroyo toad was observed freshly killed on HWY 173 upon completion of the survey (see Fig. 6b). No other arroyo toads were observed during any subsequent surveys.

While no arroyo toads have been observed on the Forest Service property, they do occur in the Grass Valley drainage. The Forest Service property also supports Pacific and California treefrogs (*H. regilla* and *H. cadaverina*) and is largely undisturbed with few exotics. As this survey reach does not contain habitat optimal for breeding, it should be examined during a high rainfall year to determine extent of habitat utilization by the arroyo toads in Grass Valley, particularly in the upland. There is potential for the lower part of this reach to be used as non-breeding habitat. Only the lower reach of Grass

Valley (within 0.2 miles of the USFS boundary) contained low gradient stream with sandy pools.

Visible Disturbances/Threats

The immediate threats to Grass Valley on USFS property appear minimal. Exotic trout were observed during the 2000 survey but were not observed in 2001. The Pacific Crest Trail passes through Grass Valley near the Forest Service Boundary, and while visitation was apparent, there appeared to be minimal disturbance to the surrounding habitat. The adjacent property is currently undeveloped which minimizes accessibility to the Forest Service property. Should this property be developed, visitation to the Forest Service property may be increased. Traffic along Highway 173 also impacts this population (Fig. 6b).

Little Horsethief Canyon (Fig. 7a and 7b)

Survey Results and Comments

During the first survey (5/10/01), several arroyo toads were observed. Measurements were recorded for 11 individuals and several toads were heard calling. At this point, the survey was ended to minimize disturbance to this population. During the second survey (5/30/01), five adults, two subadults and larvae were observed. During the third survey (6/21/01), four metamorphs were observed and the survey was ended to minimize impact. This reach of Little Horsethief Canyon appears to be in considerably excellent health with no observed exotics and an abundance of native amphibians, including Pacific treefrogs (*H. regilla*) and Western Toads (*B. boreas*) in addition to arroyo toads. This canyon drains to the east and joins Horsethief Canyon and flows into Summit Valley where it joins the West Fork of the Mojave River (see Figures 7b and 13). During high rainfall years, the north fork of Little Horsethief Canyon and the upper reaches of the southern fork should be further examined to determine extent of habitat utilized by this population of arroyo toads. Little Horsethief

Canyon contains low gradient sandy streambed with several sandbars and sandy pools with slow moving water suitable for arroyo toads.

Visible Disturbances/Threats

Threats and impacts to Little Horsethief Canyon appear minimal. Access to the downstream portion of the reach is restricted, and access to the upper portion of the reach is via the Pacific Crest Trail, which does not follow closely to the stream channel for a great distance. In between these access points, there is a small, faint, unmaintained trail that may be either historic or a game trail. During the course of the 2001 surveys, there was no visible sign of visitation to the study site.

During the 2001 survey season, a gravid arroyo toad was observed freshly killed on highway 138 in Horsethief Canyon (the upper region of Summit Valley) adjacent to Little Horsethief Canyon (See Fig. 7a). It could not be determined if this individual toad was from the population in nearby Little Horsethief Canyon, or from another population further downstream in Summit Valley. Highway 138 impacts arroyo toads in this region but it is undetermined if it impacts the arroyo toads from Little Horsethief Canyon.

Lytle Creek (Fig. 8)

Survey Results and Comments

The survey reach of Lytle Creek consists of moderate to low gradient river wash habitat, occasionally becoming narrow with boulder runs. However, much of the reach contained fast flowing water and substantial canopy cover. This reach becomes dry as it goes downstream, with only a few pools in the lower section of the reach during the surveys. Other reaches of Lytle Creek should be examined for habitat suitable for arroyo toads, including the North and Middle Forks of Lytle Creek. No arroyo toads were observed during the surveys. Observed species include California and Pacific Treefrogs (*H. cadaverina* and *H. regilla*) and the Monterey Ensatina (*Ensatina eschscholtzii*). During the surveys, most of Lytle Creek contained no sandy pools with slow moving water. The

South Fork of Lytle Creek from below Bonita Falls to the confluence with the Middle Fork of Lytle Creek contained low gradient streams with shallow sandy pools, but also contained trout.

Visible Disturbances/Threats

The principle impacts to Lytle Creek stem from recreation and nearby development. The town of Lytle Creek lies largely upstream to the survey reach. Lytle Creek also has easy access for recreation for the cities and residential areas downstream in San Bernardino and Riverside. These two influences combine to produce lots of litter and disturbance of the stream channel. People, for purposes of recreation, have created large pools that are too deep for arroyo toads. There is also a substantial amount of vehicle traffic along the length of the stream. The presence of exotic fishes such as trout may also pose a threat for amphibian larvae.

Mojave Forks Dam (Fig. 9a-9d)

Survey Results and Comments

The survey area of Mojave Forks Dam contains the confluence of the west fork of the Mojave River with Deep Creek (see Fig. 9a). This once expansive river wash has been greatly reduced by the construction of a dam to restrict water flow into Hesperia via the Mojave River (see Fig. 9c). Substantial reaches of wash exist both above and below the dam. Below the dam, the wash contains large shallow sandy pools with scattered stands of willows and desert cottonwoods. This reach receives the highest recreational usage with many bathers and campers with frequent off-road usage.

Above the dam, recreational usage is high but noticeably less than below the dam given a greater difficulty in accessing the upstream reach. However, due to extensive beaver activity, only a few sandy pools exist in the upper reach of this survey area. Upstream from the beaver ponds, the stream channel narrows and the stream gradient increases but still contains short reaches of

open sandy habitat (Fig. 9d). Invasive species are found throughout the upper and lower reaches of Mojave Forks Dam study site.

On the first survey visit (5/9/01), arroyo toad larvae and one adult were observed upstream of the dam in the west fork of the Mojave River (MFD1 through MFD4 on Figure 9a). On the third visit (6/19/01), one adult arroyo toad was observed in deep creek on the edge of one of the beaver ponds where there was a small patch of sandy shoreline. The region of Mojave Forks Dam contains low gradient sandy streambed with slow moving water. There are many sandy pools with exposed banks.

Visible Disturbances/Threats

Off-road usage, exotic bullfrogs and beavers are changing this stretch of habitat. Recreational usage of this area has tremendous impacts on the habitat. The region below the dam is an off highway vehicle playground, vehicles having been observed off road in the region below the dam on each visit (Fig. 9b). However, in contrast to the 2000 surveys, no vehicles were observed off road upstream from the dam (Fig. 9c).

There is also a large amount of litter deposited by recreational users. Management of the property downstream of the dam would be needed to minimize the impacts of recreational activity in the vicinity of the dam.

Other impacts include an abundance of invasive species including catfish, sunfish, bullfrogs and beavers. The habitat immediately upstream of the dam has been drastically altered by beavers, forming a series of large pools, some reaching over six feet in depth, and most without sandy or shallow banks. The number and size of these beaver ponds has grown since the previous year, reducing even further the amount of sandy banks and sand bars. Bullfrogs were observed throughout the reach. However, there still are some sandy banks and sand bars, and with active management, the habitat could be restored to be more suitable for arroyo toads.

San Gorgonio River (Fig. 10a and 10b)

Survey Results and Comments

San Gorgonio River was surveyed predominately in daytime to investigate potential habitat. Two daytime and two nighttime surveys were conducted. While there was suitable terrestrial habitat, there were very few pools with slow moving water that were suitable for breeding. Pacific and California treefrogs (*H. regilla* and *H. cadaverina*) were both observed in the survey reach indicating fairly good health and adequate conditions to support these amphibian species. While most of this effort was placed in examining the canyon for suitable habitat, there are still reaches that may provide more suitable habitat that should be investigated. As well, the survey reach should be reexamined under average or normal water conditions to better assess the amount of flow and extent of suitable breeding habitat in the canyon. No arroyo toads were observed. This reach of San Gorgonio River contained low gradient boulder strewn sandy streambed with numerous shallow sandy pools with slow moving water.

Visible Disturbances/Threats

The threats to this survey reach of the San Gorgonio River appear to be minimal, there being few signs of disturbance, limited litter and few apparent modifications to the immediate stream channel. A road with limited access follows the length of the survey reach and may be a limited threat to animals in the drainage (Fig. 10b).

San Jacinto River (Fig. 11)

Survey Results and Comments

This reach of the San Jacinto River consists mostly of moderate gradient, boulder-strewn wash with fast flowing water. The wash often becomes low gradient wash with slower water lower in the drainage, but there is an abundance of private property where the most suitable habitat is. Regions of potential habitat were identified, but access was limited because of adjacent private property between the roadways and the stream. The higher more accessible

habitat was thoroughly surveyed for suitable habitat, but the lower region of the wash, which is occluded with private property, still needs to be fully examined. Three day and one nighttime surveys were conducted. During these surveys, no pools suitable for arroyo toad breeding were observed, and no arroyo toads were observed.

Visible Disturbances/Threats

Threats to San Jacinto River include recreation and vehicular traffic. Highway 74 follows the San Jacinto River and supports moderate to heavy traffic between the Hemet area and Idyllwild and outlying areas. The roadway often passes within 50 meters of the stream channel and even crosses it at one point. The lower reach of the San Jacinto wash abuts private property and residential areas. Visitation from these areas is high and recreation within the region is persistent.

Whitewater Canyon (Fig. 12a and 12b)

Survey Results and Comments

Whitewater Canyon contains over 11 miles of moderate to low gradient boulder-strewn river wash above the Whitewater Fish Hatchery. While much of this river contains large amounts of exotic fish, there are still areas of low flow with shallow pools without fish. California treefrogs (*H. cadaverina)* are still present in the wash and physically the wash habitat is still in good condition.

Upper regions of Middle Fork and North Fork of Whitewater Canyon were examined from helicopter and did not contain potential for the arroyo toad, though this could not be determined for the vicinity of the confluence of these forks and below this point. Access to much of the upper reaches of the wash is difficult and this region still needs to be examined for suitable habitat. Two daytime and one nighttime surveys were conducted. No pools suitable for arroyo toad breeding were observed, and no arroyo toads were observed.

Visible Disturbances/Threats

The major threat to Whitewater canyon is the trout fishery. Trout are abundant in the stream system and there is abundant recreation in the canyon. The trout may pose a substantial threat to arroyo toad recruitment as the may devour amphibian larvae. This is accompanied by recreation. The recreation consists primarily of hiking and fishing, which while still disturbing the habitat, is minimal.

SUMMARY

During the 2001 Arroyo Toad Surveys by USGS, arroyo toads were observed at five of the twelve study sites. Arroyo toads were observed in the months of May, June and July. The timing of the detectability of the arroyo toads appears to vary between sites. Most notable is the delayed timing of the Deep Creek population of arroyo toads. While arroyo toads were observed at five other localities in the SBNF during the month of May, the first detected arroyo toad from Deep Creek Hot Springs was from mid-June. Furthermore, the arroyo toads in Deep Creek Hot Springs became more detectable by mid-July.

The lower Mojave River populations appear to have the earliest timing as detected from the 2001 surveys. Larvae were present upstream from the Mojave Forks Dam in the West Fork of the Mojave River from early May. Adults were also detected during May in this location as well, with only one adult being detected in Mojave Forks Dam vicinity in the month of June.

The Little Horsethief Canyon population of arroyo toads appears to be timed in between the lower Mojave River populations and the populations higher in Deep Creek. During early May, arroyo toads in Little Horsethief Canyon were observed breeding. By the end of May, several adult arroyo toads were observed as well as some larvae. Metamorphic arroyo toads were observed at Little Horsethief Canyon by the middle of June.

The timing of the Bautista Canyon arroyo toads is unclear. Adult arroyo toads were observed in Bautista Canyon during the months of May and June, however no indication of breeding behavior or recruitment was observed. More

surveys from throughout the late winter and early spring are needed to determine the timing and location of breeding events in this population of arroyo toads.

The populations of arroyo toads in the Mojave River, Deep Creek Hot Springs, Little Horsethief Canyon and Bautista Canyon appear to be relatively substantial populations based on their detectability in 2001. Some segments of the Mojave River population appear to be impacted as lower detectability is correlated with disturbance and habitat conversion (OHV usage and beaver ponds) in specific localities. Other populations of arroyo toads in and near the SBNF (Cucamonga, Cajon Wash, Whitewater) are located in areas that appear to be more heavily impacted with less continuous overall suitable habitat than the areas where arroyo toads were observed in 2001. These less detectable populations should be further examined to determine their extent and future viability. Concurrently, the better documented populations and outlying habitat should be monitored and managed to determine and minimize impacts in order to maintain the persistence of the arroyo toad in the San Bernardino National Forest.

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Table 1. Summary of survey sites and surveys including observers, survey type, whether arroyo toads were observed, and other observed species.

Site	Survey Date	Observers	Survey Type	Arroyo Toads Found	Other Amphibians Found	Other Species Found/Notes
Little Horsethief	5/10/2001	Chris Brown, T'Shaka Toure	Night	Adults	*Hyla regilla*	
AT Observation At Site	5/30/2001	Chris Brown, Adam Backlin	Day and Night	Larvae and Adults	*Hyla regilla, Bufo boreas*	
	6/21/2001	Chris Brown, Kasey Yturibalde	Day and Night	Juveniles	*Bufo boreas*	
Deep Creek Hot Springs	5/9/2001	Chris Brown, T'Shaka Toure	Day and Night	none	*Hyla cadaverina*	
AT Observation At Site	6/20/2001	Chris Brown, Steve Carrol	Day and Night	One Adult	*Bufo boreas*	*Leptotyphlops humilis, Salvadora hexalepis*
	7/18/2001	Steve Carrol, Liz Gallegos	Night	Adults	*Hyla cadaverina*	
Deep Creek Mojave Forks Dam	5/9/2001	Rob Lovich, Alan Hebbert	Night	none (Obs. near site)	*Rana catesbeiana*	Larvae & adult AT's obs. upstream in WF Mojave River
AT Observation At Site	5/18/2001	Rob Lovich	Night	none	*Bufo boreas, Hyla cadaverina*	
	6/19/2001	Chris Brown, Steve Carrol	Day and Night	1 Adult	*Rana catesbeiana*	
Grass Valley	5/8/2001	Chris Brown, T'Shaka Toure, Rob Lovich	Day and Night	none (1 obs. near site)	*Hyla regilla*	Adult AT found downstream from USFS property
AT Observation Near Site	5/18/2001	Rob Lovich	Night	none	*Hyla cadaverina*	
	6/19/2001	Chris Brown, Steve Carrol	Night	none	*Hyla regilla*	
Lone Pine Valley	1/25/2001	Chris Brown, Ed Ervin, Clark Mahrdt, Dave Goodwards	Day	none		
	5/7/2001	Chris Brown	Day and Night	none	*Hyla regilla, Hyla cadaverina*	
	6/18/2001	Chris Brown, Steve Carrol	Night	none	*Hyla regilla, Hyla cadaverina*	
Cajon Wash	1/25/2001	Chris Brown, Ed Ervin, Clark Mahrdt, Dave Goodwards	Day	none	*Hyla cadaverina*	*Rhinichthys osculus*
	5/7/2001	Chris Brown	Day and Night	none	*Hyla regilla, H. cadaverina*	
	6/18/2001	Chris Brown, Steve Carrol	Night	none	*Hyla regilla, H. cadaverina, Bufo boreas*	
	7/18/2001	Steve Carrol, Liz Gallegos	Night	none	*Hyla cadaverina, Bufo boreas*	
Lytle Creek	1/25/2001	Chris Brown, Ed Ervin, Clark Mahrdt, Dave Goodwards	Day	none	*Ensatina eschscholtzii*	
	5/10/2001	Rob Lovich	Day and Night	none	*Hyla regilla, H. cadaverina*	
	5/30/2001	Rob Lovich, Kim Lovich	Day and Night	none	*Hyla regilla, H. cadaverina*	
	6/12/2001	Kathie Meyer, T'Shaka Toure'	Day	none		*Crotaphytus Bicintores*
Cucamonga Creek	5/14/2001	Rob Lovich, Chris Rodriguez	Day and Night	none	*Bufo boreas, Aneides lugubris*	
	5/25/2001	Rob Lovich	Night	none	*Bufo boreas, Hyla regilla*	
	6/1/2001	Rob Lovich, Mike laea, Chris Rodriguez	Night	none	*Bufo boreas*	
Bautista Canyon	5/16/2001	Chris Brown, Nathan Moorhatch	Night	Adults	*Bufo boreas, Spea hammondii, Hyla regilla, H. cadaverin*	*Coleonyx variegatus*
AT Observation At Site	5/31/2001	Chris Brown, Anne Poopatanapong, Raul Rodriguez	Night	Adults	*Bufo boreas*	
	6/1/2001	Lisa Lyren, Steve Carroll	Night	Adults		*Crotalus ruber*
	7/10/2001	Lisa Lyren, Anne Poopatanapong, Greta Turschak	Night	none	*Hyla regilla*	
Whitewater Canyon	5/15/2001	Robb Hirsch, Adam Backlin	Day and Night	none		Rainbow Trout
	5/22/2001	Robb Hirsch, Adam Backlin	Day	none	*Hyla cadaverina*	*Phrynosoma coronatum, Crotalus mitchelli*
San Gorgonio River	5/15/2001	Rob Lovich, Curtis Rehling	Day and Night	none	*Hyla regilla, H. cadaverina*	
	7/30/2001	Steve Carrol, Chris Haas	Day and Night	none	*Hyla regilla, H. cadaverina*	
San Jacinto River	6/1/2001	Lisa Lyren, Steve Carrol	Day and Night	none		
	6/29/2001	Lisa Lyren, Chris Haas	Day	none		
	7/9/2001	Greta Turschak, Chris Haas	Day	none	*Hyla cadaverina*	

Table 2. Survey coordinates for each survey in decimal degrees in WGS 84.

Site	Survey Date	Start Lat	Start Long	End Lat	End Long
Little Horsethief	5/10/2001	34.31258	117.39841	34.31167	117.41583
AT Observation At Site	5/30/2001				
	6/21/2001				
Deep Creek Hot Springs	5/9/2001	34.34126	117.17334	34.34263	117.18028
AT Observation At Site	6/20/2001				
	7/18/2001				
Deep Creek Mojave Forks Dam	5/9/2001	34.33832	117.25828	34.3409	117.24222
AT Observation At Site	5/18/2001	34.34168	117.23752	34.33954	117.22446
	6/19/2001	34.34168	117.23752	34.33954	117.22446
Grass Valley *	5/8/2001	34.30389	117.25864	34.32562	117.2704
	5/18/2001				
	6/19/2001				
Lone Pine Valley	1/25/2001	34.27298	117.46853	34.26717	117.46441
	5/7/2001				
	6/18/2001				
Cajon Wash	1/25/2001	34.26415	117.46723	34.25248	117.46229
	5/7/2001				
	6/18/2001				
	7/18/2001				
Lytle Creek	1/25/2001	34.2302	117.48193	34.2119	117.45783
	5/10/2001	34.23241	117.50719	34.2119	117.45783
	5/30/2001				
	6/12/2001				
Cucamonga Creek	5/14/2001	34.17215	117.6322	34.1647	117.63675
	5/25/2001				
	6/1/2001				
Bautista Canyon	5/16/2001	33.64893	116.81544	33.67286	116.8339
AT Observation At Site	5/31/2001				
	6/1/2001				
	7/10/2001				
Whitewater Canyon	5/15/2001	33.9967	116.66023	34.0376	116.71725
	5/22/2001	34.06181667	116.818933	34.052333	116.8085167
San Gorgonio River	5/15/2001	34.0332	116.86028	34.01029	116.90576
	7/30/2001				
San Jacinto River	6/1/2001	33.73743	116.83378	33.70721	116.75725
	6/29/2001				
	7/9/2001				

* Grass Valley: No Arroyo Toads observed on USFS Lands. One Arroyo Toad observed downstream from USFS land approximately one mile in Grass Valley Creek.

Coordinates are Latitude and Longitude in Degree Decimal in WGS 84

Table 3. Arroyo Toad observations including measurements, age class, sex and coordinates in decimal degree in WGS 84.

Site	Survey Date	Observers	AT Lat	AT Long	Sex	Age	WtG	LnMm
Little Horsethief	5/10/2001	Chris Brown, T'Shaka Toure	34.3126	117.40649	F		50	58
			34.3126	117.40649	M	A		
			34.31279	117.40619	M	A	35	54
			34.31283	117.40608		A	56	58
			34.31299	117.4056	M	A	40	58
			34.31326	117.40492	F	A	39	50
			34.3145	117.40288	M	A	37	54
			34.31286	117.39986	M	A		
			34.31301	117.39895	F	A		
			34.31289	117.39867	F	A		
			34.31279	117.40619	F	A	56	66
	5/30/2001	Chris Brown, Adam Backlin	34.31283	117.40594		LARVAE		
			34.31397	117.40525	M	A	31	65
			34.31369	117.40381	M	A	42	73
			34.31459	117.40225	F	A	45	70
			34.31516	117.4017	F	A	43	70
			34.31339	117.40138		J	15	52
			34.31279	117.39926		J		
			34.31301	117.39922	F	A	44	70
	6/21/2001	Chris Brown, Kasey Yturibalde	34.31281	117.41237		Metamorph		
			34.31288	117.39918		Metamorph		
			34.31284	117.39907		Metamorph		
			34.31255	117.4068		Metamorph		
Horsethief Cyn. Incidental DOR	5/17/2001	Chris Brown	34.32394	117.40901	F	A		
Deep Creek Hot Springs	6/20/2001	Chris Brown, Steve Carrol	34.34307	117.17489	F	A	45	60
	7/18/2001	Steve Carrol, Liz Gallegos	34.3423	117.17764	F	A		70
			34.34228	117.17755	F	A		67
			34.34228	117.17755	F	A		73
			34.34229	117.17752		A		58
Deep Creek Mojave Forks Dam	5/9/2001	Rob Lovich, Alan Hebbert	34.33827	117.25378		LARVAE		
			34.34069	117.24702		LARVAE		
			34.34094	117.2453	M	A	25	57
			34.34011	117.24937		LARVAE		
	6/19/2001	Chris Brown, Steve Carrol	34.34242	117.22995	M	A	20	52
Grass Valley *	5/8/2001	Chris Brown, T'Shaka Toure	34.32575	117.27004	M	A		
Bautista Canyon	5/16/2001	Chris Brown (Nathan Moorhatch**)	33.67352	116.83512	F	A		
			33.66408	116.82904		A		
			33.66064	116.82157				
			33.66048	116.82106	M	A		
			33.66048	116.82106	F	A		
			33.65043	116.81722	F	A		
			33.65051	116.81754	M	A		
	5/31/2001	Chris Brown, Anne Poopatanapong and Raul Rodriguez	33.64947	116.81631	A	F		
			33.65045	116.81718	A	M		
			33.65265	116.81765	A	M		
			33.65973	116.82145	A	M		
			33.65973	116.82145	A	M		
	6/1/2001	Lisa Lyren, Steve Carroll	33.66062	116.82115				
			33.66042	116.82106				
			33.65286	116.81734				

* Grass Valley: No Arroyo Toads observed on USFS Lands. One Arroyo Toad observed downstream from USFS land approximately one mile in Grass Valley Creek.

** Nathan Moorhatch from AMEC participated for much of the survey.

Coordinates are Latitude and Longitude in Degree Decimal in WGS 84

Maps of Study Sites.

Starting and ending coordinates are given in Table 2.

Photos by Chris Brown, USGS

Figure 1. San Bernardino National Forest Study Sites. Regional map of the arroyo toad 2000 survey sites in the San Bernardino National Forest. Sites where arroyo toads were observed are highlighted yellow.

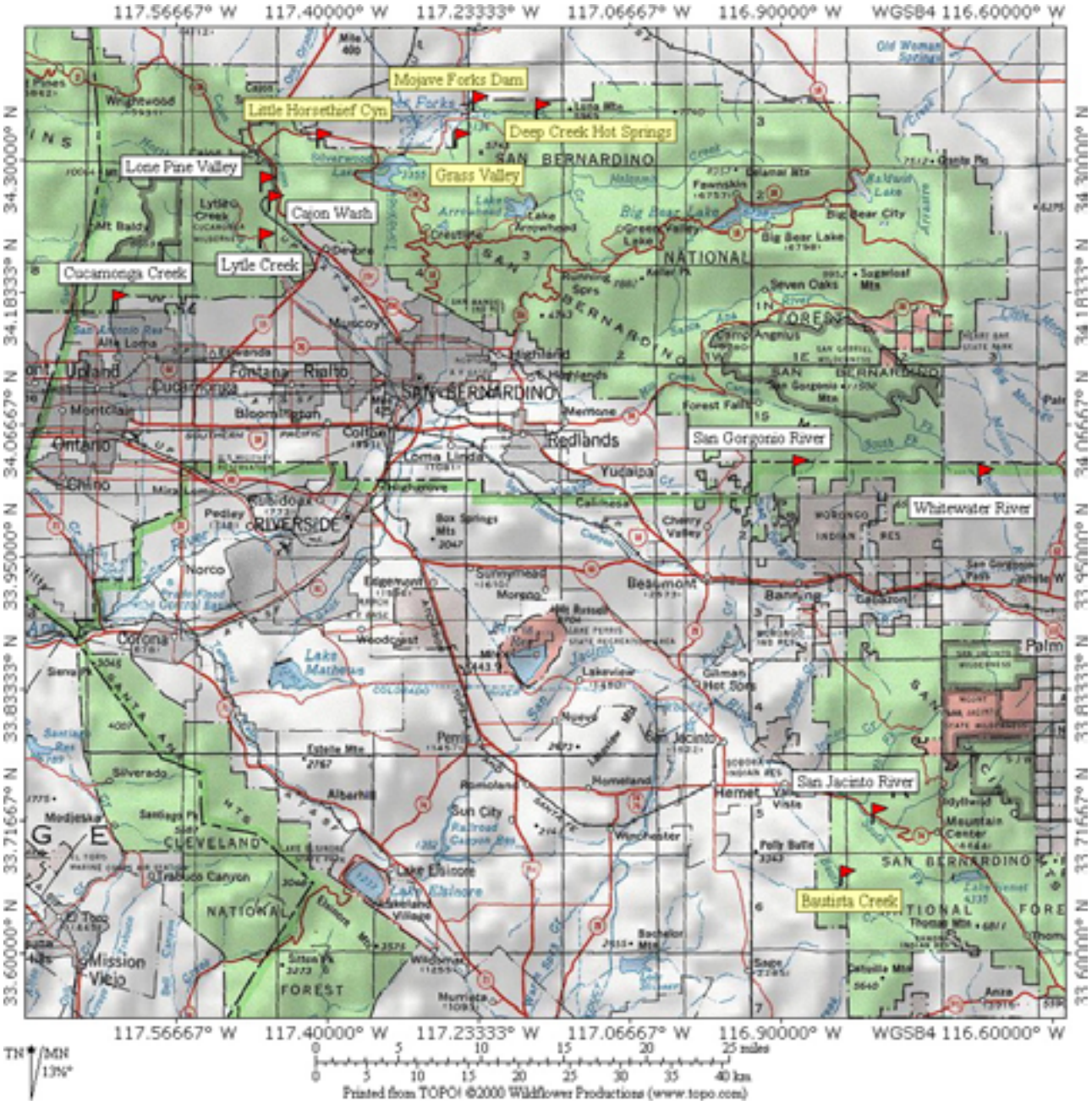


Figure 2a. Bautista Canyon. Red line indicates survey reach; individual arroyo toad locations are indicated with blue markers (coordinates are listed in Table 3). A total of 15 arroyo toads were observed. Markers labeled BCS and BCE indicate survey start and end points.

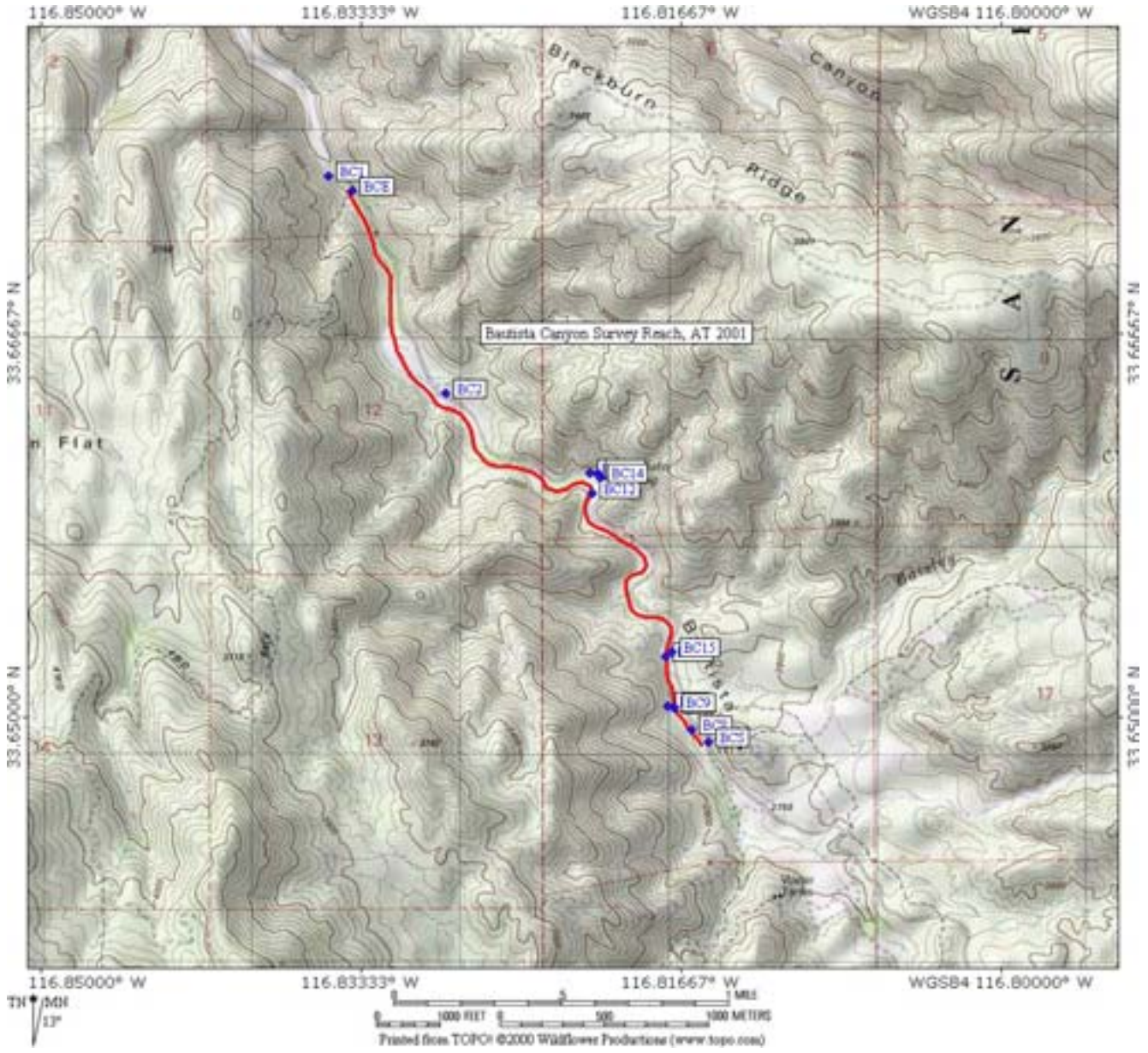


Figure 2b. Bautista Canyon. Map of incidental arroyo toad observations on the road. On two evenings, seven arroyo toads were observed on Bautista Canyon Road between the Conservation Camp and Hixon Trail.

Figure 3a. Cajon Wash and Lone Pine Valley. Red lines indicate length of survey reaches. Blue markers indicate survey start and end points. No arroyo toads were observed.

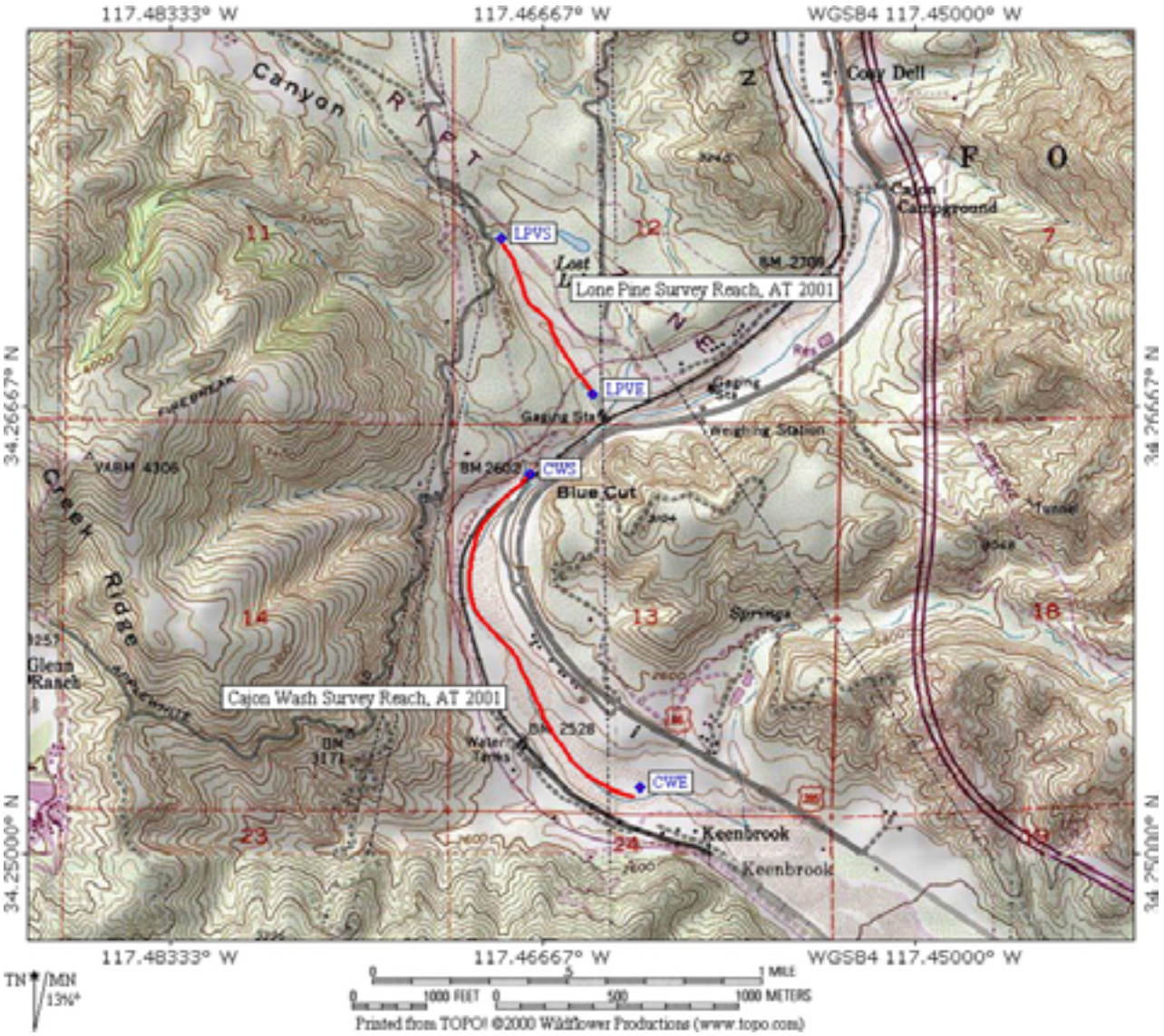


Figure 3b. Lone Pine Valley and Cajon Wash. Aerial view looking south through Lone Pine Valley wash to its confluence with Cajon Wash at Blue Cut and then further downstream through the Cajon Wash survey area.

Figure 3c. Cajon Wash below Blue Cut. Aerial view of Cajon Wash illustrating multiple impacts to the system including nearby roadways, nearby railroad and off road vehicle disturbance. This reach is also utilized for day use recreation and bathing.

Fig. 3b

Fig. 3c

Figure 4a. Cucamonga Creek. Red line indicates survey reach, blue markers indicate survey end and start points. No arroyo toads were observed.

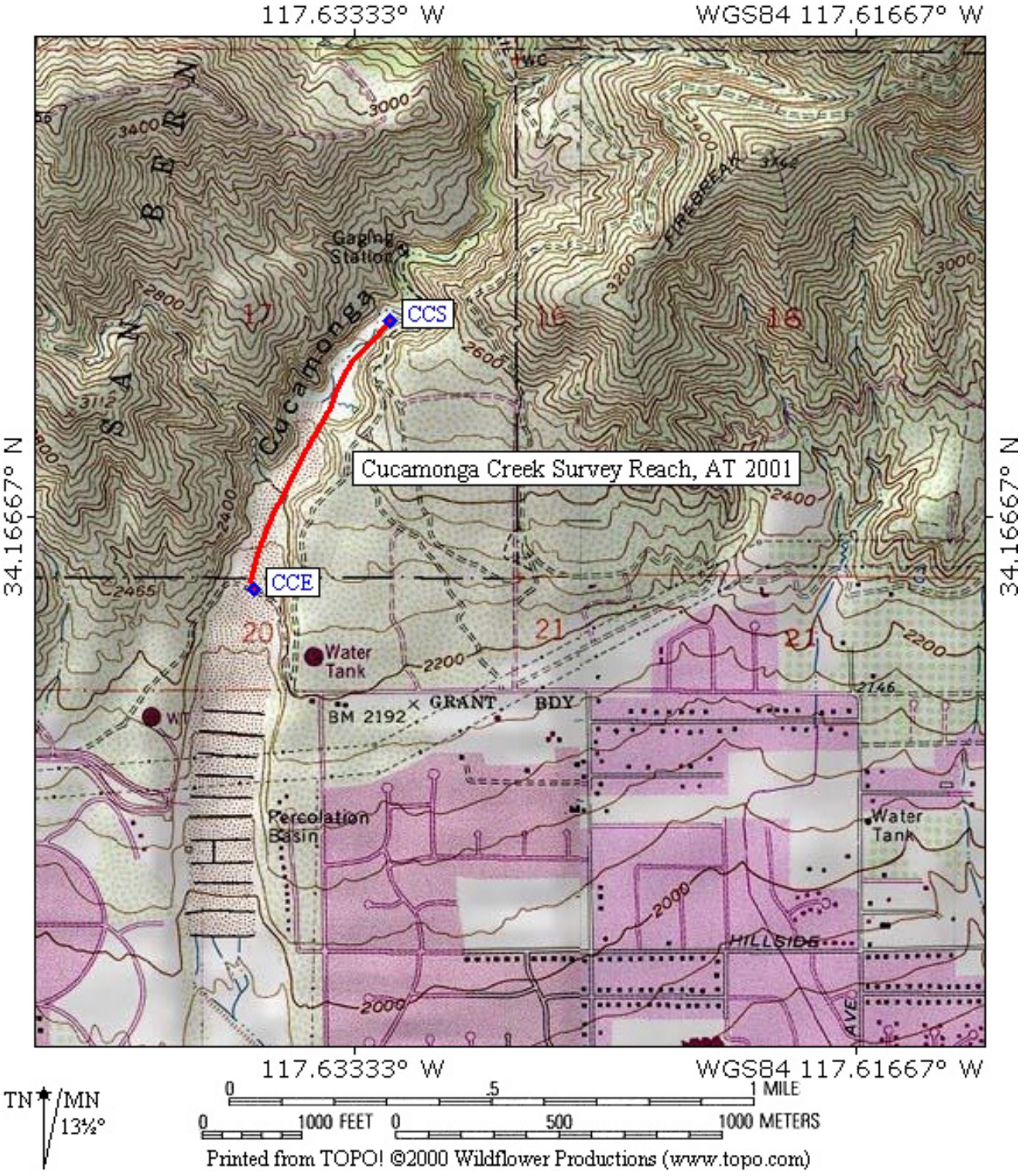


Figure 4b. Cucamonga Creek. Aerial view of Cucamonga Creek Survey Reach showing downstream percolation basin and development.

Figure 5a. Deep Creek. Red line indicates survey reach and arroyo toad localities are indicated with blue markers marked DC1 and DC5. Markers labeled DCS and DCE indicate survey start and end points. Five arroyo toads were observed.

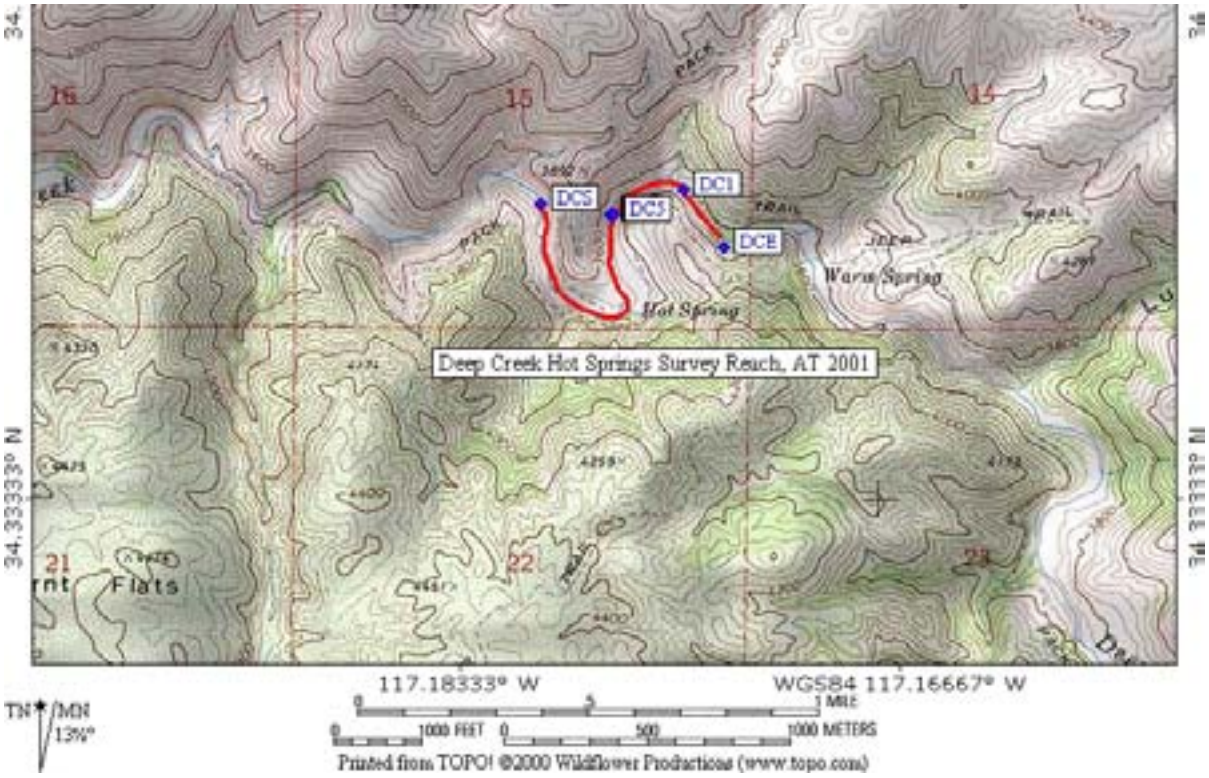


Figure 5b. Deep Creek. A pool at Deep Creek upstream from the Hot Springs where arroyo toads were observed.

Figure 6a. Grass Valley. Red lines indicate survey reach. Markers labeled GVS and GVE indicate survey start and end points. A red arrow near the point labeled GVE indicates the location of the arroyo toad found freshly killed on HWY 173 at Grass Valley. No other arroyo toads were observed.

Figure 6b. Grass Valley. Arroyo toad found freshly killed on Highway 173 at Grass Valley, 5/8/2001.

Figure 6c. Grass Valley. Pool in the lower region of Grass Valley upstream from the Hwy 173 crossing. Scattered pools like this exist in the lower reaches of Grass Valley below the USFS Property.

Figure 7a. Little Horsethief Canyon. Red line indicates survey reach, arroyo toad observations indicated with blue markers labeled LH1 through LH20. SVDOR marks the location of the incidental arroyo toad observed freshly killed on the road in Horsethief Canyon. Markers labeled LHS and LHE indicate survey start and end points. 23 arroyo toads were observed in Little Horsethief Canyon.

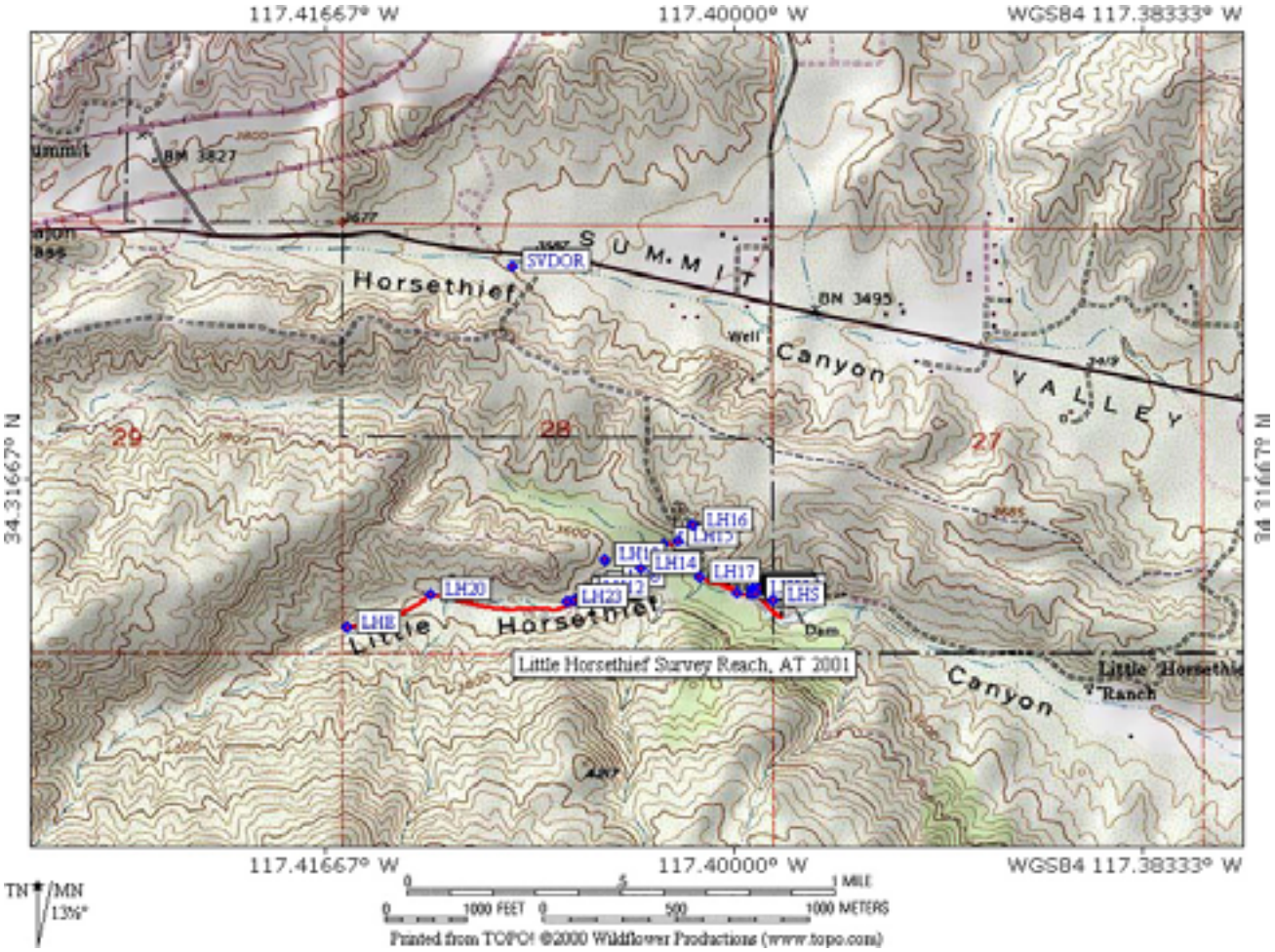


Figure 7b. Little Horsethief Canyon. Aerial view of Little Horsethief Canyon from the west looking downstream (east). Silverwood Lake can be seen in the background. The lower region of Grass Valley can be seen to the northeast of Silverwood Lake.

Figure 8. Lytle Creek. Red line indicates survey reach; blue markers indicate survey start and end points. No arroyo toads were observed.

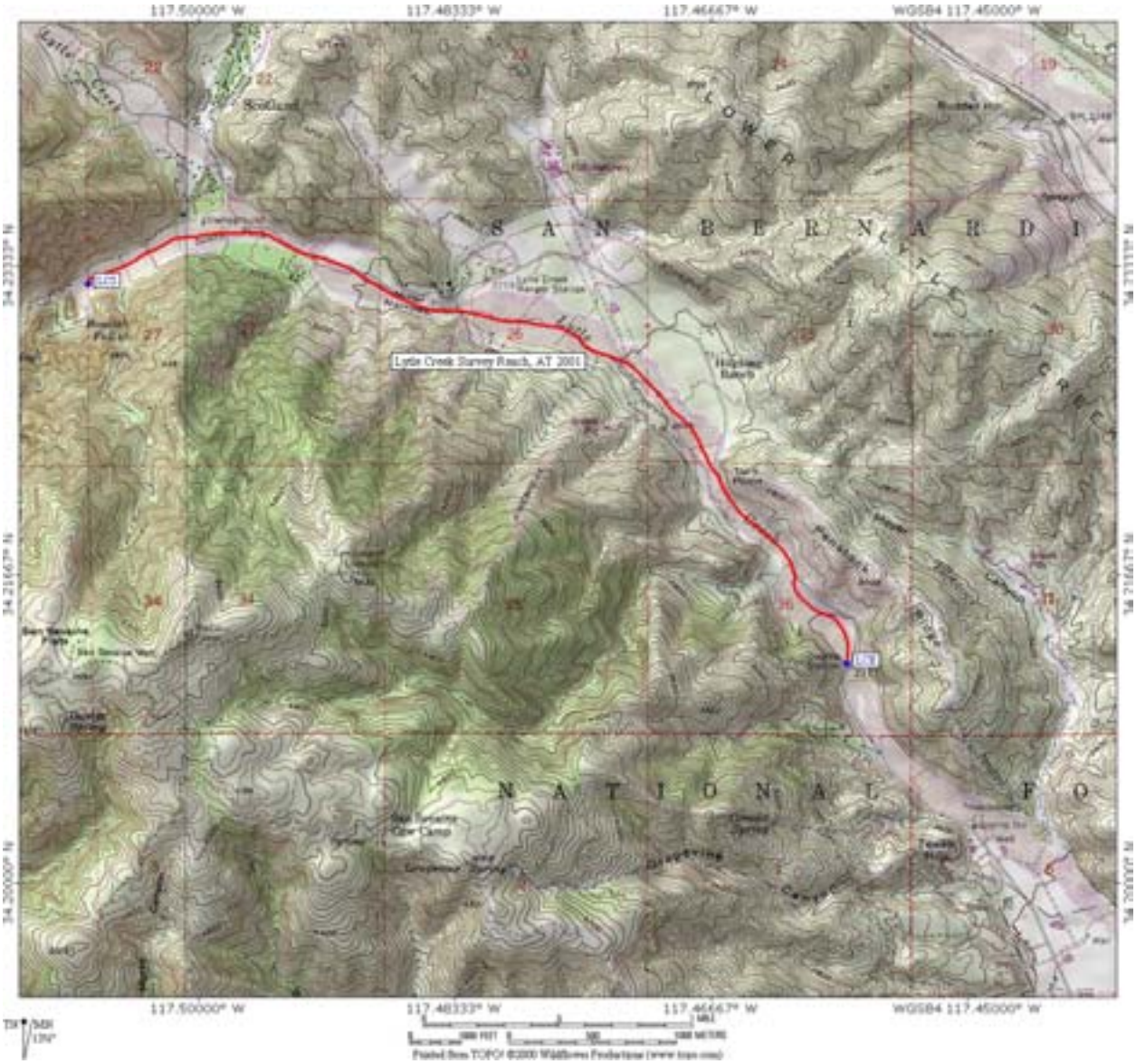


Figure 9a. Mojave Forks Dam. Red lines indicate survey reaches. Arroyo toad localities are indicated with blue markers labeled MFD1 through MFD5. MFD1S, MFD1E, MFD3S and MFD3E indicate survey start and end points. Two adult arroyo toads were observed.

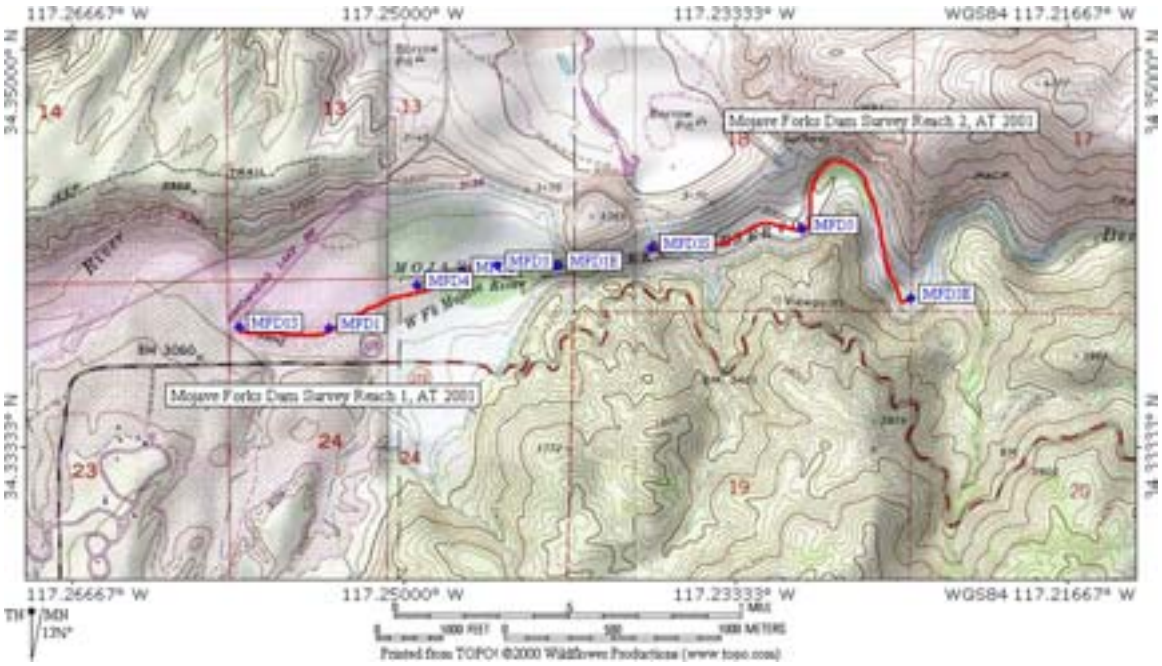


Figure 9b. Mojave Forks Dam. Wash below Mojave Forks Dam showing disturbance from recreational off road vehicle usage.

Figure 9c. Mojave Forks Dam Survey Reach. Aerial view looking east from the West Fork of the Mojave River towards Mojave Forks Dam.

Figure 9d. Survey Reach of Deep Creek above Mojave Forks Dam. Aerial view looking southeast from above the spillway at Mojave Forks Dam.

Fig. 9c

Fig. 9d

Figure 10a. San Gorgonio River. Red line indicates survey reach; blue markers indicate survey start and end points. No arroyo toads were observed.

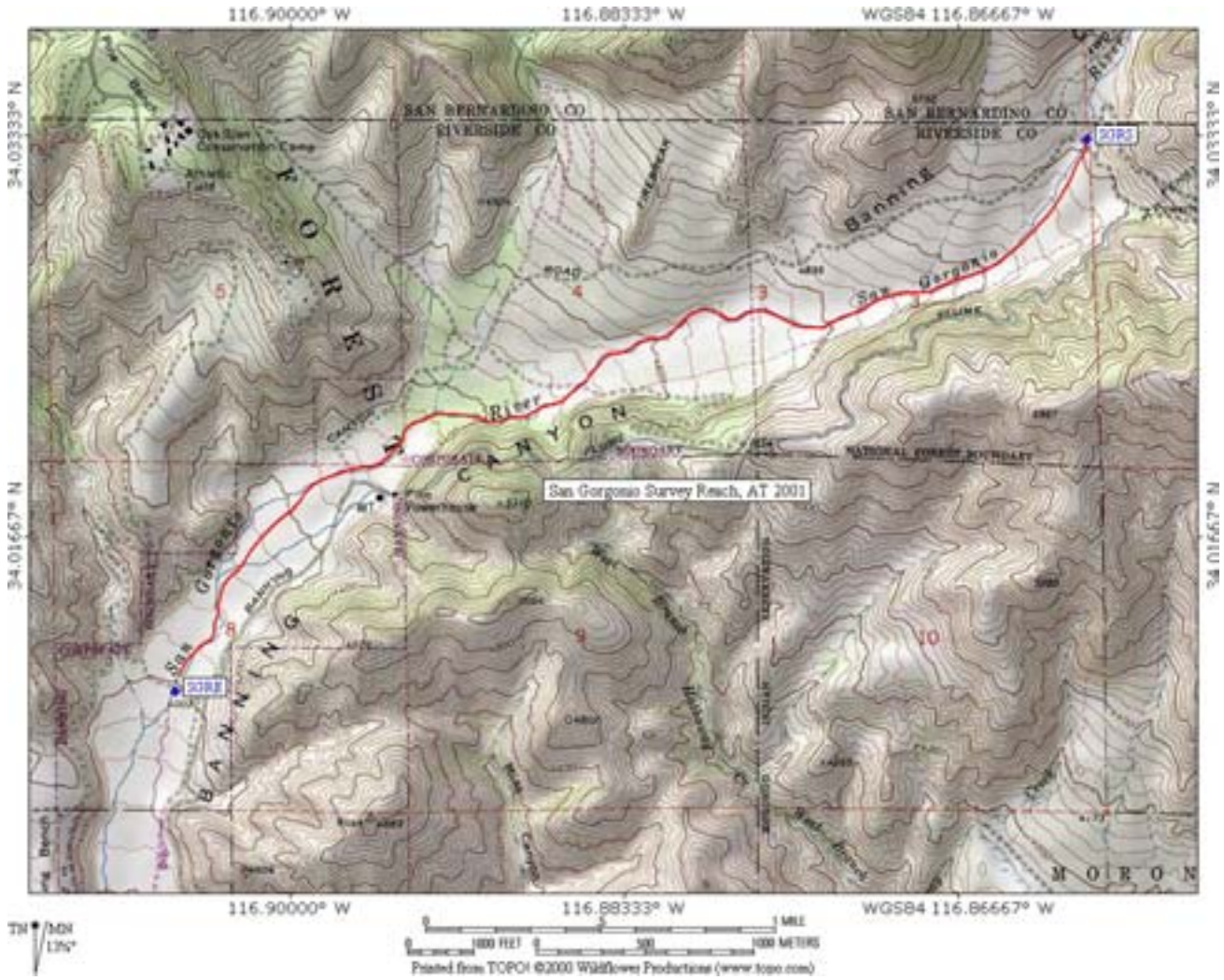


Figure 10b. San Gorgonio Wash. Aerial view of San Gorgonio Wash looking northwards (upstream) from above Banning Bench.

Figure 11. San Jacinto River survey reach. Red line indicates survey reach; blue markers indicate survey start and end points. No arroyo toads were observed.

Figure 12a. Whitewater Canyon. Red Lines indicate survey reaches. Blue markers indicate start and end points.

Figure 12b. Whitewater Canyon, North Fork. Aerial view of North Fork of Whitewater Canyon looking downstream (southeast) showing moderate to high gradient washy channel with minimal upland terraces. The vicinity of the confluence with middle fork can be seen at the top of the photo showing the lower gradient and increased terraces.

Figure 13. Summit Valley. Aerial view of Summit Valley and the Silverwood Lake region. Cedar Springs Dam is visible to the left. Horsethief and Little Horsethief Canyons drain into Summit Valley, which is visible below the lake and dam. Historically, arroyo toads were documented in the vicinity of Cedar Springs and the region that is underneath the lake.

Appendix A

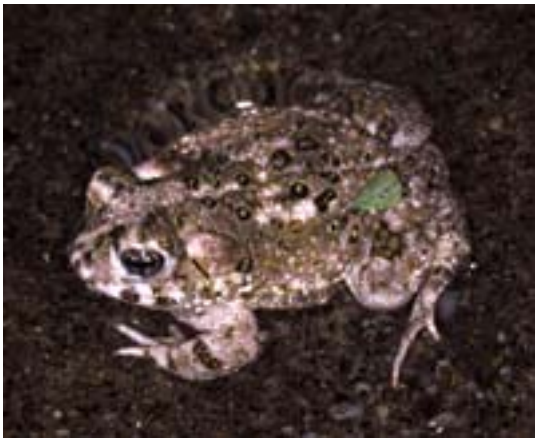
Photos of Species Observed

Photos by Chris Brown, USGS (except where indicated otherwise)

Toads

Arroyo Toads, *Bufo californicus*. Observed at Bautista Cyn., Deep Creek Hot Springs, Little Horsethief Cyn., and Mojave Forks Dam, Grass Valley and Horsethief Cyn.






Western Toads, *Bufo boreas*. Observed at many sites within study area.


Toads, cont.

Western Spadefoot Toad, *Spea hammondii*. Observed at Bautista Canyon.


Frogs

California Treefrog, *Hyla cadaverina*. Observed at many sites within study area.


Pacific Treefrog, *Hyla regilla*. Observed at many sites within study area.


Frogs, cont.

Bullfrog, *Rana catesbeiana*. Observed at Mojave Forks Dam.

Salamanders

Monterey Ensatina, *Ensatina eschscholtzii.* Observed in Lytle Creek in 2001, also observed in Bautista Canyon in 2002.

Arboreal Salamander, *Aneides lugubris*. Observed in Cucamonga Canyon.

Lizards

Zebra Tailed Lizard, *Callisaurus draconoides*. Observed at Deep Creek Hot Springs. A population also exists in Cajon Wash.

Banded Gecko, *Coleonyx variegatus.* Observed in Bautista Canyon.

Great BasinCollared Lizard, *Crotaphytus bicinctores*. Observed in Lytle Creek (Photo by Kathie Meyer, USGS).

Lizards, cont.

Coast Horned Lizard, *Phrynosoma coronatum*. Observed at Whitewater Canyon, Grass Valley and West Fork of the Mojave River.

Western Fence Lizard, *Sceloporous occidentalis*. Found throughout study area.

Side-Blotched Lizard, *Uta stansburiana*. Found throughout study area.

Snakes

Common Kingsnake, *Lampropeltis getula.* Observed in Little Horsethief Cyn., Grass Valley, and West Fork of the Mojave River.


Western Blind Snake, *Leptotyphlops humilis*. Observed at Deep Creek Hot Springs.


Long Nose Snake, *Rhinocheilus lecontei*. Observed in West Fork of the Mojave River.


Snakes, cont.

Patch Nose Snake, *Salvadora hexalepis*. Observed in Deep Creek Hot Springs.

Two Striped Garter Snake, *Thamnophis hammondii*. Observed in West Fork of the Mojave River and in Deep Creek.

Southern Pacific Rattlesnake, *Crotalus viridis*. Found throughout study area.

Snakes, cont.

Speckled Rattlesnake, *Crotalus mitchelli*. Observed in Whitewater Cyn.

Red Diamond Rattlesnake, *Crotalus ruber*. Observed in Bautista Canyon.