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Arroyo Toad and Western Pond Turtle in the San Diego Multiple Species Conservation Program Area, 2002

Interim Report

Prepared for:

County of San Diego
California Department of Fish and Game

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

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By Kathie Meyer, Ed Ervin, Melanie Madden-Smith, Stacie Hathaway, and Robert Fisher

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San Diego Field Station
USGS Western Ecological Research Center
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Rapid urbanization has led to the loss and degradation of riparian habitats in southern California. In response to the need to protect and manage habitat for native species in the South Coast Eco-Region of Southern California, the Natural Communities Conservation Planning Program (NCCP) was initiated in 1991. The arroyo toad (*Bufo californicus*) and western pond turtle (*Clemmys marmorata*) are covered species in the San Diego Multiple Species Conservation Program (MSCP). However, the current status and distribution of the arroyo toad and the western pond turtle within the MSCP is poorly known. Direct habitat loss in conjunction with hydrological alterations and the introduction of nonnative species have caused arroyo toads to disappear from about 75% of previously occupied habitat within the United States. The western pond turtle is the only turtle native to southwestern California and was historically abundant in most major drainages in San Diego County. Surveys conducted in southern California in the late 1980's suggested that pond turtles no longer occurred in many historic locations and that few viable populations of turtles remained. The US Geological Survey conducted surveys for the arroyo toad and western pond turtle at select sites within the San Diego MSCP in 2002. Arroyo toads were observed at two of the 7 sites surveyed and western pond turtles were detected at 3 of the 26 sites surveyed. A suite of non-native aquatic predatory species known to have deleterious effects on native amphibian species was detected at 46**%** of the sites that contained surface water during the surveys. Non-native turtles were detected at more locations than western pond turtles. Western pond turtles co-occur with non-native turtles at least at one location. Surveys for both, arroyo toads and western pond turtles will continue during spring and summer 2003.

INTRODUCTION

California leads the nation in riparian habitat loss with fewer than ten percent of the historic habitat remaining (Dahl 1990). High levels of urbanization driven by large human population pressures have lead to significant declines in the number, size, connectivity, and quality of riparian habitats in San Diego County. In addition, damming and channelization of our rivers and streams have interrupted the natural hydrological regimes of these systems. These habitat alterations and losses adversely affect riparian associated species.

To better balance the loss of wildlife and plant habitat with human needs for development, California adopted a Natural Community Conservation Plan (NCCP) in the South Coast Eco-Region. The NCCP offers protection to some of the last riparian areas in southern California. The San Diego sub-region NCCP program is known as the San Diego Multiple Species Conservation Program (MSCP). Within the MSCP, 85 plant (46) and animal (39) federally and state listed and sensitive species specie are covered. Even though covered species within the MSCP have some level of political protection, information about the current distribution and basic biology of some of the covered species is limited and requires further study. The purpose of this study is to gain a better understanding of the distribution of arroyo toads (*Bufo californicus*) and western pond turtles (*Clemmys marmorata*) within the MSCP. Additionally, this study could lead to a better understanding of the biology of the arroyo toad and western pond turtle.

Arroyo toads and western pond turtles differ in their use of the landscape and reliance on riparian areas, but both species have been directly affected by riparian degradation and loss. Information on the current distribution of arroyo toads and western pond turtles will facilitate land managers in identifying areas to manage for these species.

Arroyo toad

The arroyo toad is a terrestrial amphibian that occupies habitats with sandy or other friable soil types in relatively close proximity to their aquatic breeding sites. Following adequate seasonal rainfall in late winter and/or early spring (Feb-May), they migrate from upland habitats down to quiet pools that form along low gradient drainages to breed. The arroyo toad is restricted to riparian habitats that include both the drainage channel and the adjacent upland terraces and slopes.

Upland habitat loss has resulted from urbanization, agriculture, and road construction and loss of riparian habitats has occurred as a result of channelization, water overdraw, and the construction of dams and the creation of reservoirs. As a result, arroyo toad populations within the MSCP have been greatly reduced and are highly fragmented. Direct habitat loss in conjunction with hydrological alterations and the introduction of nonnative predatory aquatic species have caused arroyo toads to disappear from about 75% of the previously occupied habitat in within the United States (Jennings and Hayes 1994). In addition, the arroyo toad is considered to have the most specialized habitat requirements of any amphibian found in California (Jennings and Hayes 1994). Consequently, in 1994, the U. S. Fish and Wildlife Service (hereafter USFWS) listed the arroyo toad as endangered (Federal Register 59 FR 241:64859-64866).

Prior to the development of a management plan for this species, it imperative that the pattern and distribution of high quality arroyo toad habitat is clearly understood. In 2002, we evaluated habitat quality and conducted focused surveys to clarify the distribution of the arroyo toad within a subset of sites within the MSCP area.

Western pond turtle

The western pond turtle is the only turtle native to coastal California. Historically, it was common in most major coast-facing drainages and had a relatively continuous distribution from northern Baja to Washington, with a few scattered isolated populations elsewhere (Jennings and Hayes 1994). In southern California, pond turtles were once widespread and common.

In the late 1980's, work by Brattstrom and Messer (1988) suggested that only a few viable populations of pond turtles remained in southern California because they only observed pond turtles in 53 locations (compared to a known 87 known sites described in historical records). They also found that in areas where pond turtles remained, the number of individuals at many of these sites was low (1-5 individuals observed). A synopsis by Holland (1991) suggested that the pond turtle was in a general state of decline throughout much of its range. Despite the apparent decline in the southern portion of the species range, the western pond turtle is only considered a California Species of Special Concern.

The pond turtle inhabits many types of water bodies, ranging from creeks and slow moving rivers, to ponds, lakes, and reservoirs (Ernst et. al 1994). The principal cause of decline in the pond turtle is riparian habitat loss and alteration due to urbanization, channelization, and damming. Watercourses with dams upstream are more likely to go dry during the summer months of dry years. Many of the streams in San Diego County have been dammed (Brattstrom and Messer 1988) and the reaches below these dams are more vulnerable to going dry. Pond turtles leave water and travel to surrounding upland habitats to nest, over-winter, and aestivate. Although it is clear that pond turtles rely on these terrestrial environments to meet their life

history requirements, the amount of time that they spend in these areas and the distance they travel from water is poorly known in the arid southern portion of it's range (except see Goodman 1997).

Concerns for western pond turtle decline led to its coverage in the San Diego MSCP Sub-region plan. The MSCP Plan includes of the western pond turtle in the MSCP covered species list. For the purpose of protecting pond turtles, the MSCP plan states, "Maintain and manage areas with 1500 feet around known locations within preserve lands for the species. Within this impact avoidance area, human impacts will be minimized, non-native species detrimental to pond turtles will be controlled, and habitat restoration/enhancement measures will be implemented." To fulfill this requirement, we began conducting surveys for the western pond turtle in the San Diego MSCP area. Our primary objective was to identify areas in the MSCP where pond turtles occur so that land managers can make decisions that are more informed about the land they administer.

METHODS

We attempted to assess the habitat and survey as many riparian preserves within MSCP boundaries as possible during our surveys. For logistical and recording purposes, areas identified on maps were broken into discrete sampling units by political boundaries and differences in the type of system (i.e. an area such as Mission Trails Regional Park that contained both a lake and a river system was usually defined as two survey sites). Management areas such as Hollenbeck Canyon Wildlife Area were broken down by individual tributaries (e.g. Dulzura Creek, Hollenbeck Creek, Pringle Creek, and the Honey Springs Drainage) and were all considered separate survey sites. Furthermore, a linear reach such as Dulzura Creek that is divided into two management areas (Rancho Jamul Ecological Reserve and Hollenbeck Canyon Wildlife Area) was also divided into two survey sites. Figure 1 shows a map of sites surveyed in 2002. Table 1 represents a breakdown of sites surveyed for each species.

Arroyo toad

We employed a multi-step filtering process (Ervin et al. 2002) to evaluate sites for the presence of suitable arroyo toad habitat and conducted nocturnal surveys to detect arroyo toads. First, the initial site selection consists of examining maps to determine if key habitat characteristics indicating potentially suitable arroyo toad habitat occur at a particular site. Second, to assess the actual habitat quality for arroyo toads, we conducted daytime habitat assessment surveys (ground truthing) at all sites identified as meeting criteria defined in the initial site assessment step. These on-site surveys consisted of collecting information on actual habitat characteristics so the site could be rated in terms of habitat quality for arroyo toads (e.g., High, Good, Marginal, or Poor). Third, taxa-specific nocturnal presence surveys were conducted at sites deemed potentially appropriate to support arroyo toad populations, based on the occurrence of physical characteristics highly correlated with arroyo toad distribution (Sweet 1992; Campbell et al. 1996).

Initial Site Selection
Criteria used for initial site selection consisted of identifying 1) sites that contained lotic habitat (stream, creek, river), and 2) a drainage gradient (or portion thereof) of ≤ 3 %. These two habitat features were easily determined from available mapping resources. Because the toad is a habitat specialist known to breed in rivers, creeks and streams (avoiding breeding in

reservoirs, lakes, ponds) and requires slow to quiet pools for spawning, low gradient lotic reaches (≤ 3 %) are essential (Sweet 1992; Campbell 1996).

Daytime Habitat Assessment Survey
The objective of the daytime habitat assessment survey is to confirm the presence, and determine the distribution pattern of suitable breeding and foraging/burrowing habitat patches within a site. The survey entails walking along the drainage and the adjacent uplands (i.e., terraces, flood plains) and noting habitat features that characterizes riparian habitats in terms of quality for arroyo toads. For any given drainage, or portion there of, with a gradient of (degree of slope) ≤ 3 %, the three habitat features include, 1) the channel substrate type being predominately composed of depositional sand and the presence of sandy banks, 2) the presence of flat sandy terraces immediately adjacent to channel, and 3) the presence of channel braiding. In combination, the occurrence of a low gradient reach (≤ 3.0 %) with a sandy depositional substrate result in conditions conducive to the formation of seasonal quiet backwater breeding pools (Sweet 1992; Campbell et al.; 1996) (Figure 4). Presence of the additional two habitat features (sandy terraces, braided channel) significantly increases the quality of breeding habitat.

The rating of habitat quality within a site was made from data collected on physical features and channel morphology described above, and was not dependent on the presence of surface water (seasonal breeding pools). The following four habitat quality types are based on various conditions and combinations of upland (terrestrial) and stream channel (potential aquatic breeding pools) characteristics. The number of physical characteristics, indicated by number in parentheses, present in areas of ≤ 3% slope determines the habitat quality classification (i.e., High Quality [3], Good Quality [2], Marginal Quality [1], or Poor Quality [0]) of potential arroyo toad habitat (Figure 5).

> *High Quality*: Portion of drainage of low gradient (≤ 3 %) and containing *all three* physical characteristics (sandy substrate, flat sandy terraces, and braided channels) (Figure 5).
>
> *Good Quality*: Portion of drainage of low gradient (≤ 3 %) and containing *two* of the three physical characteristics.
>
> *Marginal Quality*: Portion of drainage of low gradient (≤ 3 %) and containing *one* of the physical characteristics.
>
> *Poor Quality*: Portion of drainage of low gradient (≤ 3 %) and containing *none* of the three physical characteristics.

Nocturnal Presence Survey
The nocturnal presence survey is a visual encounter survey that we conducted at sites determined to contain only, either “high quality” or “good quality” during the daytime habitat assessment survey.

Taxa-specific survey efforts were concentrated within habitat patches containing the best quality arroyo toad habitat because these patches offer the greatest opportunity for detection of arroyo toads, presumably because of concentrated resources. For example, sparsely vegetated *terraces* or *flood plains* along the channel are prime areas for adults to forage for ants (and to a lesser extent other small arthropods) and to burrow; the *still-quiet pools* in the drainage for breeding and subsequently the growth and development of the larvae; and the *sandy banks*

adjacent to suitable breeding habitat for recent metamorphs to forage and seek refuge in small divots in the damp sand, often using available deer footprint depressions.

The season in which adult arroyo toads are observed ranges from February through June, and corresponds with the time period when the most rainfall is received within the range of the species. However, most observations are made from March through May. Adult arroyo toads are also strongly nocturnal, favoring damp/wet substrate for activities above ground and typically avoid cold and/or extremely dry conditions. Considering the primary method of detecting arroyo toads during the nocturnal presence survey was by visual encounter (aural being secondary), we concentrated our search efforts during periods with the greatest probability of detecting toads with the least amount effort and under the most favorable environmental conditions.

Western pond turtle

Visual Surveys
We conducted visual surveys of each site to determine whether it was potentially suitable for western pond turtles. Since western pond turtles can occupy a wide range of aquatic habitats, the only criterion we used to define "potential habitat", was whether there was slow moving, pooled water at least 0.25 m deep (the minimum depth required to effectively use our smallest trap). While some of the areas western pond turtles may reside may not be optimal, it was important for us to detect turtles where they occurred. Visual encounter surveys entailed walking an entire riparian reach in search of turtles and turtle habitat. If an area was determined to be potentially suitable, the location of pooled habitat within it was recorded with a Global Positioning System (GPS) unit to help plan for future trapping surveys. If we were able to determine that potential habitat existed *a priori*, as was the case for some reservoirs, the visual assessment stage was skipped and a site was elevated to the trapping phase. However, when opportunities to preview the site before trapping were available, we conducted visual assessments to plan for trap placement during subsequent surveys.

Since 2002 was a very dry year, few sites met our basic criteria of having water at least 0.25 m deep and some sites were given a lower priority for trapping, because the potential habitat was very limited (i.e. only one or two isolated pools of water existed). Western pond turtles will usually remain in the water until it disappears (Bury pers. com). So, if pond turtles were concentrated in these small pools of water, we would have had a reasonable opportunity to detect them when we visited the sites. At the sites assigned low priority for trapping (because of limited aquatic habitat), pond turtles were not observed during visual encounter surveys. Because the length that a western pond turtle can survive in the upland habitats without water is unknown, we may visit some of these low priority sites again in 2003 if there is enough precipitation to create more suitable habitat.

In rare instances, we could rule out the suitability of a site for western pond turtles without conducting a full visual assessment survey. In some other instances, we were precluded from doing a visual assessment due to safety concerns. In cases when we visited a site briefly but did not conduct a visual assessment survey (for either reason), we deemed our survey a *reconnaissance survey.* Reconnaissance surveys occurred when we learned that there was no aquatic habitat in the portion of land once we arrived at the site (this was not apparent through maps because of uncertainty to property boundaries) or if safety hazards became apparent at the onset of a visual assessment survey.

Trapping Surveys
If we considered a site potentially suitable, we returned later and used baited traps in attempt to capture turtles. Traps were set for 3-5 days and baited/checked daily. We marked, recorded standard measurements, and determined the sex of each pond turtle captured. Western pond turtles were marked with a passive integrated transponder (AVID 12 mm) and a small triangular notch was made into the right femoral scute using a file. All turtle species observed on both visual and trapping surveys were recorded and are included in our results. Thus far, most sites have only been trapped once.

STUDY AREA DESCRIPTIONS

Numerous sites were assessed for the potential habitat suitability for both southwestern arroyo toads and western pond turtles in San Diego County (Figure 1). A general description of the sites surveyed is found below. These descriptions are organized by watershed roughly from north to south and then east to west. Site names can be found by number in Table 1. Not all sites were surveyed for both arroyo toads and western pond turtles. Table 1 shows what types of surveys were conducted at each site.

San Dieguito River Watershed

Boden Canyon (SITE 1) California Department of Fish and Game
The Boden Canyon Ecological Reserve is located in the foothills above the San Dieguito River. It contains a small portion of Santa Ysabel Creek and a much larger portion of one of its tributaries, along with the surrounding hillsides. The tributary of Santa Ysabel Creek consist of an upper portion and a lower portion divided into an upper and lower portion by a large artificially created stock pond. The upper portion has seasonal surface water in the creek. The lower portion has perennial surface water that is restricted to a few small ponded areas along the creek during dry conditions. The main tributary forms a confluence with the Santa Ysabel Creek at the southern end of the lower portion of the reserve. Both Santa Ysabel Creek and its tributary are lined with oak woodland, sycamores, and other riparian vegetation and coastal sage scrub covers the hillsides. There are a number of exposed rocky outcrops on the surrounding hillsides.

Bernardo Lakes (SITE 2) Owned by the County of San Diego, Managed by The Environmental Trust
Bernardo Lakes is comprised of two ponds that are fed by an unnamed intermittent stream from the east which drains north from the larger of the two ponds into the San Dieguito River below Lake Hodges. New housing developments exist immediately to the south and to the east of this parcel. Costal sage scrub occurs on undeveloped slopes leading into mulefat, willow, rush, and coyote bush intermixed with form the riparian vegetation with tamarisk, ice plant, telegraph weed, pampas grass, and eucalyptus present on site.

Lusardi Creek (SITE 3) / 4S Ranch (SITE 5) County of San Diego
Situated on the north side of Black Mountain, Lusardi Creek bisects 4S Ranch. The creek is dammed at two points, which form two large ponded areas (each approximately 200 meters long) separated by approximately a kilometer. The easternmost pond has a strong odor and irregular color. Rushes surround the edges of the ponds. A thin riparian strip comprised of willows, elderberry, and laurel sumac characterizes the unponded areas of the creek. Non-native species including fan palm, tamarisk, and fennel also occur in the immediate area. A

housing development project was underway adjacent to the northern portion of the riparian edge of the ponds and a newer neighborhood abutted the property at the western edge. At the north side of the creek, a mosaic of chaparral/coastal sage scrub was intermixed with a disturbed low-growing non-native dominated vegetative community overlaid by a small dirt road network. Downstream from 4S Ranch, just west of the Lusardi Creek parcel boundary, the creek drains into the San Dieguito River. Along this stretch, willow dominates the riparian zone.

San Dieguito River, Fairbanks Ranch (SITE 4) County of San Diego
This habitat patch is bisected by the San Dieguito River and is surrounded by a landscape of agriculture and urbanization. The San Dieguito River channel within the preserve is seasonal. Scrub willow riparian habitat dominates the margins of the primary river channel with mulefat and willows occurring on the sandy banks and in the braided sandy channels. Immediately upstream from the preserve, and within the river channel, is a small lake that formed in the basin of an abandoned sand mining pit. The dam to Lake Hodges is located 10 km upstream.

Poway Creek Watershed

Los Penasquitos Preserve (SITE 10) City of San Diego
The Los Penasquitos Preserve extends to within 3 kilometers of the Pacific Coast were it is hydrologically linked by the perennial Penasquitos Creek. The preserve contains riparian, grassland, coastal sage scrub, and chemise chaparral, habitat types. Penasquitos Creek historically had a seasonal hydroperiod but has become perennial as a result of the effects of urbanization. Currently, the riparian corridor, extending the length of the preserve, is composed of large mature willows stands with oaks occupying the slightly higher slopes and coastal sage scrub primarily on the north facing canyon slope and chemise covering the south-facing slope. Grasslands also occupy the low-lying canyon bottom.

Torrey Pines State Reserve (SITE 11) California State Parks
Torrey Pines State Reserve is bordered by the Pacific Ocean on the west and extensive urbanization on the north, east, and south. Los Penasquitos Creek terminates at Torrey Pine State Reserve after traveling through a semi-commercial area at the southeast portion of the reserve. The creek becomes an estuarine/salt marsh type environment before making its way to the Pacific Ocean. The reserve is comprised of coastal sage scrub, intermixed with chaparral and maritime succulent scrub habitats and also has a Torrey Pine forest. A thick riparian zone comprised chiefly of willow borders the wide, slow moving creek at the south eastern end and transforms into a sparsely vegetated riparian area dominated by spike rush as it approaches the ocean.

San Diego River Watershed

San Vicente Creek (SITE 6) City of San Diego
San Vicente Creek has the largest watershed of all drainages that flow directly into San Vicente Reservoir. This San Vicente Creek site is located between the boundary of privately property in Kimball Valley on the north and the high water line of San Vicente Reservoir on the south. The upper reach of the creek, in the southern end of Foster Valley, has low drainage gradient consisting primarily of sandy substrate and contains some perennial pools among willow thickets. The lower reach of this site is steeper and supports a few permanent pools among the rock and boulder channel. Vegetation on the adjacent slopes is chaparral, while the riparian woodland consists of willow, sycamore, and oak trees.

San Vicente Open Space Preserve and Foster Valley (SITE 7) County of San Diego
The rolling slopes of San Vicente Open Space Preserve are characterized by rocky outcroppings and covered by coastal sage scrub vegetation. The main narrow bedrock creek of Foster Valley drains south directly into San Vicente Reservoir. The creek bed supports only sparse and patchy hydrophilic vegetation such as willows and cattails, indicating that the hydrology is ephemeral. A few seeps feed along the channel maintain small shallow seasonal pools.

San Vicente Reservoir (SITE 8) City of San Diego
San Vicente Reservoir is a deep (maximum depth of 58 meters.) steep-sided reservoir on San Vicente Creek located south of Ramona in the rural foothills of Lakeside. It was constructed as a water storage unit and has recreational uses including water-skiing, fishing, as well as picnicking. The reservoir contains a wide array of introduced warm-water game fish species to support the demand for recreational fishing. The surrounding slopes support a coastal sage scrub/chaparral mix, with sporadic willows and cattails along perimeter.

Sycamore Canyon/Gooden Ranch Open Space Preserves (SITE 9) County of San Diego
Sycamore Canyon, which includes Gooden Ranch, is located in the inland valleys and foothills of Santee. Sycamore canyon is a tributary of the San Diego River. It has seasonal surface water except for a small seep-fed pond that is possibly perennial. There is riparian scrub vegetation such as mulefat and desert broom along the creek in addition to riparian trees including willows, cottonwoods, sycamores, and oaks. There are open grassy floodplains adjacent to the creek and the surrounding hillsides are covered in coastal sage scrub and chaparral. There are a few rocky outcrops in the upper portion of Sycamore Canyon. There are a number of man-made structures on site including a few abandoned buildings associated with Gooden Ranch.

El Monte Park (SITE 12) County of San Diego
The El Monte County Park is located on the south side of the San Diego River just west of El Capitan Reservoir. It is a flat area in the floodplain of the San Diego River that is covered with non-native grass and has a few scattered large oaks and sycamores. The hillside south of the park has undisturbed coastal sage and chaparral vegetation with oaks of varying sizes.

Louis Stelzer Open Space Preserve (SITE 13) County of San Diego
The dominant vegetation in Louis Stelzer Open Space Preserve is a chaparral / oak mix on the slopes and hillsides, with oak woodlands shading the length of Wildcat Canyon drainage that bisects the preserve. The unnamed creek appears to be seasonal and would primarily have surface flow in relation to seasonal rainfall events. The well-vegetated understory and channel morphology indicated that large scouring events are uncommon. Stelzer Park within the preserve contains developed facilities such as picnic grounds and hiking trails.

Carlton Oaks Preserve (SITE 14) The Environmental Trust
Carlton Oaks Preserve is located along the San Diego River northeast of Mission Trails Regional Park and south of Santee Lakes. The topography of this preserve is flat. The preserve boundaries incorporate a large pond surrounded by willow, cattails, mulefat, and coyote bush. Non-native vegetation species including: tamarisk, arundo, cocklebur, date palm, eucalyptus and California pepper trees also occur at the site. Carlton Oaks golf course borders the site to the west and housing surrounds the site on other sides.

Mission Trails Regional Park (SITE 15 and 16) City of San Diego
Mission Trails Regional Park is bordered by Miramar Naval Air Station to the north and northwest and housing developments on all other sides. There are two bodies of water at

Mission Trails Regional Park, which include Kumeyaay Lake and the San Diego River. The Kumeyaay Lakes (SITE 15) are a series of large ponds created by historic sand extraction activities. The lakes remain filled today although the river has since been redirected. The ponds are surrounded by clumps of sycamore, willow and cottonwood and emergent vegetation including cattails and non-native aquatic primrose. The San Diego River (SITE 16) intersects Mission Trail Regional Park flowing from Kumeyaay Lake, southwest through Mission Gorge. A thick willow, sycamore, cottonwood riparian zone parallels the river for almost its entire length. Slow-moderate flowing water forms a series of long, deep pools characterize the river for most of its length in the park. Areas adjacent to the river are dominated by oak woodland that transitions quickly into steep rugged slopes covered by chaparral and rocky outcrops.

San Diego River, Mission Valley - First San Diego River Improvement Project (FSDRIP) (SITE 17) City of San Diego
The San Diego River in Mission Valley has been highly modified to accommodate rapid urbanization, and more recently, as part of a flood control project. As recently as 4 decades ago, primary habitat modifications in Mission Valley adjacent to the San Diego River, included cattle grazing on the sparsely vegetated sandy flood plains, and to a more limited degree, loss of habitat to roadways and human structures. However currently, virtually all the native vegetation and associated animal communities in the entire valley bottom has been extirpated as a result of the conversion to commercial, residential, and to an increasingly limited degree, sand extraction operations. The historically seasonal San Diego River now flows year round as a result of urbanization and the associated runoff. The riparian corridor of the San Diego River primarily consists of mature willow woodlands, which contain an entire suite of non-native invasive vegetation including, but not limited to, arundo, casterbean, and fennel.

Sweetwater River Watershed

Sycuan Peak Ecological Reserve (SITE 18 and 19) California Department of Fish and Game
The Sycuan Peak Ecological Reserve incorporates the Sweetwater River (SITE 18) and Lawson Creek (SITE 19). The reserve is located below the Loveland Reservoir. Sycamore, willow, and cottonwood characterized the dominant canopy vegetation with mulefat, poison oak, mugwart, and grape occurring in the understory. Pooled water in the drainage channels supported cattails, rush, and duckweed. In 2000, a fire burned through a large portion of the reserve leaving many of the slopes facing the drainages denuded. Chaparral and costal sage scrub remains on unburned slopes and a non-native grassland/oak woodland occur at the confluence. Large rock outcrops occur in along both canyons.

San Diego National Wildlife Refuge, Sweetwater River (SITE 20) US Fish and Wildlife Service
The San Diego National Wildlife refuge consists of several parcels of relatively undisturbed land found in the inland valleys and western foothills of Rancho San Diego and Jamul. The Sweetwater River and several of its tributaries occur within several of these parcels. The Sweetwater River has permanent surface water in some reaches and seasonal surface water in other reaches and in its tributaries. The river and its tributaries are characterized by the presence of willows, cottonwoods, sycamores, and oaks along with riparian scrub type plants such as mulefat. The upland portions of the refuge are characterized by flat grassy areas that transition into relatively steep slopes of coastal sage scrub and chaparral habitats with numerous rocky outcrops and a few natural caves.

Sweetwater Reservoir (SITE 21) Sweetwater Authority
The Sweetwater Reservoir (including a portion of the Sweetwater River and associated gravel ponds) is located southwest of the San Diego National Wildlife Refuge and northeast of Sweetwater River Valley Park. Mother Miguel Mountain borders the reservoir on the east and

urban development abuts the reservoir on the west and north. Mulefat, willow, coyote bush, cattails, and rush occurred along the shore.

Sweetwater River Valley Park (SITE 22) County of San Diego
Aquatic habitat within the Sweetwater Regional Park includes the Sweetwater River and Morrison Pond. The park consists of a north and south section separated by a golf course fairway. The northern portion of the Park abuts the dam at Sweetwater Reservoir and urban development surrounds the remaining edges of the Park. Riparian vegetation along the Sweetwater River and Morrison Pond is comprised mainly of willow with rush and cattails in the understory. The River was shallow for most of its length with only a few pooled areas. The Park receives heavy recreational use associated with its proximity to urban areas.

Otay River Watershed

Hollenbeck Canyon Wildlife Area (SITE 23, 24, 26, and 27) California Department of Fish and Game
The Hollenbeck Canyon Wildlife Area incorporates Dulzura Creek (SITE 26) and three tributaries, Pringle (SITE 27) and Hollenbeck (SITE 23) Creeks and one unnamed tributary, dubbed the Honey Springs drainage (SITE 24). Dulzura Creek parallels Highway 94 currently initiating from the Barrett Flume and draining from the Hollenbeck Canyon Wildlife Area, under Highway 94, southward into Ranch Jamul Ecological Reserve. Pringle Creek, Honey Springs drainage, and Hollenbeck Creek, feed into Dulzura from the northeast. Pooled water at the eastern end of Dulzura Creek became intermittent and then dries as it progressed downstream. Large articles of trash were strewn along Dulzura Creek. In contrast, Pringle and Hollenbeck Creek were free of such debris. Pringle and Hollenbeck Creeks both contained shallow pooled water for most of their length early in the year and dried at the lower extent of their reaches later in summer. Honey Springs drainage was shallow and intermittent. Riparian canopy along Dulzura and its tributaries included willow, oak, and sycamore with poison oak, wild rose, and arundo in the understory. Oak woodland occurred at the lower half of Hollenbeck Canyon. A few clusters of ranches with outbuildings exist along the Honey Springs Drainage. Rugged hilly terrain covered with chaparral and rock outcrops surrounded the riparian areas.

Rancho Jamul Ecological Reserve (Jamul Creek and pump pond are SITE 25) California Department of Fish and Game
The Rancho Jamul Ecological Reserve is located in the foothills and valleys of Jamul. It is a large reserve that contains portions of Jamul Creek and Dulzura Creek along with portions of some of their tributaries. The creeks and their tributaries are surrounded by broad flat valleys and rolling hills. The creeks are heavily incised with relatively sandy streambeds throughout most of their lengths within the reserve. They have seasonal flow with the exception of Dulzura Creek, which sometimes flows year round when water is being release from the Barrett Reservoir down into the Otay Reservoirs. The creeks are lined sporadically with large sycamores and a few oaks and willows dominate some reaches of the creeks. The riparian vegetation is noticeably restricted to the immediate vicinity of the creeks and there are no trees in the outer portions of the floodplains. Most of the surrounding valleys are flat broad fallowed agricultural fields that were also grazed and are now covered in non-native grasses and shrubs. Many of the hillsides consist of disturbed grassland and coastal sage scrub; however, there are few slopes with undisturbed coastal sage scrub and chaparral vegetation. There are a number of artificially created cattle ponds that are networked by a complex of irrigation ditches. Only one of these ponds (known as the “Pump Pond”) holds water throughout the year. There is a concrete cistern that also holds year around water. In addition to several buildings that are currently occupied, there are a few other man-made structures found on the reserve including a historic brick kiln, an unidentified concrete chimney-like structure, several culverts, and a bridge.

Otay Mountain – Sycamore Canyon (SITE 28) Bureau of Land Management
The drainage of Sycamore Canyon is a tributary of Dulzura Creek and is ephemeral in nature. Vegetation covering the upper slopes are a coastal sage scrub / chemise chaparral mix. Along the low gradient rock and cobble streambed, trees such as sycamore, Tecate cypress, and oaks occur sparsely. Thick grasses dominate the relatively flat terraces adjacent to the streambed.

Otay Mountain – Cedar Canyon (SITE 29) Bureau of Land Management
Cedar Canyon, located on the north side of Otay Mountain. It is a seasonal tributary of Dulzura Creek that is narrow and rocky in its upper reaches and transitions into a relatively broad low gradient stream with a rock and cobble bed. Tecate Cypress lines the upper reaches and the lower reaches are dominated by oak woodland that grows on flat terraces adjacent to the creek. Coastal sage scrub and chaparral dominates the steep rocky slopes above the creek. There is an old horse trough with year round water located among some oak trees in the lower portion of the canyon. At the base of the canyon there is a private campground known as Thousand Trails that owns the property surrounding the confluence of Cedar Canyon with Dulzura Creek.

Otay Lakes (SITE 30 and 31) City of San Diego
Otay Lakes includes an upper and lower reservoir. Upper Otay Lake (SITE 30) is located to the south of Proctor Valley. A large-scale housing development was under construction to the west and the Jamul Mountains abut the lake on the east. Lower Otay Lake (SITE 31) is located to the south. Lower Otay Lake has a relatively poorly defined riparian zone consisting of sparse mulefat, rush, and Willow. Some chaparral occurs to the northeast of the lake. Upper Otay Lakes is relatively large compared to the lower lake and is located adjacent to the San Ysidro Mountains on the southeast. Lower Otay Lakes is also sparsely vegetated with mulefat, rush, and willow along the shore with the exception of a dense willow riparian area where Jamul Creek feeds into the reservoir.

Otay River Valley Park (SITE 32 and 34) Joint ownership with the City and County of San Diego
The Otay River Valley Park is divided into unconnected 2 reaches, upper and lower. The upper Otay Valley River Park (SITE 32) reach begins immediately beneath the Lower Otay Lakes Reservoir dam and continues along a steep walled canyon surrounded by rocky slopes (including one abandoned mine) until it opens up at the bottom of the county's property boundaries at the eastern boundary of the Eastlake community (currently under development). The upper portion was dry with the exception of two small pools of water toward the bottom of the reach. Vegetation in the canyon included laurel sumac, willow, mulefat, and buckwheat. Non-native vegetation included arundo, castor bean, tamarisk, umbrella sedge, and date palm. The lower Otay River Valley Park (SITE 34) contained at least two large ponds, resulting from previous gravel mining operations. The lower stretch of the park was occupied by a large number of homeless people and therefore did not get well surveyed. Riparian vegetation along the ponds included a mix of willow, mulefat, bottlebrush, rush, arundo, and tamarisk.

Otay Mountain – O'Neil Canyon (SITE 33) Bureau of Land Management
O'Neil canyon is a drainage located on the west side of Otay Mountain. It is a seasonal tributary of the Otay River that is fairly narrow and rocky throughout most of its length until very near the confluence with the Otay River where it begins to flatten and broaden and has a primarily cobble bed. It is lined with Tecate Cypress along its upper reaches where the trees can be quite dense, but there are very few riparian trees except a few sycamores and willows that dot the middle and lower reaches. The slopes above the creek consist of coastal sage scrub and some maritime succulents. There are numerous rocky outcrops along the slopes and portions of the creek are rock walled.

Tijuana River Watershed

Cottonwood Creek (SITE 35) City of San Diego
The portion of Cottonwood Creek in Marron Valley is the lowest portion of the drainage before it joins the Tijuana River. It traverses through Marron Valley with the dominant soil type being depositional sand. However, because Cottonwood Creek through Marron Valley is below Barrett Dam, there is continuous the net loss of transported sandy bed load in this reach, transforming the channel from a wide sandy braided channel to a more defined rock and boulder strewn channel. Currently the vegetation in the seasonal creek bed mainly consists of mulefat and scrub willow, while the adjacent sand terraces support coastal sage scrub. This area has just been cleared of cattle that have grazed the valley bottom for decades.

Tecate Creek (SITE 36) and Tijuana River (SITE 37) City of San Diego
Tecate Creek drains from Mexico into San Diego County a few hundred feet before the confluence of Cottonwood Creek in Marron Valley. The watercourse down stream from this confluence becomes the Tijuana River, drains south back into Mexico after 3.8 km, and is virtually identical in riparian vegetation to the above Tecate Creek segment. Both segments are perennial and known to contain high level of fine sediment and biological and chemical contaminants. These low gradient drainages are dominated by a thick willow riparian habitat and bordered by marsh-like wetlands of yerba mansa and rushes.

Tijuana River Valley Park (SITE 38, 39, and 40) Joint Management with City and County of San Diego and US Fish and Wildlife Service
The Tijuana River Valley Park is located in the extreme southwestern portion of San Diego County. The boundaries of the Park incorporate the Tijuana River (SITE 40), Dairy Mart Road ponds (SITE 39), and several other ponds (SITE 38). The mostly channelized Tijuana River was nearly dry over its entire length (except where it was tidally back flooded by the Pacific Ocean). Vegetation along the Tijuana River was comprised of willow and mulefat heavily intermixed with non-native species including: castor bean, arundo, fennel, nasturtium, tamarisk, and date palm. The north Dairy Mart Pond was dry and the southern pond was only a few inches deep. The water in the southern pond had a blue-greenish coloration. One pond, located west of 19th Street and south of Sunset Ave were resultant of previous sand mining operations. This pond subsequently filled in with a dense patch of cattails and gave the appearance of 3 distinct ponds. An additional pond of water found along Saturn Road was also heavily inundated with cattails.

RESULTS

Arroyo toad

Initial Site Selection
After examining maps of all the sites within our 2002-2004 scope-of-work, it was determined that forty of the sites contained both lotic habitat, on or adjacent to it, with a drainage gradient of ≤ 3%. Consequently, these forty sites met the minimum criteria to be identified as potentially containing arroyo toad habitat and required on-site ground truthing (Table 1).

Daytime Habitat Assessment Surveys
Daytime habitat assessment *surveys* were conducted at thirty sites identified as potentially containing suitable arroyo toad habitat. Fourteen sites contained physical and geomorphologic characteristics know to be highly correlated with arroyo toad populations (Table 1).

Nocturnal Presence Survey
Ten taxa-specific *nocturnal presence surveys* were conducted at seven of the fourteen sites. Arroyo toads were only observed at Marron Valley and Boden Canyon, both of which were previously known to support arroyo toads.

Non-native Species Detected
Non-native species detected during the arroyo toad included crustaceans, amphibians, and fish (Table 2).

Western pond turtle

Visual and Trapping Surveys
In 2002, we conducted 4 reconnaissance surveys, 31 visual surveys, and 18 trapping surveys inside MSCP boundaries (Table 1). Our trapping effort totaled 747 trap days and 19,391 trap hours. Western pond turtles were only detected at 3 (10%) sites visited. Western pond turtles were detected at: 4S Ranch on Lusardi Creek, Los Penasquitos Creek at the Los Penasquitos Canyon Preserve, and at the Sweetwater River at the Sycuan Peak Ecological Reserve (Table 1). Two pond turtles were captured at 4S Ranch (Our trapping equipment was vandalized at 4-S Ranch and in the short period of time that we trapped, we only detected pond turtles at the easternmost of the two ponds. We plan to trap this site (at least the easternmost pond) more extensively in 2003 to obtain more information about the pond turtles at this location), 1 pond turtle was captured at Los Penasquitos Canyon Preserve, 6 pond turtles were captured at Sycuan Peak Ecological Reserve. Non-native turtles were detected at 28% of sites surveyed and co-occurred with western pond turtles at one location. Non-native turtles comprised 80% of our 135 turtle observations (See map, Figure 3). The following non-native turtles were captured during our surveys: red-eared slider (*Trachemys scripta elegans*) (Figure 8), yellow-bellied slider (*Trachemys scripta scripta*) (Figure 9), an unidentified turtle species that may be a *Trachemys spp.* from outside the United States (Figure 10), painted turtle (*Chrysemys picta*) (Figure 11), mud turtle (*Kinosternon sp*.) (Figure 12), and the false map turtle (*Graptemys pseudogeographica*) (Figure 13). The partial shell of a river cooter (*Pseudemys concinna*) was also detected at one site. Sites where non-native turtles were detected are shown in Table 1. Red-eared sliders comprised over 40% of our observations and were detected at 100% of sites that contained non-native turtles thus far.

SUMMARY AND RECOMMENDATIONS

Arroyo toad

Summary
Historical records indicate that the arroyo toad was more widespread in coastal San Diego County as well as within the MSCP boundaries. Based on the first year of focused surveys for arroyo toads and historical records, it is possible that arroyo toads may still occur on additional preserve sites within the MSCP where focused arroyo toad surveys by qualified biologists have not been conducted yet. To increase the likelihood of detecting arroyo toads, nocturnal presence surveys should be conducted under favorable environmental conditions. However, since last rain year (July-June, 2001-2002) was the driest on record in San Diego County (resulting in sub-optimal conditions), we only conducted a minimal number of nocturnal presence surveys in 2002.

Despite the appearance of suitable habitat, habitat changes over many decades have degraded the quality of wetland and upland habitats within the MSCP. Many human-related activities

have resulted in the loss or degradation of seasonal breeding and upland arroyo toad habitat range wide. These activities include urbanization, agriculture within and adjacent to riparian habitats, dam building and the resulting reservoirs, water diversions, sand and gravel mining, road placement across and within stream terraces, livestock grazing, introduction of non-native species, off-highway vehicle use, and the use of stream channels and terraces for recreational activities (USFWS 1999). Many of these factors, such as dams and livestock grazing, have degraded arroyo toad habitat within the MSCP preserves before the MSCP was established. Arroyo toad habitat, both current and historic, that falls within the MSCP can be maintained or improved with proper management.

Generally, the physical geography within the MSCP includes foothill topography on the eastern border, characterized by narrow canyons and rocky ridges (e.g. Boden Canyon, San Vicente OSP, Marron Valley), with the western portion characterized by coastal plains and/or wide canyon bottoms and mesa tops (e.g. Fairbanks Ranch OSP, Los Penasquitos Canyon Preserve). The drainages within these foothill and coastal canyons were historically unobstructed conduits for the sandy material being generated in the drainage headwaters in the mountain further to the east. However, over the last several decades these drainages have been altered resulting in a significant reduction of the transported sandy bedload. Habitat alterations include the construction of dams for reservoirs, large sand extraction operations within the main drainage channels, and water draw, which reduces the flow/associated physical energy required to transport bedload.

There is a strong positive correlation between drainage gradient and flow velocity, a greater proportion of the finer depositional material such as sand (as opposed to gravel, cobble, rock, etc.) collects along lower gradient reaches compared with steeper gradients. Consequently, the low gradient (≤ 3 %) aspect of a drainage segment is a prerequisite for the formation and maintenance of the three physical characteristics (sandy channel substrate, presence adjacent sandy terraces, and braided channels) that are highly correlated with arroyo toad populations. These physical characteristics, that are also representative of dynamic fluvial processes, are essential elements of arroyo toad habitats types that include, still–quiet pools for breeding, sandy pool substrate for larval foraging, sandy banks for newly metamorphosed toadlets for foraging and thermoregulation, and adjacent terraces/flood plains composed of friable soils for foraging and burrowing adults. These low-gradient reaches are essential for all life history stages of arroyo toads. In short, the low-gradient reaches are critical for the viability of arroyo toad populations. These conditions and functions should serve as a goal to closely approximate on MSCP preserve lands. Management policies and actions should be developed and implemented to achieve this objective.

The sites that we evaluated for habitat quality and/or occupation for arroyo toads are all effected by ‘up stream’ habitat alterations outside of the MSCP boundaries. These practices include, maintaining wetlands containing non-native predatory species that function as source populations for wetlands downstream, operations that change the natural hydrology of the riparian system and unobstructed sand transport, allowing incompatible recreation. Previous studies have demonstrated that non-native predatory amphibian and fish species often have negative effects on native aquatic breeding amphibians, including the endangered arroyo toad. Arroyo toad larvae do not possess effective anti-predatory mechanisms (Sweet 1992) and thus are vulnerable to predatory fish (Bradford 1989; Fisher and Shaffer 1996; Hecnar and Closkey 1997; Sexton and Phillips 1986). Natural and extra-limital (established populations outside their native range) populations of African clawed-frogs are non-discriminating predators that are known to include amphibian larva as part of their diet (Measey and Tinsley 1998). Crayfish have also been shown to prey on native amphibian eggs and larvae (Gamradt and Kats 1996),

while adult arroyo toads are known to be preyed on by bullfrogs (Griffin and Case 2002). Non-native fish may also serve as potential vectors for disease and parasites. Infections may include iridoviruses and the protozoan commonly referred to as white spot disease, or 'Ich' (*Ichthyophthirius multiliis*). A study of wild fish communities in San Diego County determined that native and introduced fish species were infected with the exotic parasite *I. multiliis* (Kuperman et al. 2002). Recent studies have demonstrated that iridoviruses and the protozoan *I. multiliis* can be transmitted between different taxonomic classes [i.e., fish ↔ amphibians] (Mao et al. 1999; Moody and Owens, 1994; Gleeson 1999). Although outbreaks of *I. multiliis* infections have been reported in wild fish and amphibian larva in the past, it is currently unknown what the effect of this infection has at the population level (Scholz, 1999; Gleeson, 1999).

Preliminary Recommendations:

- Manage preserves to prevent or minimize disturbance to arroyo toads and/or their habitat resulting from on-site activities (i.e., livestock grazing, OHV, incompatible recreation, etc.).

- Restrict access to essential areas to restrict access to habitat types (breeding pools, sandy terraces) critical to all arroyo toad life history stages (egg strings, larvae, metamorphs, adults).

- Install educational signs or display cases to educate the public and inform the public of any restrictions.

- Enforcement of above restrictions.

- Remove and monitor non-native vegetation that has negative effects on the creation and maintenance of arroyo toad habitats (arundo, tamarisk, ice plant).

- Develop and implement a program to reduce (eliminate if possible) non-native aquatic species that are known to have negative effects on native amphibians (crayfish, African clawed-frogs, bullfrogs, mosquitofish, warm water game fish) where arroyo toads breed.

- Monitor the status of arroyo toad populations to track population trends.

Western pond turtle

Summary
We detected more non-native turtles at more locations in the MSCP than western pond turtles. It is possible that we missed western pond turtles in some areas where they occur. However, failing to detect pond turtles is most likely to occur in larger bodies of water, such as reservoirs and larger river systems when/if only few individuals are present. We suspect that failing to detect the presence of pond turtles on our surveys was not a common occurrence (except potentially in reservoirs), because the number of traps used and the duration of trapping effort for each site should have been adequate. Most areas where non-native turtles were detected were easily accessed by humans or were designated as recreational areas. Many of these non-native turtles may have been sold in the pet trade and subsequently released into the wild. Some species of non-native turtles, such as the red-eared slider, may be able to establish

breeding populations in the wild because they appear to be common at some locations as shown by our surveys thus far. Although the threats of non-native turtles to western pond turtles are unclear, potential threats include serving as vectors for disease and parasites (Jacobson et al. 1999) and competition for resources, including basking sites (Spinks et al. In Press). Non-native turtle removal could be beneficial to western pond turtles at Los Penasquitos Canyon Preserve and at other sites where non-native turtles co-occur with western pond turtles.

Introduced predators such as bullfrogs and large mouth bass, also pose potential threats to western pond turtles (Holland 1991,1994). Bullfrogs were detected at most of the locations we surveyed in the MSCP, including the locations where pond turtles occur. Bass co-occurred with pond turtles at Los Penasquitos Canyon Preserve. In general, turtles are most vulnerable to predation during the younger life history stages (when they are neonates and small juveniles). When western pond turtles enter aquatic systems, they are about the size of a silver dollar. Bass and bullfrogs are “gape limited” predators and could potentially eat young turtles. Recruitment into any population is critical to its persistence. Non-native predator control should be considered in areas managed for pond turtles.

Educational signing outlining the ramifications of releasing captive turtles into the wild should be considered as a management action at 4S Ranch and Los Penasquitos Canyon Preserve. People frequent Los Penasquitos Canyon Preserve for use as a recreational outlet and 4S ranch is currently undergoing development for housing. Hence, the likelihood of pet turtles being released into these sites is higher than at a more remote site, such as Sycuan Peak Ecological Reserve. At a minimum, educational signs should outline contact information where unwanted pet turtles can be deposited if they can no longer be cared for. An example of such an organization that might aid in this service would be a local Turtle and Tortoise Club, if they accept unwanted pet turtles.

Non-consumptive recreation (such as hiking and dog walking) can potentially trigger problems for native turtles if the recreational activities interfere with an aspect of the turtle’s life history requirements. Garber and Burger (1995) showed that once human recreation (hiking and dog walking) occurred at a location, a stable population of wood turtles (*Clemmys insculpta*), dramatically declined. Radio telemetry at 4-S Ranch would also be useful in monitoring the upland movements of the turtles until construction activities are complete so that direct mortality associated with construction activities could be avoided. Furthermore, if possible, it might be beneficial to limit large equipment operation/earth moving operations when turtles are likely to be using the upland habitats (winter-spring and again in early summer-fall).

Conservation of any organism requires a basic understanding of the species needs in each life history stage coupled with the ability of the species to meet its needs within the landscape in which it resides. Managing for a species that occupies a habitat located in a highly urbanized setting may be difficult. However, it is critical to consider all available data and recommendations when implementing management plans, if they are to successfully preserve the species. More intensive surveys are necessary to better illuminate the demographic structure of the remaining pond turtle populations in the MSCP. Studies investigating the terrestrial habitat use and requirements of the western pond turtle and its interaction with non-native turtles should be considered.

Preliminary Recommendations:

- Manage preserves to prevent or minimize disturbance to pond turtles and/or their habitat resulting from on-site activities (i.e., livestock grazing, OHV, incompatible recreation, etc.).

- Install educational signs or display cases to educate the public and inform the public of any restrictions and the importance of not releasing unwanted pet turtles.

- Enforcement of above restrictions.

- Maintain or improve habitat quality by removing exotic plant species, monitoring and improving water quality if necessary (i.e., the source of contamination at the westernmost pond at 4S Ranch should also be identified and resolved to improve the water quality at this site), etc.

- Develop and implement a program to reduce (eliminate if possible) non-native aquatic species that may have negative effects on pond turtles (African clawed-frogs, bullfrogs, large mouth bass).

- Monitor the status of pond turtle populations to track population trends.

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Table 1. Arroyo toad and western pond turtle survey locations.

This table shows a list of sites surveyed for arroyo toads and/or western pond turtles in the MSCP in 2002. The table also shows where arroyo toads, western pond turtles, and non-native turtles were detected and the resulting habitat ranking for each species. A check (✓) denotes that the species was detected. Abbreviations for survey type for arroyo toads are as follows: D = daytime habitat assessment and N = nocturnal focused survey. Habitat suitability definitions for arroyo toads are in the report text. Abbreviations for survey type for western pond turtles are: R= reconnaissance, V = visual, and T = trapping. Abbreviations for habitat suitability ranking for western pond turtles is as follows: NS = not suitable in 2002 and PS = potentially suitable. PS* (with asterisk*) signifies that a site was assigned low priority for trapping in 2002 because suitable habitat within the site was limited.

Site Number	Site Name	Arroyo Toad			Western Pond Turtle			Non-native Turtles
		Survey Type	Habitat Suitability Ranking	Detected	Survey Type	Habitat Suitability Ranking	Detected	Detected
1	**Boden Canyon Ecological Reserve**	D, N	High	✓	V, T	PS*		
2	**Bernardo Lakes**	Not surveyed			V	PS		
3	**Lusardi Creek Preserve Lands**	D	Poor		V, T	PS*		
4	**Fairbanks Ranch, San Diegito River**	D	High		V	PS		
5	**4S Ranch**	D	Poor		V, T	PS	✓	
6	**San Vicente Creek (below Kimball Valley)**	D, N	High		V	PS		
7	**San Vicente Open Space Preserve, Foster Valley**	D	Poor		R	NS		
8	**San Vicente Reservoir**	Not surveyed			V, T	PS		
9	**Sycamore Canyon/Gooden Ranch Open Space Preserves**	D	Poor		V	PS*		
10	**Los Penasquitos Canyon Preserve**	D	Poor		V, T	PS	✓	✓
11	**Torrey Pines State Reserve**	Not surveyed			V, T	PS		✓
12	**El Monte County Park**	Not surveyed			R	NS		
13	**Louis Stelzer Open Space Preserve**	D	Poor		V	NS		

Table continued on next page

Site Number	Site Name	Arroyo Toad			Western Pond Turtle			Non-native Turtles
		Survey Type	Habitat Suitability Ranking	Detected	Survey Type	Habitat Suitability Ranking	Detected	Detected
14	Carlton Oaks	D	Poor		V, T	PS		✓
15	Mission Trails Regional Park, Kumeyaay Lakes	D, E	Marginal		T	PS		✓
16	Mission Trails Regional Park, San Diego River	D	Poor		V, T	PS		✓
17	Mission Valley, San Diego River (First San Diego River Improvement Project (FSDRIP))	D	Poor		V	PS		✓
18	Sycuan Peak Ecological Reserve, Sweetwater River	D, N	Marginal		V, T	PS	✓	
19	Sycuan Peak Ecological Reserve, Lawson Creek	D	Marginal		V	PS		
20	San Diego National Wildlife Refuge, Sweetwater River	Not surveyed			V, T	PS		
21	Sweetwater Reservoir	Not surveyed			V	PS		✓
22	Sweetwater County Park, includes Sweetwater River and Morrison Pond	D	Poor		V, T	PS		✓
23	Hollenbeck Canyon Wildlife Area, Hollenbeck Creek	D, N	Marginal		V, T	PS		
24	Hollenbeck Canyon Wildlife Area, Honey Springs drainage	D	Poor		V	NS		
25	Rancho Jamul Ecological Reserve, Jamul Creek (includes pump pond)	D	Marginal		V, T	PS		
26	Hollenbeck Canyon Wildlife Area, Dulzura Creek	D	Marginal		V, T	PS		
27	Hollenbeck Canyon Wildlife Area, Pringle Creek	D	Poor		V	NS		
28	Otay Mountain - Sycamore Canyon	D	Marginal		Not surveyed			
29	Otay Mountain - Cedar Canyon	D	Poor		Not surveyed			

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Site Number	Site Name	Arroyo Toad			Western Pond Turtle			Non-native Turtles
		Survey Type	Habitat Suitability Ranking	Detected	Survey Type	Habitat Suitability Ranking	Detected	Detected
30	Otay Lakes, Upper	Not surveyed			V, T	PS		✓
31	Otay Lakes, Lower	Not surveyed			V, T	PS		✓
32	Otay Valley Regional Park, Upper Otay River	D	High		V	PS*		
33	Otay Mountain - O'Neil Canyon	D	Poor		Not surveyed			
34	Otay Valley Regional Park, Lower Otay River	D	Poor		R	PS		
35	Marron Valley, Cottonwood Creek	D, N	High	✓	V	PS*		
36	Tecate Creek - Marron Valley	D	Good		Not surveyed			
37	Tijuana Creek - Marron Valley	D	Good		Not surveyed			
38	Tijuana River Valley Park, Miscellaneous Ponds	D	Poor		V, T	PS		✓
39	Tijuana River Valley Park, Dairy Mart Pond	Not surveyed			V	NS		
40	Tijuana River Valley Park, Tijuana River	Not surveyed			R	NS		

Table 2. Amphibian and reptile species detected on arroyo toad surveys.

This table shows the native and non-native species detected on arroyo toad surveys by site. Additional species detected on pond turtle surveys are not included here but, will appear in the final report.

	Native amphibians					Native snake	Non-native amphibians		Non-native fish and crustaceans					
	Western spadefoot toad	California toad	Arroyo toad	Pacific tree frog	California tree frog	Two-striped garter snake	African clawed-frog	Bullfrog	Crayfish	Mosquito-fish	Fathead minnow	Green sunfish	Large-mouth bass	Goldfish
Boden Canyon Ecological Reserve		✓	✓	✓	✓			✓	✓	✓			✓	
Lusardi Creek Preserve Lands									✓	✓				
Fairbanks Ranch, San Diegito River		✓		✓										
4S Ranch		✓		✓						✓				
San Vicente Creek (below Kimball Valley)				✓	✓			✓	✓	✓		✓		
San Vicente Open Space Preserve / Foster Valley				✓										
Sycamore Canyon / Gooden Ranch Open Space Preserves				✓			✓							✓
Los Penasquitos Canyon Preserve				✓				✓	✓	✓		✓	✓	
Louis Stelzer Open Space Preserve				✓										
Carlton Oaks TET									✓	✓			✓	
Mission Trails Regional Park, Kumeyay Lakes				✓										
Mission Trails Regional Park, San Diego River				✓					✓	✓		✓	✓	
Mission Valley, San Diego River (First San Diego River Improvement Project (FSDRIP))									✓	✓	✓		✓	
Sycuan Peak Ecological Reserve, Sweetwater River				✓	✓	✓	✓	✓	✓	✓		✓		
Sycuan Peak Ecological Reserve, Lawson Creek														
Sweetwater County Park, includes Sweetwater River and Morrison Pond				✓			✓	✓	✓	✓				

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	Native amphibians					Native snake	Non-native amphibians		Non-native fish and crustaceans					
	Western spadefoot toad	California toad	Arroyo toad	Pacific tree frog	California tree frog	Two-striped garter snake	African clawed-frog	Bullfrog	Crayfish	Mosquito-fish	Fathead minnow	Green sunfish	Large-mouth bass	Goldfish
Hollenbeck Canyon Wildlife Area, Hollenbeck Creek				✓										
Hollenbeck Canyon Wildlife Area, Honey Springs Drainage														
Hollenbeck Canyon Wildlife Area, Dulzura Creek				✓			✓		✓	✓			✓	
Hollenbeck Canyon Wildlife Area, Pringle Creek				✓	✓	✓	✓							
Otay Mountain - Sycamore Canyon														
Otay Mountain - Cedar Canyon														
Rancho Jamul Ecological Reserve, Jamul Creek														
Otay Valley Regional Park, Upper Otay River				✓	✓			✓	✓	✓		✓		
Otay Mountain - O'Neil Canyon				✓	✓									
Otay Valley Regional Park, Lower Otay River				✓				✓	✓	✓				
Marron Valley - Cottonwood Creek	✓		✓	✓	✓									
Tijuana River / Tecate Creek - Marron Valley														

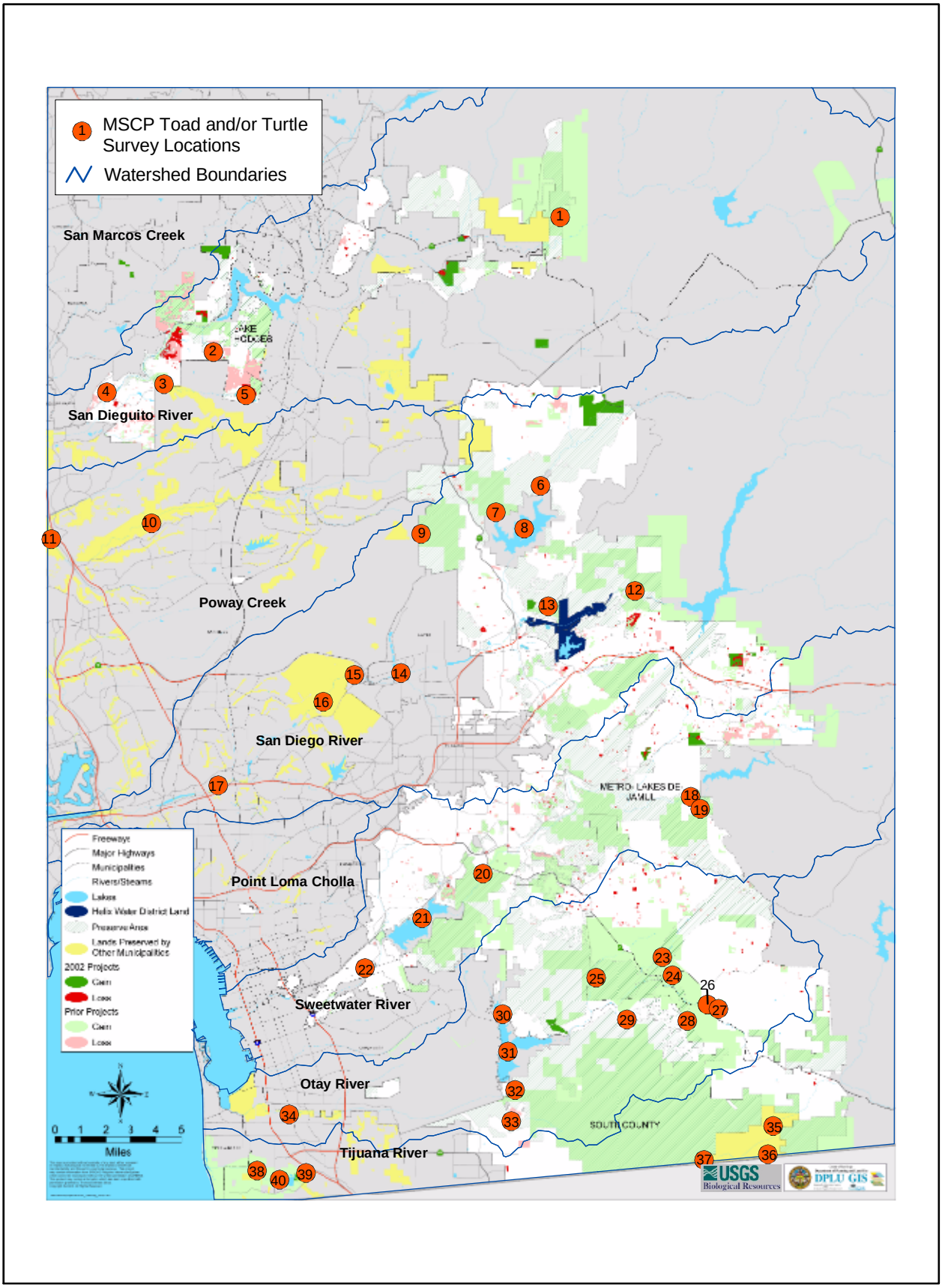

Figure 1. Map of sites surveyed for arroyo toads and western pond turtles in 2002. This map shows the 40 points surveyed for arroyo toads and/or western pond turtles. Not all sites were surveyed for both species. Site names are found in Table 1. Centralized points are shown for survey locations on map. These points represent a generalized location within a larger survey reach in the field.

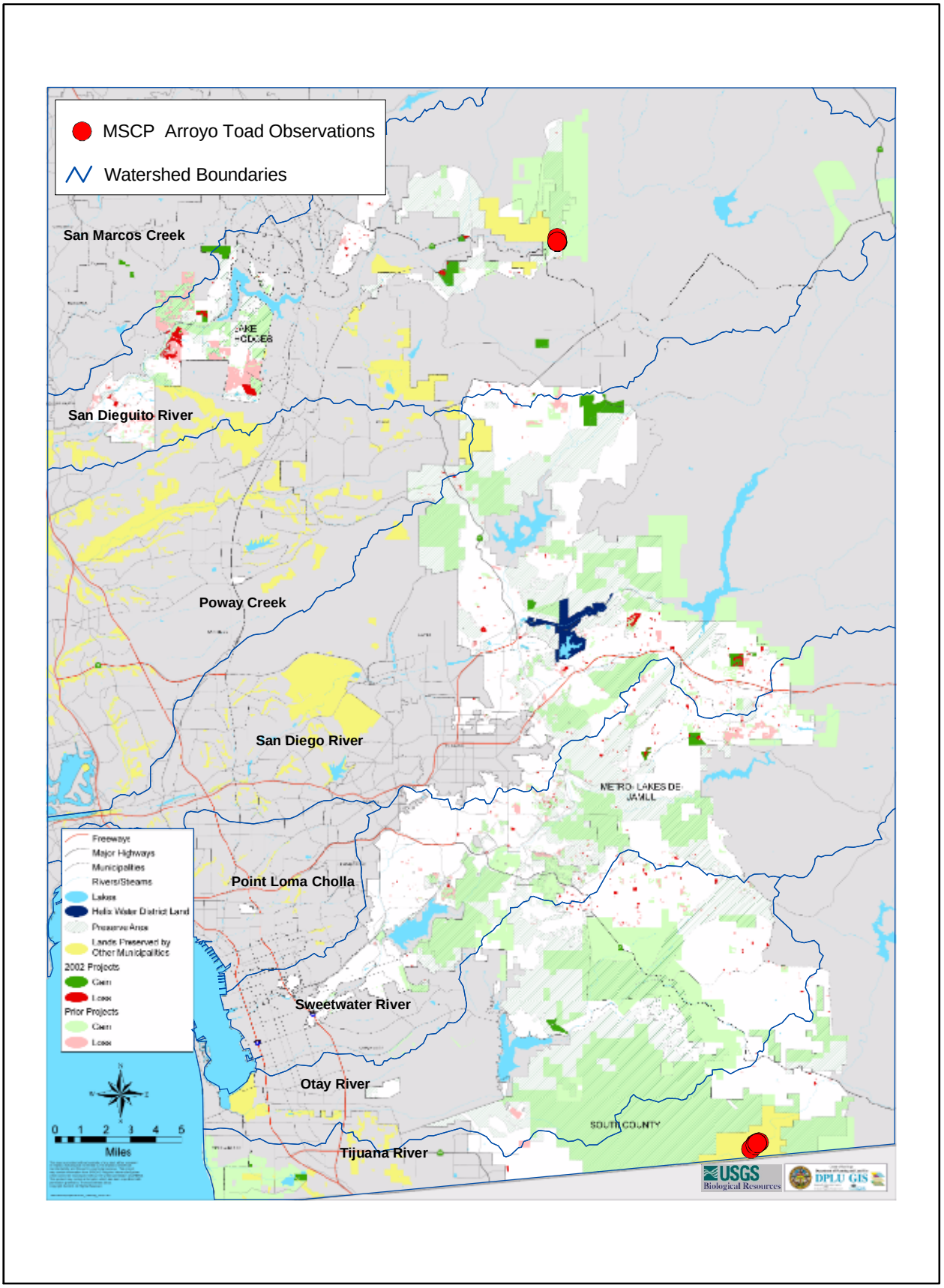

Figure 2. Map of arroyo toad observations located during nocturnal surveys in 2002.

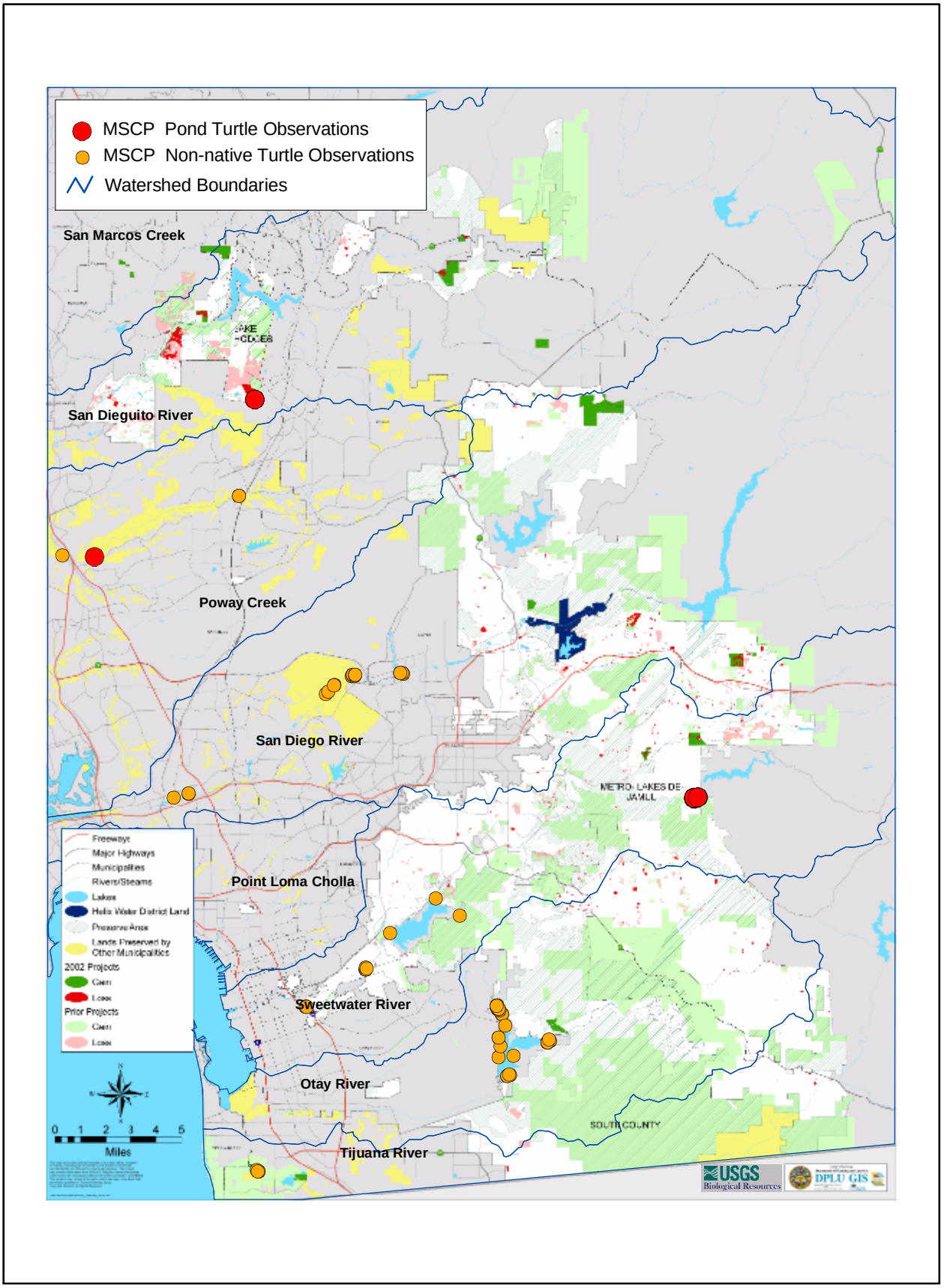

Figure 3. Map of turtle observations in 2002. Red dots denote locations of western pond turtles observed on visual and trapping surveys in 2002. Orange dots represent locations where non-native turtles were observed during these surveys. Additional non-native turtle observations were made on arroyo toad surveys and are not represented here. These additional data will be incorporated into the final report.

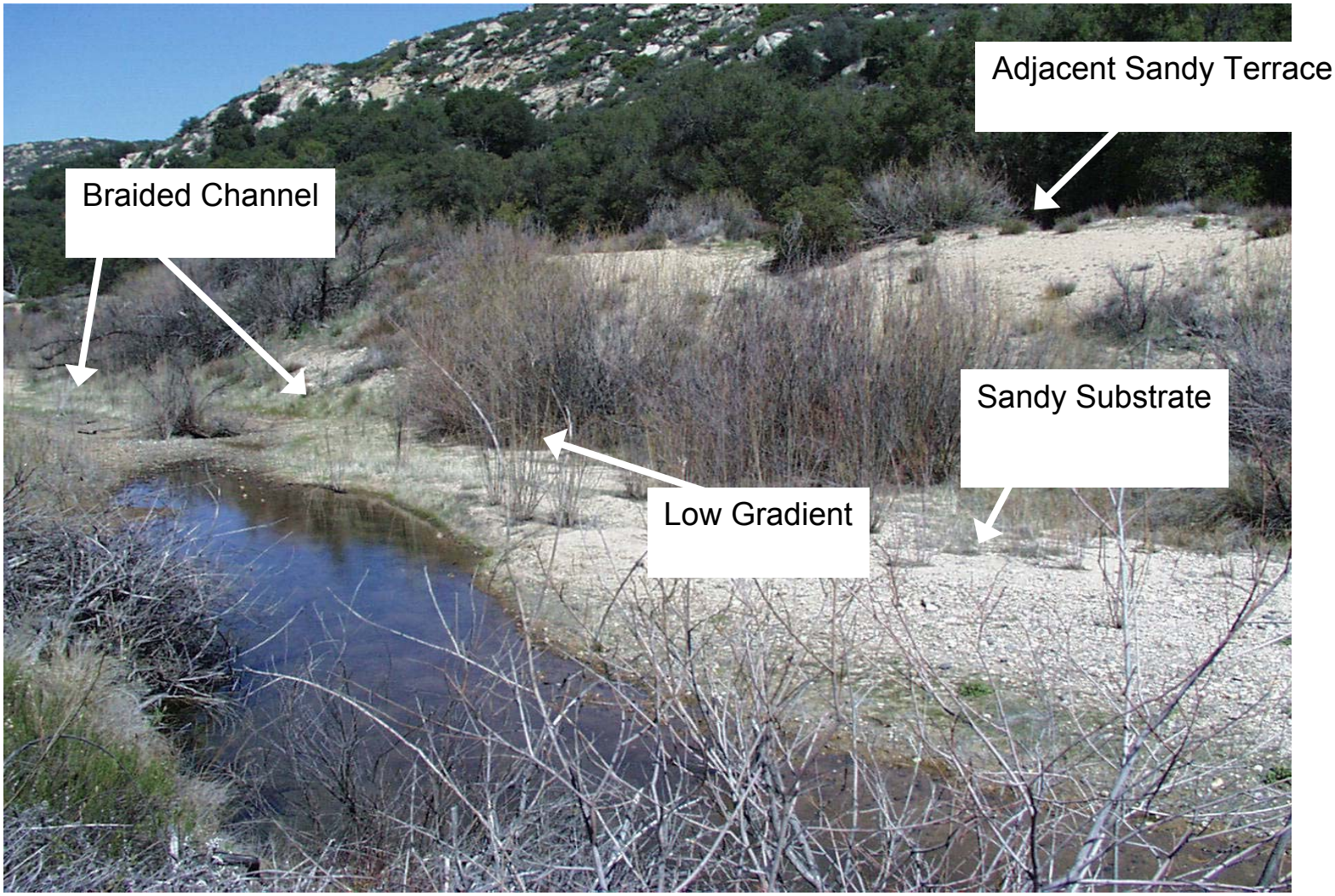

Figure 4. Habitat requirements of the arroyo toad.
This diagram shows the four components of arroyo toad habitat including: low gradient, sandy substrate, braided channel, and adjacent sandy terraces.

Figure 5. Various qualities of arroyo toad habitat.
These figure show examples for sites ranked high, good, marginal, and poor for arroyo toads using criteria described for daytime habitat suitability surveys.

Figure 6. Western pond turtle.

A photo of a western pond turtle *Clemmys marmorata.*

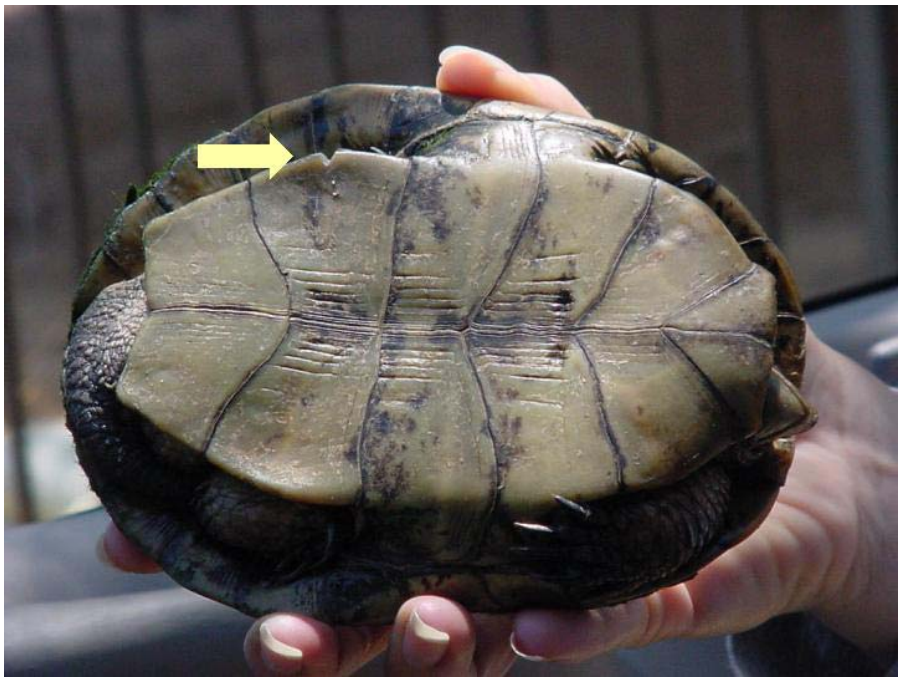

Figure 7. Western pond turtle plastron and notch.

The yellow arrow points to a notch placed in each western pond turtle's plastron that will signify that this animal was captured on a previous date in the event that the PIT tag fails.

Figure 8. Red-eared slider.
A photo of a red-eared slider *Trachmys scripta elegans.*

Figure 9. Yellow-bellied slider.
A photo of a yellow-bellied slider *Trachemys scripta scripta*.

Figure 10. Undetermined slider species.
A photo of a undetermined species thought to be in the genus *Trachemys*.

Figure 11. Painted turtle.
A photo of a painted turtle *Chrysemys picta*.

Figure 12. Mud turtle.

A photo of a mud turtle *Kinosternon spp*.

Figure 13. False map turtle.

A photo of a false map turtle *Graptemys psuedogeograohica*. Photo courtesy of the San Diego Natural History Museum.