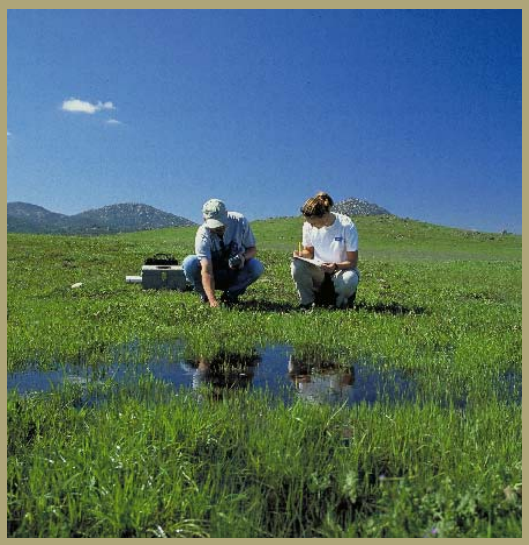
City of San Diego

Vernal Pool And Quino Habitat Restoration Project Implementation Report



January 2010

Prepared for:
City of San Diego
Multiple Species Conservation Program
202 C Street, Mail Station 5A
San Diego, CA 92101
Phone: (619) 533-4543

Prepared by:
AECOM
1420 Kettner Boulevard
Suite 500
San Diego, CA 92101
Phone: (619) 233-1454

In Cooperation with:

County of San Diego
9150 Chesapeake Drive, Suite 200
San Diego, CA 92123
Phone: (858) 694-3030

U.S. Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, California 92009
Phone: (760) 431-9440

San Diego Association of Governments
401 B Street, Suite 800
San Diego, California 92101
Phone: (619) 699-1916

California Department of Fish and Game
4949 Viewridge Avenue
San Diego, California 92123
Phone: (858) 467-4234

California Energy Commission
1516 9th Street MS 2000
Sacramento, California 95814
Phone: (916) 653-1639

AECOM

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VERNAL POOL AND QUINO HABITAT RESTORATION PROJECT
IMPLEMENTATION REPORT

Prepared for:

City of San Diego
Multiple Species Conservation Program
202 C Street, Mail Station 5A
San Diego, California 92101
Phone: (619) 533-4543
Contact: Jeanne Krosch

In Cooperation with:

County of San Diego
9150 Chesapeake Drive, Suite 200
San Diego, California 92123
Phone: (858) 694-3030

San Diego Association of Governments
401 B Street, Suite 800
San Diego, California 92101
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1516 9th Street, MS 2000
Sacramento, California 95814
Phone: (916) 653-1639

Prepared by:

AECOM
1420 Kettner Boulevard, Suite 500
San Diego, California 92101
Phone: (619) 233-1454
Contact: Scott McMillan

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CHAPTER 1.0
INTRODUCTION

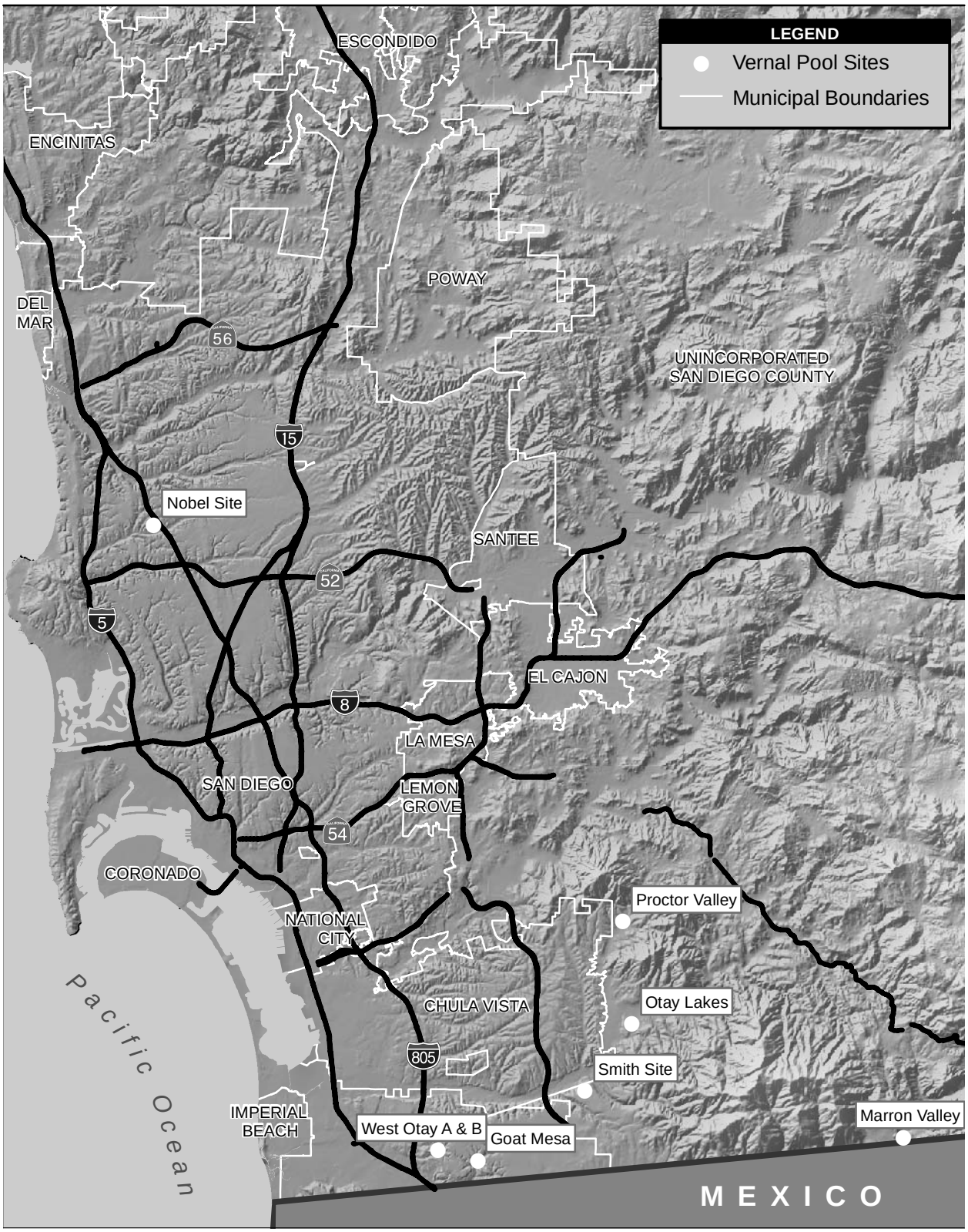
1.1 PROJECT OVERVIEW

Vernal pool habitat in southern California, and specifically southern San Diego County, has been greatly diminished as a result of extensive development throughout the region. The value and function of remaining vernal pool habitat continue to be degraded by development-related disturbances such as trespassing, grazing, and invasion of nonnative species. As a result, the sensitive species that are supported by vernal pool habitat are also at risk: San Diego fairy shrimp (*Branchinecta sandiegonensis*), Riverside fairy shrimp (*Streptocephalus woottoni*), and Quino checkerspot butterfly (*Euphydryas editha quino*; Quino), which are all federally endangered species, as well as the federally and state listed San Diego button-celery (*Eryngium aristulatum* var. *parishii*) and the federally threatened spreading navarretia (*Navarretia fossalis*). To halt the decline and stabilize the vernal pools in San Diego County, and restore habitat function and sensitive species populations, restoration and management actions are necessary.

The City of San Diego (City), in cooperation with other coordinating agencies such as the County of San Diego (County), San Diego Association of Governments (SANDAG), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and California Energy Commission (CEC), obtained grant funding[1] to protect, restore, and manage portions of the remaining vernal pool habitat in southern San Diego County. AECOM (formerly EDAW, Inc.) was retained by the City to conduct a comprehensive assessment of existing vernal pool sites within the jurisdiction of the City and County, develop and prioritize recommendations for restoration and management of those sites, and implement restoration and management of the sites.

This report summarizes the results of implementation of the restoration and management recommendation actions at five key vernal pool sites in the County, as shown in Figure 1 (Nobel Drive, Goat Mesa, Otay Lakes, Proctor Valley, and Marron Valley). More detailed maps of each site are provided in Figures 2 through 6. Chapters 2.0 through 6.0 of the report correspond to a specific site. Within each of these chapters, a description of the restoration and management actions undertaken at the site are included (i.e., dethatching, weeding, reseeding, recontouring of

[1] Funding for the project was provided by SANDAG's TransNet Environmental Mitigation Program and mitigation funds released by USFWS to SANDAG for a CEC energy facility in Otay Mesa.



Source: USGS 2000; SanGIS 2007

5 2.5 0 5 Miles

Scale: 1:316,800; 1 inch = 5 miles

Figure 1
Vernal Pool Site Locations

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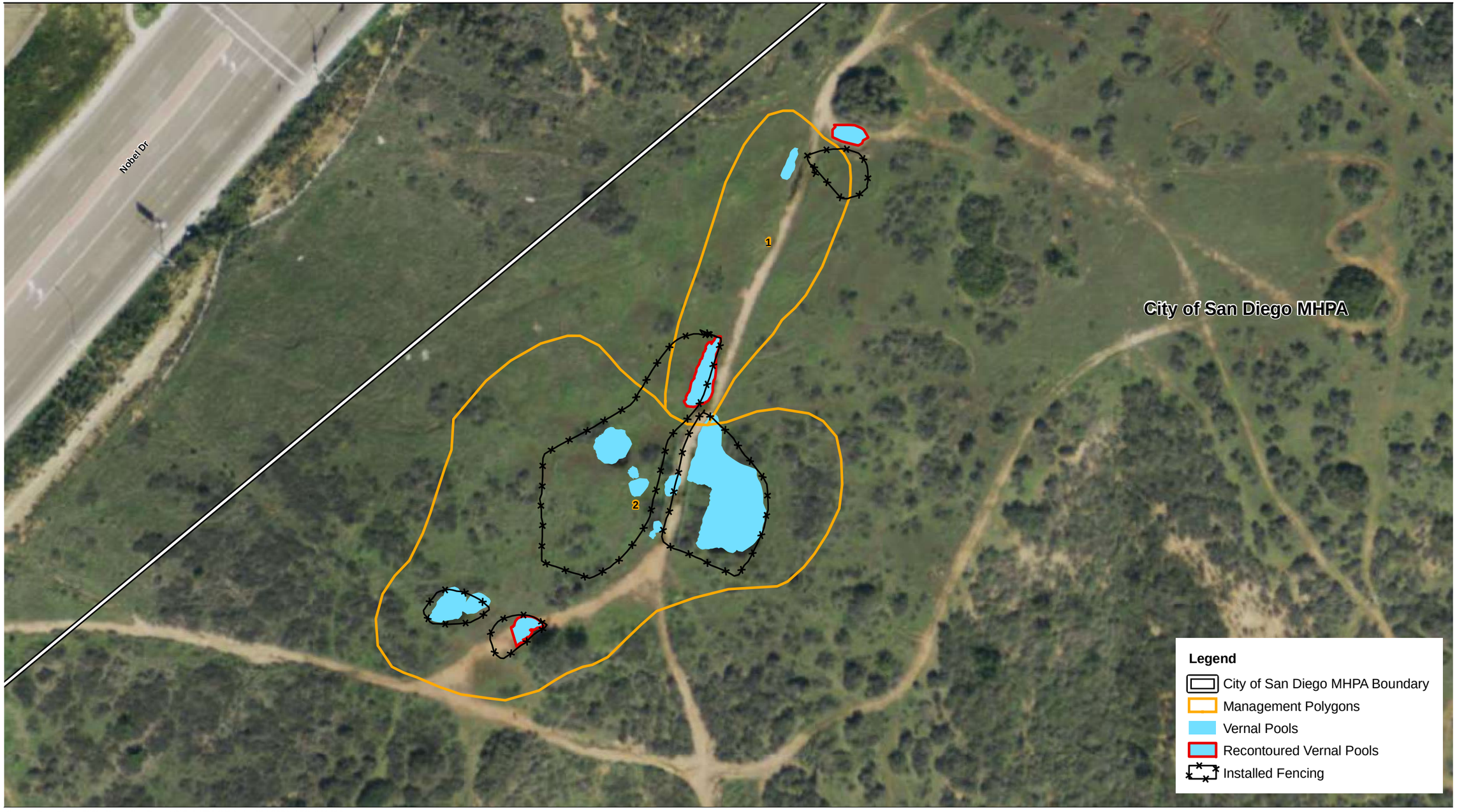

Source: DigitalGlobe 2008; City of San Diego 2003; MHPA 2003; SanGIS 2009; AECOM 2010

75 37.5 0 75 Feet

Scale: 1 = 900; 1 inch = 75 feet

Figure 2
Nobel Drive

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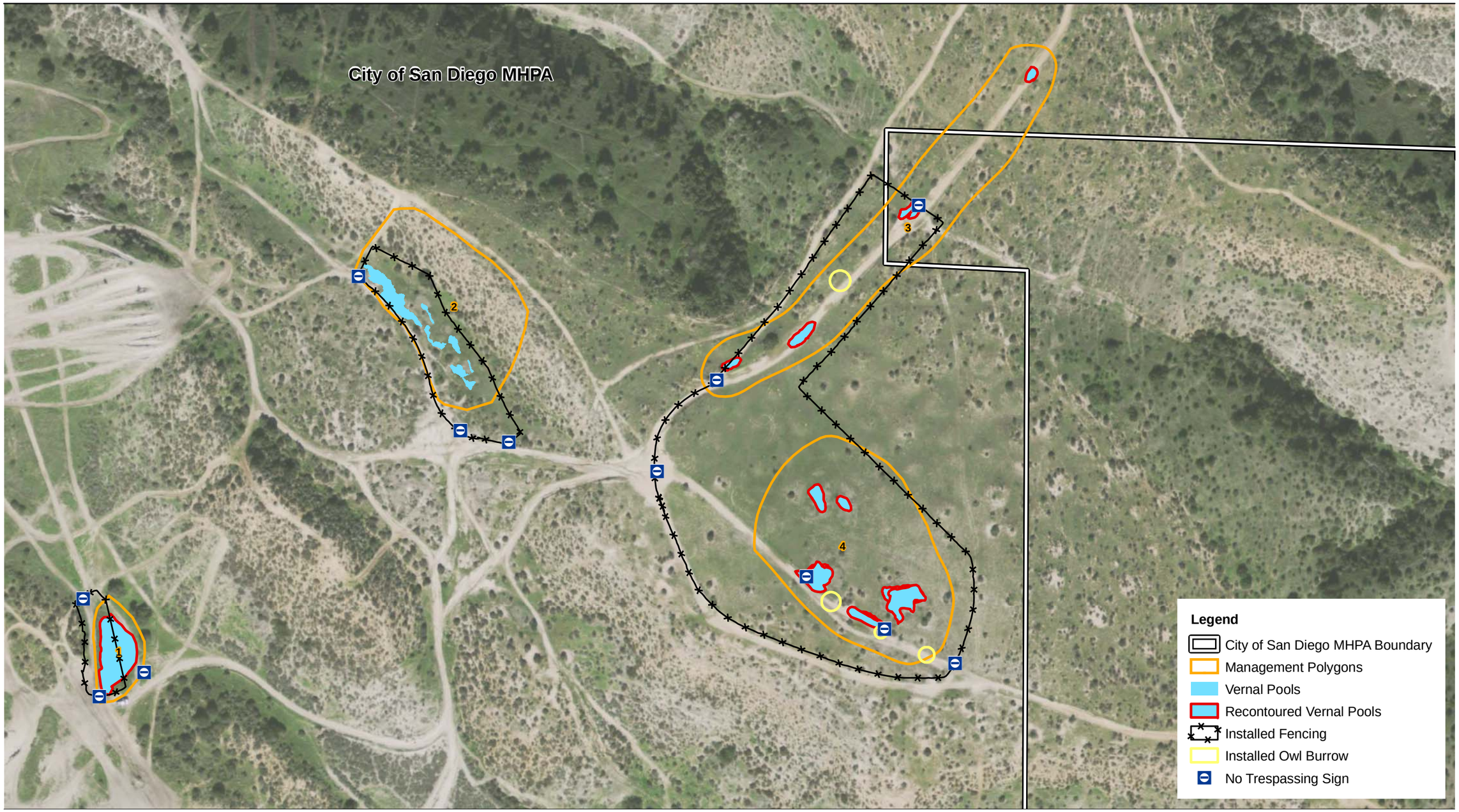

Source: DigitalGlobe 2008; City of San Diego 2003; MHPA 2003; SanGIS 2009; AECOM 2010

150 75 0 150 Feet

Scale: 1 = 1,800; 1 inch = 150 feet

Figure 3
Goat Mesa

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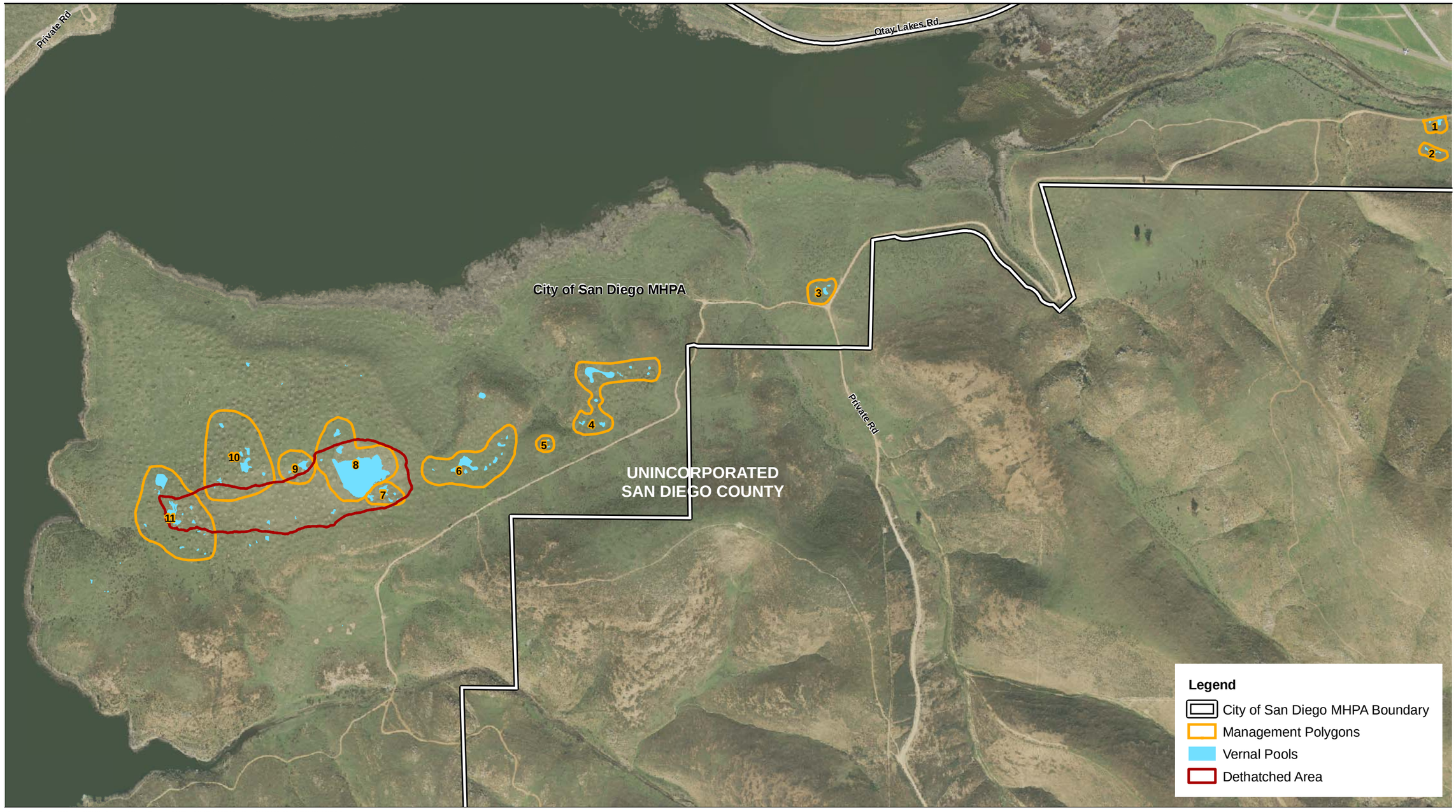

Source: DigitalGlobe 2008; City of San Diego 2003; MHPA 2003; SanGIS 2009; AECOM 2010

750 375 0 750 Feet

Scale: 1 = 9,000; 1 inch = 750 feet

Figure 4
Otay Lakes

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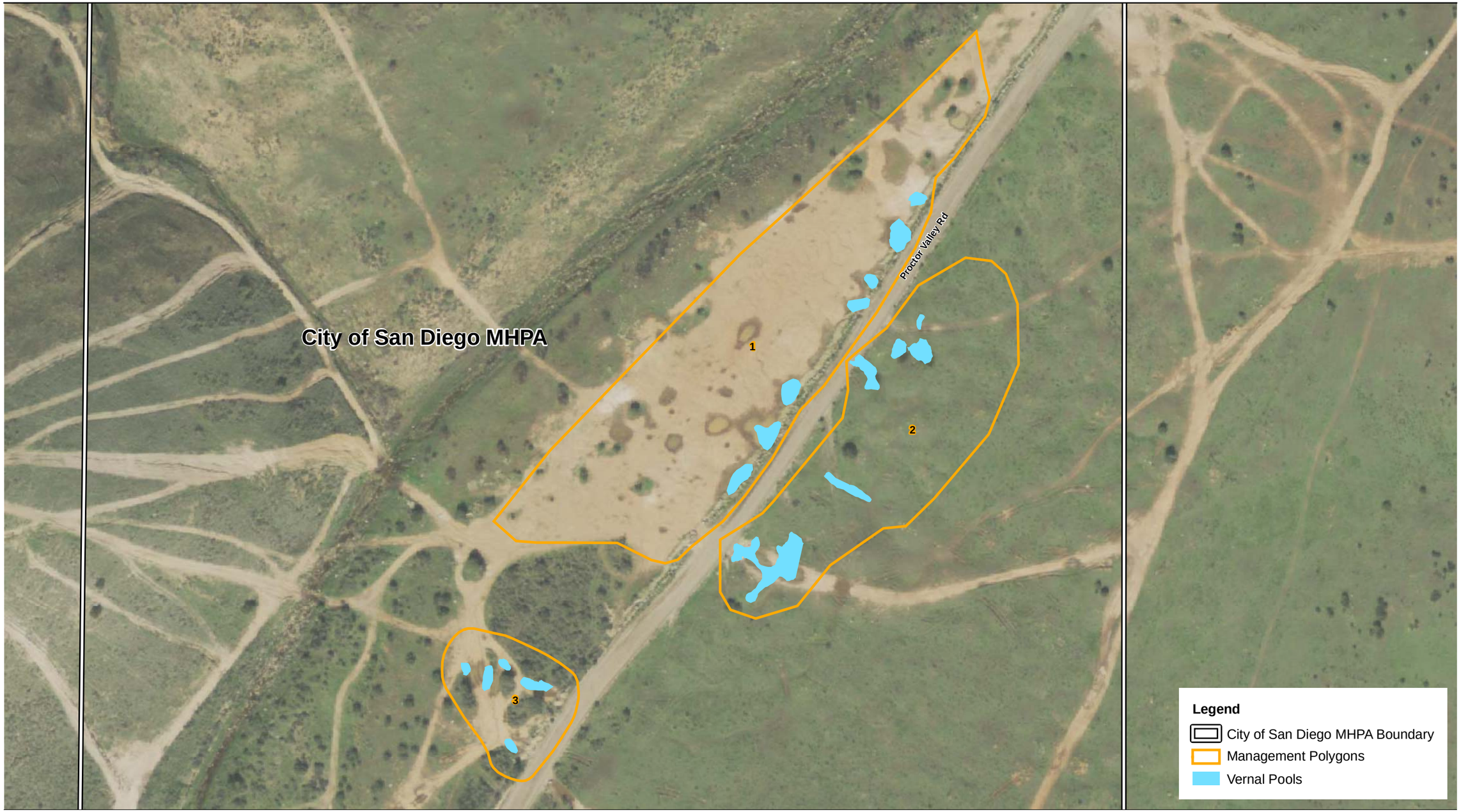

Source: DigitalGlobe 2008; City of San Diego 2003; MHPA 2003; SanGIS 2009

125 62.5 0 125 Feet

Scale: 1 = 1,500; 1 inch = 125 feet

Figure 5
Proctor Valley

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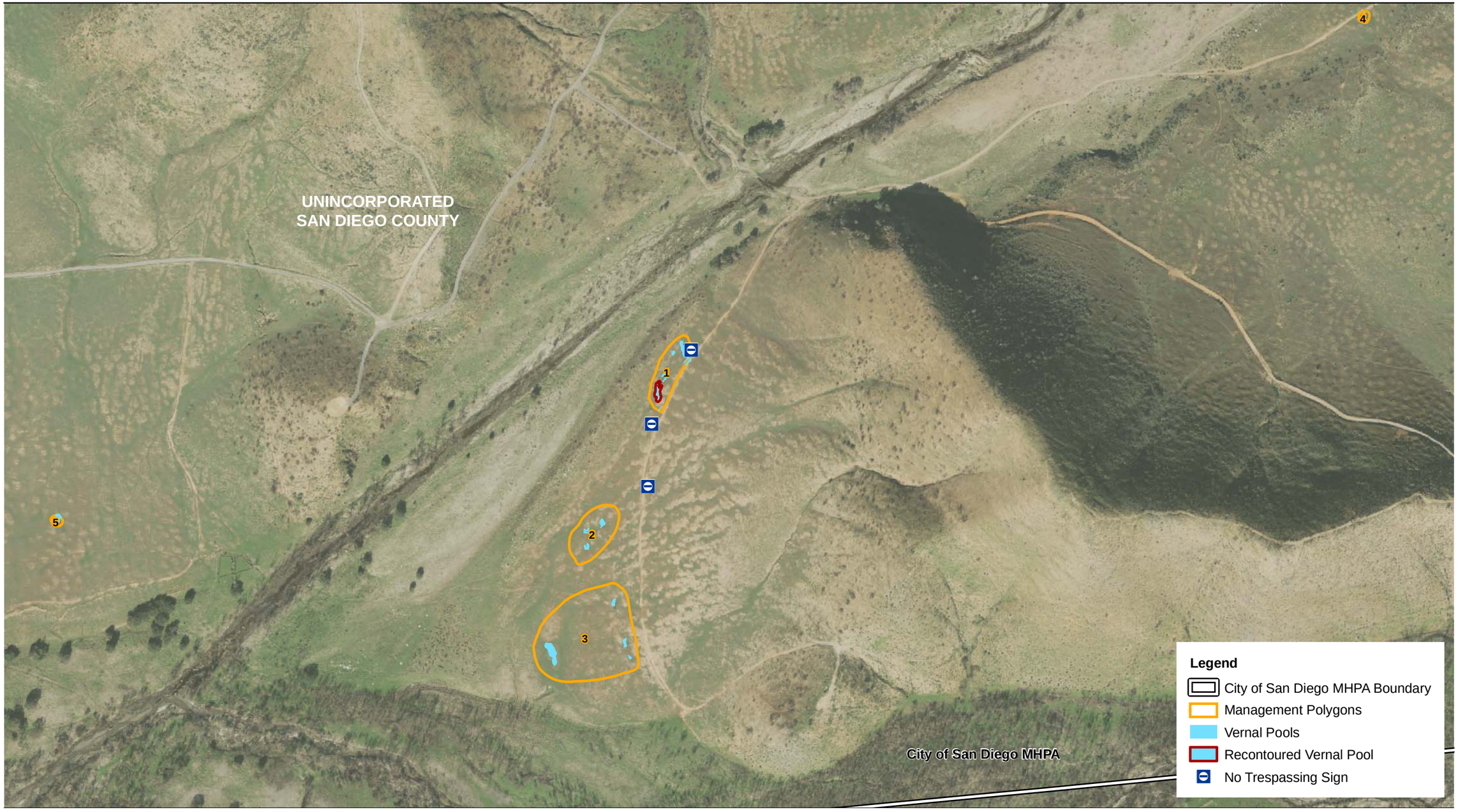

Source: DigitalGlobe 2008; City of San Diego 2003; MHPA 2003; SanGIS 2009; AECOM 2010

400 200 0 400 Feet

Scale: 1 = 4,800; 1 inch = 400 feet

Figure 6
Marron Valley

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vernal pools, installation of artificial burrowing owl burrows, and/or access control). A summary of the site condition following implementation of the restoration and management effort and comparison to pre-implementation site conditions is then provided. Finally, Chapter 7.0 includes recommendations for future restoration and management activities at each of the five vernal pool sites, as well as general costs associated with the recommended actions.

1.2 GOALS AND OBJECTIVES

The main objective of this project was to implement the necessary restoration and management actions to stabilize and aid recovery of vernal pools and sensitive species associated with vernal pools, specifically the Quino, in San Diego County. While it addresses only a portion of the entire remaining vernal pool habitat in the region, this project will help develop an efficient and effective process that can be used as a model for future vernal pool restoration and management efforts.

The restoration and management actions described in this report have been implemented to accomplish the following specific goals from the USFWS Vernal Pool Recovery Plan (1998):

- Goal 2: Reestablish vernal pool habitat to historic structure and composition to increase genetic diversity and population stability
- Goal 3: Rehabilitate and enhance secured vernal pool habitats and their constituent species
- Goal 4: Manage protected habitat

1.3 PROJECT BACKGROUND

The project initially involved a historical data review and assessment of seven sites within the jurisdiction of the County of San Diego or the City during the spring and summer of 2007. Figure 1 shows the general location of each site within San Diego County.

Following an assessment of seven vernal pool sites in the City (Nobel Drive, Goat Mesa, Otay Lakes, Proctor Valley, and Marron Valley, West Otay A & B, and the Smith Site), AECOM prepared a draft report, entitled *City of San Diego Vernal Pool and Quino Habitat Restoration and Management Recommendations Report* (Recommendations Report) that included recommended restoration and management actions for each of the sites (EDAW 2007). In August 2007, AECOM met with representatives from the City and the other coordinating

agencies to determine what recommendations should be implemented at each site. The final Recommendations Report was submitted to the City and coordinating agencies in October 2007. However, prior to implementation, two of the sites (West Otay A & B and the Smith Site) were determined by the City to be ineligible for restoration work due to safety concerns (potential unexploded ordnances on the Smith Site) and legal constraints with access and ownership. Accordingly, the City directed AECOM to implement the recommended restoration and management actions at the five remaining sites (Nobel Drive, Goat Mesa, Otay Lakes, Proctor Valley, and Marron Valley).

For a detailed description of the sites prior to restoration activities and a general discussion of the different types of restoration and management activities, refer to the final Recommendations Report (EDAW 2007).

The implementation period occurred between October 2007 and February 2009. Throughout that period, some adaptive modifications to the original site recommendations were necessary due to various factors, such as changes in site conditions (e.g., damage from off-road vehicles), detection of previously undetected sensitive species (e.g., little mouse tail [*Myosurus minimus*] at Marron Valley), and availability of funding from other sources to implement management recommendations (e.g., potential funding from the Otay Ranch Preserve Owner/Manager for fencing at the Proctor Valley site). AECOM worked with the City through the implementation phase to make adaptive management decisions to prioritize the most appropriate restoration and management actions at each site. This report is a follow-up to the Recommendations Report and summarizes the activities that were implemented at each site.

As part of the implementation phase and final report preparation, AECOM biologists conducted qualitative assessments of the vernal pools and upland areas in 2008 and 2009. This qualitative assessment was conducted on the same vernal pools and upland areas that were surveyed in the original Recommendations Report so that a qualitative comparison of site conditions before and after habitat restoration could be provided.

CHAPTER 2.0
NOBEL DRIVE

Prior to implementation of restoration activities at Nobel Drive (Figure 2), the vernal pool and upland habitat value at the site was relatively high, with most of the vernal pool habitat protected by existing fencing and management by the City Park Ranger. Nobel Drive is part of a larger open space area that is actively used by hikers, mountain bikers, and other visitors. The site is intended for some recreational uses, so site access has been maintained except where it was affecting the vernal pools or the vernal pool watershed.

The restoration and management work at Noble Drive was conducted over approximately 1.7 acres and included nine vernal pools.

2.1 RESTORATION AND MANAGEMENT ACTIONS IMPLEMENTED ON-SITE

2.1.1 Dethatching

The entire complex of nine vernal pools at Nobel Drive was dethatched, along with the upland buffer area surrounding the basins.

2.1.2 Weeding

Nobel Drive was dethatched using weed eaters to cut the extensive nonnative grass cover and *Erodium* sp. After cutting the nonnative plants, the material was raked into piles and gas powered blowers were used to help concentrate the weed seed and biomass. The biomass was hauled off-site for green waste recycling. Three separate exotic control visits were conducted using herbicide in the upland areas and hand pulling of the vernal pool weeds. The more difficult weeds to control on the site were lythrum hyssopifolium (*hyssop loosestrife*) and brass buttons (*Cotula coronopifolia*) in the vernal pools, which mature quickly and drop seed. Repeated visits allowed removal prior to seed set of these species.

2.1.3 Recontouring/Topographic Reconstruction

Most of Nobel Drive was already protected by existing fencing, so the vernal pool basins were relatively undisturbed prior to restoration activities. Three vernal pools that were not within the

fenced areas were impacted by past vehicle activity and recent hiking and mountain biking activities. Following dethatching and weeding, these three pools (Figure 2) were recontoured with a small Bobcat and a skid sprayer hauling water for compaction. Grading work was conducted during June 2008. The grading enlarged the vernal pool area and allowed for a more natural shape rather than the linear condition, which was caused by vehicles driving through the pools. After the dethatching work was complete, the vernal pool plant seed visible on the surface was collected into cardboard boxes. The surface of the soil was then removed with shovels and hand tools to collect the top portion of the soil profile containing vernal pool propagules. This material was temporarily set aside to allow the recontouring and grading work to continue with minimal loss of propagules. After the rough grading work was complete, the upper portion of the soil was placed back into the basins for reestablishment. The seed material was then placed back into the completed basins.

2.1.4 Seeding

Seeds of several species of vernal pool plants, including spreading navarretia, wooly marbles (*Psilocarphus tenellus* var. *tenellus*), annual hair grass (*Deschampsia danthonioides*), and Howell's foxtail (*Alopecurus saccatus*), were collected in spring 2008 prior to dethatching and redistributed in the pools in November 2008 to enhance populations of these species.

2.1.5 Access Control

Approximately 1,528 linear feet of fencing consisting of steel T-posts and three strands of barbless wire was installed around the previously unfenced pools at Nobel Drive (Figure 2). The fencing protects the pools by directing foot and bicycle traffic away from the vernal pools, while maintaining access to the existing trail system.

2.2 SITE CONDITION FOLLOWING IMPLEMENTATION

Table 1 provides a comparison of the site conditions prior to and following implementation of restoration activities. As shown, the federally endangered spreading navarretia population expanded from 20 individuals in one pool to approximately 100 individuals within two pools. Nonnative cover was reduced substantially in both the upland and vernal pool habitat, with no disruption to the plantago (*Plantago erecta*) cover, which remained constant. Plantago is a Quino host species and a key component of viable Quino habitat.

Table 1
Summary of Site Conditions for Nobel Drive

Observation Data	Historical Conditions	EDAW 2007 Recommendations Report	AECOM 2008–2009 Data
Sensitive Species			
San Diego fairy shrimp (*Branchinecta sandiegonensis*)	6 pools	Surveys not conducted due to dry season	5 pools
Spadefoot toad (*Spea hammondii*)	1 pool	Surveys not conducted due to dry season	2 pools
Spreading navarretia (*Navarretia fossalis*)	1 pool, 20 individuals total (2001)	Not found	2 pools, approximately 100 individuals total
Nonnative Plant Percent Cover			
Upland	No data available	Polygon 1 = 95 Polygon 2 = 95 **Average = 95**	Polygon 1 = 35 Polygon 2 = 15 **Average = 25**
Vernal pool	No data available	Polygon 1 = 65 Polygon 2 = 25 **Average = 45**	Polygon 1 = 15 Polygon 2 =5 **Average = 10**
Plantago percent cover	No data available	Polygon 1 = 5 Polygon 2 = 5 **Average = 5**	Polygon 1 = 5 Polygon 2 = 5 **Average = 5**

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CHAPTER 3.0
GOAT MESA

Prior to implementation of restoration activities, the vernal pool and upland habitats at the Goat Mesa site (Figure 3) were heavily impacted by both grazing (goat herds) and illegal off-road activities. The grazing on Goat Mesa occurred for more than 10 years, and, in that time, the pools transitioned from nearly pristine pools to severely degraded habitat. Grazing did help to maintain a lower cover of nonnative plants, especially nonnative grasses, but also reduced the native plant cover. Both vernal pool (e.g., San Diego button-celery) and upland (e.g., Jojoba [*Simmondsia chinensis*]) plant species were reduced in cover and density because of grazing. In recent years, disturbance from illegal off-road activity in the general Spring Canyon area and the associated mesas has become the biggest threat to the habitat, with some areas completely devoid of vegetation as a result of off-road vehicles (ORVs). This problem is not unique to Goat Mesa, as most of the Spring Canyon area and the adjacent mesas have suffered from repeated ORV activity. However, even with the high level of ORV activity and grazing, Goat Mesa still supported vernal pools and upland areas with sensitive plant and animal species.

The restoration and management work at Goat Mesa was conducted over approximately 5.2 acres and included 17 vernal pools.

3.1 RESTORATION AND MANAGEMENT ACTIONS IMPLEMENTED ON-SITE

3.1.1 Dethatching

Because of the goat grazing, most of the vernal pools at the Goat Mesa upper pool area did not have extensive weed cover. The exception was the slump pools on the west side of the site, where grazing did not appear to commonly occur. The lower slump pool had extensive cover of Italian ryegrass (*Lolium perenne* ssp. *multiflorum*) and curly dock, both nonnative species. The upper slump pool was also covered with nonnative species, including soft chess (*Bromus mollis*) and tocalote (*Centaurea melitensis*). Nonnative species in the slump pools were removed with dethatching. Figure 7 shows the results of dethatching on the left side of the fence. In addition, approximately 3 cubic yards of trash from an abandon campsite under laurel sumac (*Malosma laurina*) shrubs was removed for off-site disposal at a landfill.

Figure 7. Fence separating dethatched area (left) from undethatched area (right)

3.1.2 Weeding

Vernal pool and grassland habitats that are being grazed typically show lower weed cover levels, but the lower cover is often a false indicator. Weeds are typically present in large quantities; they are just "managed" by the grazing animals that essentially mow the weeds, but do not remove them. Grazing can help control seed set, but it does not typically prevent the seed set entirely. Once grazing is eliminated from a site, weed cover and density tend to increase substantially.

To prevent an increase in weed cover at Goat Mesa following dethatching, herbicide was applied and weed eating/mowing was conducted. Three weed control visits were made to the site using a mixture of herbicide treatments in the uplands and hand weeding and glove herbicide for the vernal pool areas.

3.1.3 Seed Dispersal

The field crew and biologists collected and redistributed wooly marbles, annual hair grass, San Diego button celery, broad leaf pepper grass (*Lepidium latifolium*), spreading navaretia, and little mousetail in the pools after the recontouring and burrow owl mound construction was completed (see Section 3.1.5).

Seed collection, greenhouse propagation, and seeding of vernal pool plants took place to rebuild populations in the smaller pools. Plantago seed from plants that were propagated at the AECOM growing facility were redistributed in October 2009 prior to the rainy season.

3.1.4 Recontouring/Topographic Reconstruction

Almost all of the pools at the Goat Mesa site were disturbed by ORV activity, but most only suffered aesthetic impacts and not problems associated with altered hydrology. The lower slump pool had more extensive ORV damage and had altered hydrology. During June 2008, five basins (Figure 3) were topographically recontoured by a Bobcat and skiploader. A water truck to haul water was used for compacting the mounds to minimize erosion. The topographic reconstruction was designed to reestablish a more natural inundation regime by reducing the gradient to allow for better vegetation diversity establishment.

3.1.5 Artificial Burrowing Owl Burrow Installation

Although owls are not known from the site, burrowing owls are known from numerous nearby historical and current localities. The Otay Mesa area is believed to support the largest remaining population of burrowing owls on the coast in southern California, but surveys in recent years have found the species to be declining in distribution. Efforts are underway to establish multiple artificial owl burrow sites in Otay Mesa, and the Goat Mesa site was identified as an excellent addition to that program. Accordingly, four burrows were installed in conjunction with the topographic reconstruction of the basins (Figure 3). Figure 8 is a photograph showing one of the artificial burrows following installation. For a detailed description of artificial burrowing owl burrow construction methods, refer to the final Recommendations Report (EDAW 2007).

3.1.6 Access Control

To redirect ORV activity away from the pools at Goat Mesa and to restrict grazing by goats, approximately 4,562 linear feet of three-strand barbless wire fencing was installed around the basin areas, including the slump pools (Figures 3 and 9). AECOM's restoration ecologist supervised installation to minimize disturbance to the habitat. During 2008, there were several incidents of vandalism damaging the fencing (i.e., portions of the fence were cut with wire cutters). Damaged sections were repaired and no additional vandalism has been observed.

Figure 8. Artificial burrowing owl burrow

Figure 9. A fenced vernal pool

In addition to fencing, bilingual signs were installed at Goat Mesa (Figure 3) to indicate that the area is restricted. The signs included the following language:

THIS AREA IS RESTRICTED
ECOLOGICAL PRESERVE

ENTRY PROHIBITED
ES PROHIBIDO EL PASO

Your assistance is needed to protect the biological resources found
within this Preserve. Hunting, fishing, motorized vehicles,
mountain bikes, and dogs are strictly prohibited.

For more information, call:
The City of San Diego
(619) 515-3500

3.2 SITE CONDITION FOLLOWING IMPLEMENTATION

Table 2 provides a comparison of site conditions at Goat Mesa prior to and following restoration activities. As shown, expanded populations of numerous sensitive and vernal pool indicator species were observed following restoration activities, including San Diego fairy shrimp, Riverside fairy shrimp, spreading navarretia, little mousetail, and San Diego button-celery. Nonnative cover in both the upland and vernal pool habitat was substantially reduced. Plantago cover doubled at the site. In addition to the collected data shown in Table 2, a coastal California gnatcatcher (*Polioptila californica californica*), a federally threatened species and a California Species of Special Concern, was observed on-site in June 2008.

Table 2
Summary of Site Conditions for Goat Mesa

Observation Data	Historical Conditions	EDAW 2007 Recommendations Report	AECOM 2008–2009 Data
Sensitive Species			
San Diego fairy shrimp (*Branchinecta sandiegonensis*)	1 pool	Surveys not conducted due to dry season	5 pools
Riverside fairy shrimp (*Streptocephalus woottoni*)	Not detected	Surveys not conducted due to dry season	1 pools
Spadefoot toad (*Spea hammondii*)	3 pools	Surveys not conducted due to dry season	2 pools
Spreading navarretia (*Navarretia fossalis*)	Not detected	Not detected	1 pool (approx. 20 individuals)
Little mousetail (*Myosurus minimus*)	Not detected	Not detected	3 pools (approx. 500 individuals)
San Diego button-celery (*Eryngium aristulatum* spp. *parishii*)	5 pools	4 pools	6 pools (approx. 500 individuals)
Nonnative Plant Cover			
Upland	No data available	Polygon 1 = 35 Polygon 2 = 40 Polygon 3 = 35 Polygon 4 = 25 **Average = 34**	Polygon 1 = 20 Polygon 2 = 15 Polygon 3 = 5 Polygon 4 = 10 **Average = 11**
Vernal Pool	No data available	Polygon 1 = 30 Polygon 2 = 35 Polygon 3 = 5 Polygon 4 = 20 **Average = 23**	Polygon 1 = 5 Polygon 2 = 5 Polygon 3 = 5 Polygon 4 = 5 **Average = 5**
Plantago Percent Cover	No data available	Polygon 1 = 5 Polygon 2 = 0 Polygon 3 = 0 Polygon 4 = 5 **Average = 3**	Polygon 1 = 10 Polygon 2 = 5 Polygon 3 = 5 Polygon 4 = 5 **Average = 6**

CHAPTER 4.0
OTAY LAKES

The Otay Lakes (Figure 4) site has some of the highest quality vernal pool, native grassland, and clay lens habitats in San Diego County. The remote location of the site on the south side of Otay Lakes makes it difficult for illegal ORV activity and other types of trespass. Cattle grazing occurred at Otay Lakes until just a few years ago, and the site was burned during the Otay Mountain fire in 2003. Prior to the fire, the upland habitats were dominated by high-quality chamise chaparral, but now the chamise chaparral is struggling to recover due to the immediate weed invasion that followed the fire. Although illegal ORV activity is not a current problem, the U.S. Border Patrol occasionally drives through the vernal pool habitat. In addition, the Border Patrol does not generally lock the access gate to the site, resulting in the potential for future off-road trespass.

There are numerous sensitive species in both the vernal pools and the upland watershed area that benefited from the restoration and enhancement actions described below. No single vernal pool site within the City's Multiple Species Conservation Program (MSCP) preserve lands has more sensitive species than the Otay Lakes site.

The restoration and management work at Otay Lakes was conducted over approximately 38.1 acres, including 56 vernal pools.

4.1 RESTORATION AND MANAGEMENT ACTIONS IMPLEMENTED ON-SITE

4.1.1 Dethatching

Dethatching occurred over the entire 38.1 acres, including all 56 vernal pools (Figure 4). Dethatching the pools will ultimately help to stabilize the existing populations of sensitive species such as San Diego button-celery (federally and state listed as endangered), San Diego fairy shrimp (federally endangered), and spreading navarretia (federally threatened), while the watershed dethatching will improve populations of vernal pool indicator species such as variegated dudleya (*Dudleya variegata*), San Diego goldenstar (*Muilla clevelandii*), and San Diego thornmint (*Acanthomintha ilicifolia*). Figure 10 shows a dethatched vernal pool at Otay Mesa. The dethatching work was conducted by the AECOM field crew with weed eaters to cut and remove the weed biomass. This site had a heavy infestation of tumbleweed (*Salsola*

tragus), which needed to be removed prior to seed drop. More than 16 tons of tumbleweed and other weed biomass was removed off-site for green waste recycling.

Figure 10. A dethatched vernal pool

4.1.2 Weeding

The vernal pools at Otay Lakes did not have extensive weed cover, but the pools did have populations of weed species that required hand herbicide application with the glove method. The glove method was also used around some of the upland areas that support sensitive species, such as the San Diego thornmint population.

4.1.3 Seed Dispersal

Vernal Pools

San Diego button-celery was collected and redistributed in pools that were lacking the species or have the species in low cover. Spreading navarretia was collected and redistributed into additional pools to expand on-site populations. AECOM field crews collected larger quantities of

upland, Quino, and vernal pool habitat seeds for the Shinohara Vernal Pool Project being conducted on USFWS property near Sweetwater Lake. A list of the collected species and weights of seed collected is provided in Attachment A. USFWS biologist John Marting took a portion of this seed for distribution on the Shinohara site in December 2009. Additional seed still remains at the AECOM facility in National City.

Plantago collected from the area surrounding the Otay Lakes vernal pool site was propagated in the off-site AECOM growing facility. The plantago plants were seed bulked outdoors in growing beds and propagation flats. Seed from this propagation effort was reintroduced at Otay Lakes in December 2008 to expand Quino habitat on-site.

4.1.4 Access Control

Although there has been some unauthorized vehicle activity in the vernal pool areas at Otay Lakes, this activity most likely is from the Border Patrol. These disturbances are not common and have not caused adverse impacts, so heavy-duty fencing of the site was not necessary. Bilingual signs were installed at the site to inform Border Patrol agents about the sensitive nature of the preserve area (Figure 4). Refer to Section 3.1.6 for the language included on the signs. Communication with the Border Patrol will continue to be important to confirm that its agents understand the boundaries of the preserve areas and the importance of keeping the access gate locked for general entry.

4.2 SITE CONDITION FOLLOWING IMPLEMENTATION

Table 3 provides a summary comparison of site conditions at Otay Lakes prior to and following implementation of restoration activities. Implementation of restoration activities resulted in an expansion of the San Diego fairy shrimp, spreading navarretia, and San Diego button-celery populations. Nonnative cover was reduced by more than half in both the upland and vernal pool habitats, and average plantago cover more than doubled over the site.

Table 3
Summary of Site Conditions for Otay Lakes

Observation Data	Historical Conditions	EDAW 2007 Recommendations Report	AECOM 2008–2009 Data
Sensitive Species			
San Diego fairy shrimp (*Branchinecta sandiegonensis*)	6 pool	Surveys not conducted due to dry season	12 pools
Spreading navarretia (*Navarretia fossalis*)	2 pools (2003)	1 pool	4 pools (approx. 150 individuals)
San Diego button-celery (*Eryngium aristulatum* spp. *parishii*)	27 pools	21 pools	26 pools (approx. 5,600 individuals)
Nonnative Plant Cover			
Upland	No data available	Polygon 1 = 80 Polygon 2 = 100 Polygon 3 = 55 Polygon 4 = 35 Polygon 5 = 70 Polygon 6 = 50 Polygon 7 = 70 Polygon 8 = 60 Polygon 9 = 60 Polygon 10 = 75 Polygon 11 = 75 **Average = 66**	Polygon 1 = 45 Polygon 2 = 55 Polygon 3 = 25 Polygon 4 = 15 Polygon 5 = 35 Polygon 6 = 25 Polygon 7 = 25 Polygon 8 = 15 Polygon 9 = 10 Polygon 10 = 45 Polygon 11 = 30 **Average = 30**
Vernal Pool	No data available	Polygon 1 = 80 Polygon 2 = 100 Polygon 3 = 35 Polygon 4 = 30 Polygon 5 = 90 Polygon 6 = 80 Polygon 7 = 50 Polygon 8 = 25 Polygon 9 = 70 Polygon 10 = 60 Polygon 11 = 70 **Average = 63**	Polygon 1 = 40 Polygon 2 = 45 Polygon 3 = 15 Polygon 4 = 5 Polygon 5 = 55 Polygon 6 = 35 Polygon 7 = 20 Polygon 8 = 5 Polygon 9 = 15 Polygon 10 = 15 Polygon 11 = 25 **Average = 25**
Plantago Percent Cover	No data available	Polygon 1 = 0 Polygon 2 = 0 Polygon 3 = 0 Polygon 4 = 5 Polygon 5 = 5 Polygon 6 = 5 Polygon 7 = 0 Polygon 8 = 0 Polygon 9 = 5 Polygon 10 = 0 Polygon 11 = 5 **Average = 2**	Polygon 1 = 5 Polygon 2 = 5 Polygon 3 = 0 Polygon 4 = 5 Polygon 5 = 5 Polygon 6 = 10 Polygon 7 = 5 Polygon 8 = 0 Polygon 9 = 10 Polygon 10 = 0 Polygon 11 = 10 **Average = 5**

CHAPTER 5.0
PROCTOR VALLEY

The pools at the Proctor Valley (Figure 5) site have suffered extensively from off-road activities, especially those on the west side of Proctor Valley Road. This site had been used as a staging area for ORV use and had almost no vegetation (native or nonnative) on the west side. Not only had the vegetation been completely removed, but the basin areas were heavily impacted by vehicle ruts and excavation. Figure 11 shows impacts to the vernal pool restoration area resulting from ORV use.

Figure 11. Tire damage in the vernal pool restoration area

Based on the Recommendations Report and adaptive management decisions made by AECOM and the City in 2007 (EDAW 2007), only a small portion of the budget was allocated to conducting restoration and management activities at Proctor Valley. Because the site is in need of extensive restoration and management actions, it is anticipated that additional funding will be pursued by the City in the future to conduct a more comprehensive and encompassing restoration effort at the site.

The restoration and management work at Proctor Valley was conducted over approximately 7.8 acres, including nine vernal pools.

5.1 RESTORATION AND MANAGEMENT ACTIONS IMPLEMENTED ON-SITE

5.1.1 Dethatching

Dethatching was conducted in the nine vernal pools at Proctor Valley, as well as the upland buffer area surrounding the pools. Figure 12 shows a dethatched vernal pool following a rain event in February 2009. The area was dethatched by the field crew using weed eaters to cut the nonnative plant material. Rakes and gas-powered blowers were used to concentrate and collect the weed biomass material. The material was then hauled off-site for green waste recycling.

Figure 12. A dethatched vernal pool at Proctor Valley

5.1.2 Weeding

The vernal pools at Proctor Valley received two visits for control of nonnative plants. Methods included herbicide treatments in the uplands and a combination of hand pulling and hand herbicide treatment with the glove method in the vernal pools.

5.1.3 Seed Dispersal

Vernal pool species were collected and redistributed to increase pool species diversity in June 2008. Plantago seed from the seed bulking effort at the AECOM off-site facility was redistributed in October 2008.

5.1.4 Access control

More than 2,000 linear feet of fencing was installed to fix gaps and repair existing fencing installed previously by the City (Figure 5). Signs were installed at points being used by ORVs to indicate that the area was off limits (Figure 5).

5.2 SITE CONDITION FOLLOWING IMPLEMENTATION

Table 4 provides a summary comparison of site conditions at Proctor Valley prior to and following restoration activities. As shown, nonnative native cover was substantially reduced in both the upland and vernal pool habitat. Plantago cover also increased across the site as a result of seeding.

Table 4
Summary of Site Conditions for Proctor Valley

Observation Data	Historical Conditions	EDAW 2007 Recommendations Report	AECOM 2008–2009 Data
Sensitive Species			
San Diego fairy shrimp (*Branchinecta sandiegonensis*)	8 pools	Surveys not conducted due to dry season	5 pools
Spadefoot toad (*Spea hammondii*)	No data available	Surveys not conducted due to dry season	1 pool
Nonnative Plant Cover			
Upland	No data available	Polygon 1 = 5 Polygon 2 = 65 Polygon 3 = 5 **Average = 25**	Polygon 1 = 5 Polygon 2 = 15 Polygon 3 = 5 **Average = 8**
Vernal Pool	No data available	Polygon 1 = 5 Polygon 2 = 35 Polygon 3 = 5 **Average = 15**	Polygon 1 = 0 Polygon 2 = 10 Polygon 3 = 0 **Average = 3**
Plantago Percent Cover	No data available	Polygon 1 = 10 Polygon 2 = 15 Polygon 3 = 15 **Average = 13**	Polygon 1 = 15 Polygon 2 = 15 Polygon 3 = 20 **Average = 17**

CHAPTER 6.0
MARRON VALLEY

The vernal pools at Marron Valley (Figure 6) had suffered some ORV and grazing disturbance, but they supported a range of vernal pool species even before the restoration effort. Officially, cattle grazing was suspended in the area, but cattle herds from across the U.S./Mexican border continued to use the site for grazing. The site was burned in the Otay Mountain fire in 2003, which resulted in an increase in the nonnative cover, especially in the upland grassland areas.

The restoration and management work at Marron Valley was conducted over approximately 3.8 acres, including 11 vernal pools.

6.1 RESTORATION AND MANAGEMENT ACTIONS IMPLEMENTED ON-SITE

6.1.1 Dethatching

All of the vernal pools at the Marron Valley site were dethatched, along with most of the upland watershed. Figure 12 shows a dethatched area compared to a nondethatched area. The primary nonnative plants removed in the dethatching work was filaree or storksbill (*Erodium cicutarium*) and soft chess. These species were removed with weed eaters, raking, and gas-powered blowers to remove unwanted biomass. Weed biomass was hauled off-site for green waste recycling. Dethatching the pools will help to stabilize populations of the existing of San Diego fairy shrimp and little mousetail, while dethatching the upland watershed areas will help to recover habitat for the Quino. Figure 13 shows a dethatched vernal pool that ponded following a rain event in February 2009.

Figure 12. Fence separating dethatched area (right) from nondethatched area (left)

Figure 13. A ponded vernal pool following a February 2009 rain event

6.1.2 Weeding

Dethatching was followed by herbicide application and weed eating/mowing. The vernal pools had populations of grass poly, brass buttons, and soft chess, which were removed by hand weeding.

6.1.3 Seed Dispersal

Seed collection and bulking for both vernal pool species (annual hair grass and little mousetail) and plantago seed was conducted at Marron Valley. Seed was collected in spring 2008 and redistributed in December 2008.

6.1.4 Recontouring/Topographic Reconstruction

Two pools were recontoured at Marron Valley during July 2008 (Figure 6). To complete the recontouring work, a small Bobcat was used in addition to hand tools.

6.1.5 Access Control

Cattle grazing was the primary threat to the sensitive resources at Marron Valley, so a three-strand barbless wire fence was installed around the pools (approximately 2,900 linear feet). This fence can be removed in the future if the threat of cattle grazing is eliminated. Bilingual signs were installed at the site, as shown in Figure 6, to indicate that the area is off limits (refer to Section 3.1.6 for a description of the language). Figure 14 shows a fenced vernal pool with a sign.

Figure 14. Signage and fencing around a dethatched vernal pool

During the implementation phase, Border Patrol agents were observed driving off the access roads within the preserve area. AECOM coordinated with the City to contact the Border Patrol and inform its personnel about the sensitive status of the preserve and request that agents drive only on designated access roads. Continued communication with the Border Patrol will be important to confirm that its agents understand the boundaries of the preserve areas and the importance of keeping the access gate locked for general entry.

6.2 SITE CONDITION FOLLOWING IMPLEMENTATION

Table 5 provides a summary comparison of site conditions at Marron Valley prior to and following restoration activities. Most notably, as a result the restoration effort, San Diego fairy shrimp and little mousetail were observed in twice as many pools as previous recorded. In addition, plantago, which was not observed on-site during previous surveys, was observed in three polygons. Nonnative cover was reduced substantially in both upland and vernal pool habitats.

Table 5
Summary of Site Conditions for Marron Valley

Observation Data	Historical Conditions	EDAW 2007 Recommendations Report	AECOM 2008–2009 Data
Sensitive Species			
San Diego fairy shrimp (*Branchinecta sandiegonensis*)	3 pools	Surveys not conducted due to dry season	6 pools
Spadefoot toad (*Spea hammondii*)	1 pool	Surveys not conducted due to dry season	2 pools
Little mousetail (*Myosurus minimus*)	3 pools (2001)	1 pool (1 individual)	6 pools (approx. 1,000 individuals)
Nonnative Plant Cover			
Upland	No data available	Polygon 1 = 75 Polygon 2 = 70 Polygon 3 = 55 Polygon 4 = 60 Polygon 5 = 80 **Average = 68**	Polygon 1 = 35 Polygon 2 = 35 Polygon 3 = 25 Polygon 4 = 35 Polygon 5 = 20 **Average = 30**
Vernal Pool	No data available	Polygon 1 = 50 Polygon 2 = 60 Polygon 3 = 45 Polygon 4 = 20 Polygon 5 = 25 **Average = 40**	Polygon 1 = 10 Polygon 2 = 10 Polygon 3 = 10 Polygon 4 = 5 Polygon 5 = 15 **Average = 10**
Plantago Percent Cover	No data available	Polygon 1 = 0 Polygon 2 = 0 Polygon 3 = 0 Polygon 4 = 0 Polygon 5 = 0 **Average = 0**	Polygon 1 = 5 Polygon 2 = 0 Polygon 3 = 0 Polygon 4 = 5 Polygon 5 = 5 **Average = 3**

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CHAPTER 7.0
SUBSEQUENT RESTORATION AND MANAGEMENT RECOMMENDATIONS

This chapter provides additional restoration and management recommendations for each site to expand and enhance the progress that was made with the 2007–2009 restoration effort. These recommendations are based on review of historical data, 2007 site reconnaissance surveys, monitoring data collected during the 2007–2009 restoration implementation phase, and final qualitative site assessments conducted in 2009.

General costs are provided for recommended restoration and management activities in Table 6, which summarizes the tasks and estimated cost for each site (expressed in 2010 dollars). These costs are general estimates, and assume restoration oversight by the lead restoration ecologist and a minimal amount of agency coordination. These costs may be used to help reviewers estimate future funding opportunities. Recommendations and cost estimates are provided for the five sites that were restored and enhanced as part of this project (Nobel Drive, Goat Mesa, Otay Lakes, Proctor Valley, and Marron Valley). The two sites that were evaluated in 2007 but not restored or enhanced (West Otay A & B and the Smith site) are not included, since they were not part of project implementation. If, in the future, these two sites become available for implementation, the 2007 Recommendations Report (EDAW 2007) can be used to determine future restoration and management recommendations and cost estimates, taking into account that the estimated budgets in that document reflect 2007 dollars.

The intent of the recommended restoration program described below is to build on the progress that was made as a result of the 2007–2009 implementation efforts at each site. As described in the previous chapters, the vernal pool and upland habitat areas (including potential Quino habitat) at each site were substantially improved by the implementation of restoration and management activities. While there is potential for expanding restoration efforts at some of the sites to incorporate additional areas of vernal pool and upland habitats, the general recommendation is to concentrate on the areas where progress has already been made and to continue to improve those areas, rather than expand into new areas where the results of restoration may not be as beneficial or cost effective.

Table 6
Estimated Site-Specific Restoration and Management Recommendation Costs

Site	Area (acre)	Vernal Pools	Vernal Pool Area (acre)	Dethatching	Weed Control (3 visits)	Reseed Vernal Pool Species	Reseed Plantago	Container Plant Installation	Recontouring	Owl Burrow Installation	Fencing	TOTAL
Nobel Drive	1.7	9	0.15	$4,250	$5,100	$3,000	NR	NR	NR	NR	NR	**$12,350**
Goat Mesa	5.2	17	0.37	$13,000	$15,600	$5,000	$5,000	NR	NR	NR	NR	**$38,600**
Otay Lakes	38.1	56	2.97	$95,250	$114,300	$5,000	$10,000	NR	NR	NR	$30,000	**$254,550**
Proctor Valley	7.8	9	0.19	$19,500	$23,400	$15,000	$5,000	$10,000	$45,000*	$15,000	$150,000	**$282,900**
Marron Valley	3.8	11	0.15	$9,500	$11,400	$3,000	$10,000	NR	NR	$15,000	NR	**$48,900**

*Includes $25,000 for a recontouring plan and microtopographical pre- and post-mapping
NR = Not recommended

7.1 DETHATCHING AND WEED CONTROL

Unlike the original 2007 Recommendations Report, weed control recommendations included herein are not separated into three different effort and cost levels. Almost all of the weed control that was conducted during the 2007–2009 implementation was completed at the Weed Control 2 Level (approximately $3,000 per acre), as described in the 2007 Recommendations Report (approximately three winter/spring visits by weed control crews). This is the level that is recommended for all of the sites moving forward. As stated in the original recommendations, this assumes that the site has been dethatched prior to weed control. Dethatch costs (approximately $2,500 per acre) assume that the work would be conducted on areas that were dethatched and had weed control measure implemented as part of the 2007–2009 restoration effort, and that future weed control would be conducted within 2 to 3 years (by the end of 2011). Weed control efforts should include hand weeding, herbicide application, and mowing, and should follow the guidelines described in the 2007 Recommendations Report. Continued dethatching and weed control is recommended for all five sites.

7.2 PROPAGATE AND RESEED VERNAL POOL SPECIES

Following dethatching and weed control, all of the pools and upland areas should continue to be seeded with appropriate species (refer to the 2007 Recommendations Report for methodology). Seed for both vernal pool and upland species should only come from on-site sources. In most cases, there would not be enough seed to simply collect and redistribute on-site, so a greenhouse propagation program would be required. The cost listed in Table 6 assumes that a greenhouse program is needed for each site.

Continued propagation and reseeding of plantago for Quino habitat should continue at all of the sites except Nobel Drive. At Nobel Drive, the surrounding upland area is too thick with native grassland to support plantago in most areas, and Quino is not known to occur anywhere near the site (refer to the 2007 Recommendations Report).

The remainder of the sites (Goat Mesa, Otay Lakes, Proctor Valley, and Marron Valley) have known population of Quino on or near them. As described in the previous chapters, considerable progress was made to enhance the Quino habitat at these four sites, which are all currently supporting plantago populations. These populations can continue to be stabilized and expanded with future management efforts.

7.3 VERNAL POOL CONTAINER PLANTING

Priority at the sites should generally be focused on seed propagation and reseeding. The only exception is at the Proctor Valley site. If major topographic reconstruction is implemented on the west side of the site, then a program of vernal pool container plant installation should be implemented to help "jump-start" the new basin areas that will be void of vernal pool vegetation following topographic reconstruction.

7.4 TOPOGRAPHIC RECONSTRUCTION

Other than at the Proctor Valley site, additional topographic reconstruction is not recommended, as most of the areas in need of topographic repair at the other sites were restored during the 2007–2009 implementation effort. While there is some potential for the creation/restoration of additional pools at Nobel Drive and Marron Valley, this work should only be conducted if future funding is substantial enough to also continue the restoration and management of the restored areas. For now, creation/restoration of additional pools should remain a low priority.

For the Proctor Valley site, the recommendations are the same as in the 2007 Recommendations Report, as funding did not support reconstruction of pools on the west side of Proctor Valley. If funding can be obtained to adequately plan the work and control site access (see Section 7.6, below), then this work is recommended. Topographic reconstruction should only be considered for Proctor Valley if the site can be adequately secured against ORV activity.

7.5 INSTALLATION OF ARTIFICIAL BURROWING OWL BURROWS

Installation of artificial owl burrows is only recommended at the sites that have a reasonable expectation for burrowing owl activity based on historical and current known activity of the owls (i.e., Proctor Valley and Marron Valley). In particular, artificial owl burrows should be installed at Proctor Valley if the site undergoes any major topographic reconstruction. Installing artificial burrows in conjunction with topographic reconstruction minimizes site disturbance and installation costs. Refer to the 2007 Recommendations Report for a description of installation of artificial burrows.

7.6 FENCING

Fencing installation is only recommended for two sites, Otay Lakes and Proctor Valley, both of which did not have fencing installed during the 2007–2009 restoration effort due to the high costs required to adequately secure the sites. Both of these sites would require substantial fencing to restrict ongoing ORV activity. At Otay Lakes, the ORV disturbance appears to be limited to Border Patrol incursions into the open space areas. While an expensive post-and-cable-type fence is not recommended, the fence would need to wrap around a large contiguous area, which would be costly (approximately $30,000). If cooperation with the Border Patrol can be established so that its agents stay out of the sensitive areas and on established roads, the need for this fencing could be eliminated. Continued coordination with the Border Patrol is recommended before pursuing funding for fencing.

At Proctor Valley, most of the illegal ORV activity is from the general public. Currently, the Proctor Valley area is still subject to substantial illegal ORV use, which continues to destroy vernal pools, Quino habitat, and other sensitive open areas. To adequately restrict this illegal use of the site, a substantial fence would be required around the entire site. A post-and-cable-type fence would be necessary, which is very costly ($150,000 or more). A less costly fence design could be installed if additional methods of restricting off-road activity (e.g., patrol and citation) are implemented successfully. There may be opportunities to partner with other land management entities to implement access control at Proctor Valley, such as the Otay Ranch Preserve owner/manager, a joint entity composed of the City of Chula Vista and County of San Diego to manage lands within Otay Ranch Preserve.

7.7 LONG-TERM SITE MAINTENANCE

Implementation of restoration and enhancement activities between 2007 and 2009 achieved the original goals for the project by recovering sensitive plant species once thought extirpated (i.e., spreading navarettia at Nobel Drive and little mousetail at Marron Valley), increasing cover of vernal pool and Quino habitat indicator species, reducing weed cover in the pools and upland watershed areas, improving hydrological conditions and potential ponding area, and establishing habitat for burrowing owls. While these successes were achieved, the goal of the restoration is to recover these habitats to a level where they are stable and can be maintained with a lower level of maintenance over a longer period of time.

To reach a level of habitat condition at the sites where maintenance efforts can be reduced, it is recommended that the weed control effort carried out during the 2007–2009 implementation

phase be continued for at least another 2 to 3 simultaneous years before reducing the restoration efforts.

One way to reduce the estimated long-term costs for future work is to limit the time between implementation of maintenance activities to no more than a 3-year span (following the initial 4- to 5-year phase of more intensive weed control). If the break in management activities is no more than 3 years, it may be possible to eliminate the need for a more intensive dethatch program. If the recommended program can be implemented for another 2 to 3 years, and this program continues to build upon the successes of the 2007–2009 restoration efforts, it will be possible to reduce the next phases of maintenance efforts and the cost to a more moderate level. Once the sites have reached this point, then long-term maintenance efforts can be likely reduced to the level and cost shown in Table 7.

There are two different approaches to a long-term management program that is designed to maintain a site's stability and habitat quality. One approach is to conduct maintenance at a low level of effort, but on a more frequent basis (every 1 to 2 years). The other approach is to conduct maintenance at a higher level (similar to what is proposed in Table 7) on a less frequent basis (every 3 to 4 years). The main concern with a more frequent lower level of effort is that one or two weed control visits per season may not adequately control all nonnative species. While a limited weed control effort can be effective on weeds coming up at the time of the visits, certain weed species will not be addressed, as the timing may be either too early or too late in the season to effectively target those species. Eventually, species that have not been targeted effectively will be favored and will likely become a more serious problem for the maintenance of habitat stability and quality. Therefore, implementation of a less frequent (every 3 to 4 years), but more aggressive (3 to 4 visits per season) long-term weed control program is recommended, such as the one proposed in Table 7.

For some of the sites, additional seeding may be needed along with the weed control to help keep the site stable, but this level of effort should be reduced as well as long as the site has been adequately restored and nonnative cover is at an acceptable level.

Table 7
Estimated Site-Specific Long-Term Restoration and Management Recommendation Costs (Implemented Every 3 to 4 Years)

Site	Area (acres)	Vernal Pools	Vernal Pool Area (acre)	Dethatching*	Weed Control 2 (3 visits)	Propagate and Reseed Vernal Pool Species	Reseed Plantago	Container Plant Installation	TOTAL
Nobel Drive	1.7	9	0.15	Not recommended	$5,100	$1,000	Not recommended	Not recommended	$6,100
Goat Mesa	5.2	17	0.37	Not recommended	$15,600	$2,000	$2,000	Not recommended	$19,600
Otay Lakes	38.1	56	2.97	Not recommended	$114,300	$3,000	$3,000	Not recommended	$120,300
Proctor Valley	7.8	9	0.19	Not recommended	$23,400	$2,000	$2,000	Not recommended	$27,400
Marron Valley	3.8	11	0.15	Not recommended	$11,400	$1,000	$2,000	Not recommended	$14,400

*Not recommended unless the site has gone without maintenance for more than 3 years

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CHAPTER 8.0
REFERENCES

EDAW, Inc.

2007 Final Vernal Pool and Quino Habitat Restoration and Management Recommendations Report. October.

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ATTACHMENT A
LIST OF PLANT SPECIES COLLECTED FOR THE SHINOHARA VERNAL POOL PROJECT

Attachment A
List of Plant Species Collected for the Shinohara Vernal Pool Project

Species	~Kilograms
Alopecurus saccatus	0.05
Artmesia dracunculus	2.94
Bothriochloa barbinodes	0.25
Clematis lasiantha	1.81
Deschampsia danthenoides	0.01
Dienandra fasciculata	94.34
Downingia cuspidata	0.04
Epilobium pygmaeum	0.02
Erigonum fasciculatum	14.50
Eryngium ceristulatum var. *parshii*	0.55
Ferocactus viridescens	0.90
Grindellia camp.	1.36
Helianthemum scoparium	0.22
Heteromeles arbutifolia	0.90
Isocoma menzesii	9.20
Isomeris arboreta	7.25
Malacathamnus fasciculatus	17.69
Malosma laurina	6.35
Marah marcocarpa	0.90
Myoserus minimus	0.01
Phacelia cicuata var. *hispida*	34.70
Plantago erecta	48.20
Salvia apiana	5.44
Salvia munzii	4.53
Sambucus mexicana	3.17
Simmondsia chinensis	21.40
Sisyrinchium bellum	0.25
Viguiera lacinata	36.00