

Final Vernal Pool and Quino Habitat Restoration and Management Recommendations Report

October 2007



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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. The City of San Diego (City), in cooperation with 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), has obtained grant funding¹ that will be utilized to protect, restore, and manage portions of the remaining vernal pool habitat in southern San Diego County. EDAW, Inc. has been retained by the City to conduct a comprehensive assessment of seven existing vernal pool sites within the jurisdiction of the City or County. The purpose of the site assessment is to evaluate the existing conditions at each site, including threats to the biological resources that occur on-site, identify the potential restoration opportunities, and develop management recommendations to protect and restore the habitat function and ecosystem value of remaining vernal pool habitat.

To halt this decline, stabilize the vernal pools, and restore habitat function and sensitive species populations, immediate restoration and management actions are necessary. The goal of this project is to identify the resources and actions necessary to stabilize and aid recovery of vernal pools and vernal pool sensitive species in San Diego County. While it does not address 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.

This report summarizes the results of the site assessment performed by EDAW, Inc., including a review of historical data, and identifies the most appropriate techniques for restoring and managing vernal pool habitat to increase sensitive species presence and hydrological function and value. The report includes five key chapters, as follows: Chapter 1.0 provides an introduction to the project and the project background; Chapter 2.0 details the vernal pool site

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.

assessment approach and summarizes the assessment results; Chapter 3.0 describes the approach to site restoration and management; Chapter 4.0 provides comprehensive restoration management recommendations for each site; and Chapter 5.0 provides the priority site recommendations based on existing grant funds, including an estimated schedule and cost for implementation.

1.2 PROJECT BACKGROUND

San Diego County has the appropriate climate, topography, and soil characteristics for the formation of ephemeral wetlands known as vernal pools. This unique type of wetland habitat is restricted to southern Oregon, California, and northern Baja California. The vernal pool habitat within San Diego County supports numerous sensitive plant and animal species that are specifically adapted to the climatic and hydrological conditions found in southern California. The vernal pools of San Diego are home to no less than six federally threatened or endangered species, making vernal pools one of the most important habitat types to protect and conserve in southern California, as well as the United States.

Within San Diego County, it has been estimated that only approximately 5 percent of the historical vernal pool habitat remains (Bauder and McMillan 1996). Not only have the numbers of pools been dramatically reduced, but much of the vernal pool habitat that remains has become extensively degraded due to development, grazing, agriculture, off-road vehicle (ORV) use, weed invasion, and invasive species. Many of the vernal pools remaining in San Diego County are located in areas that are conserved as open space. In these areas, the pressures of development, grazing, agriculture, and other factors have been reduced, but off-road activity, pollution, edge effects, and invasive species continue to be serious threats. Due to these continued threats, these conserved vernal pools are continuing to decline in sensitive species presence, hydrological function, and overall general habitat quality.

This project will help accomplish the following 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 OVERVIEW OF VERNAL POOL SITES

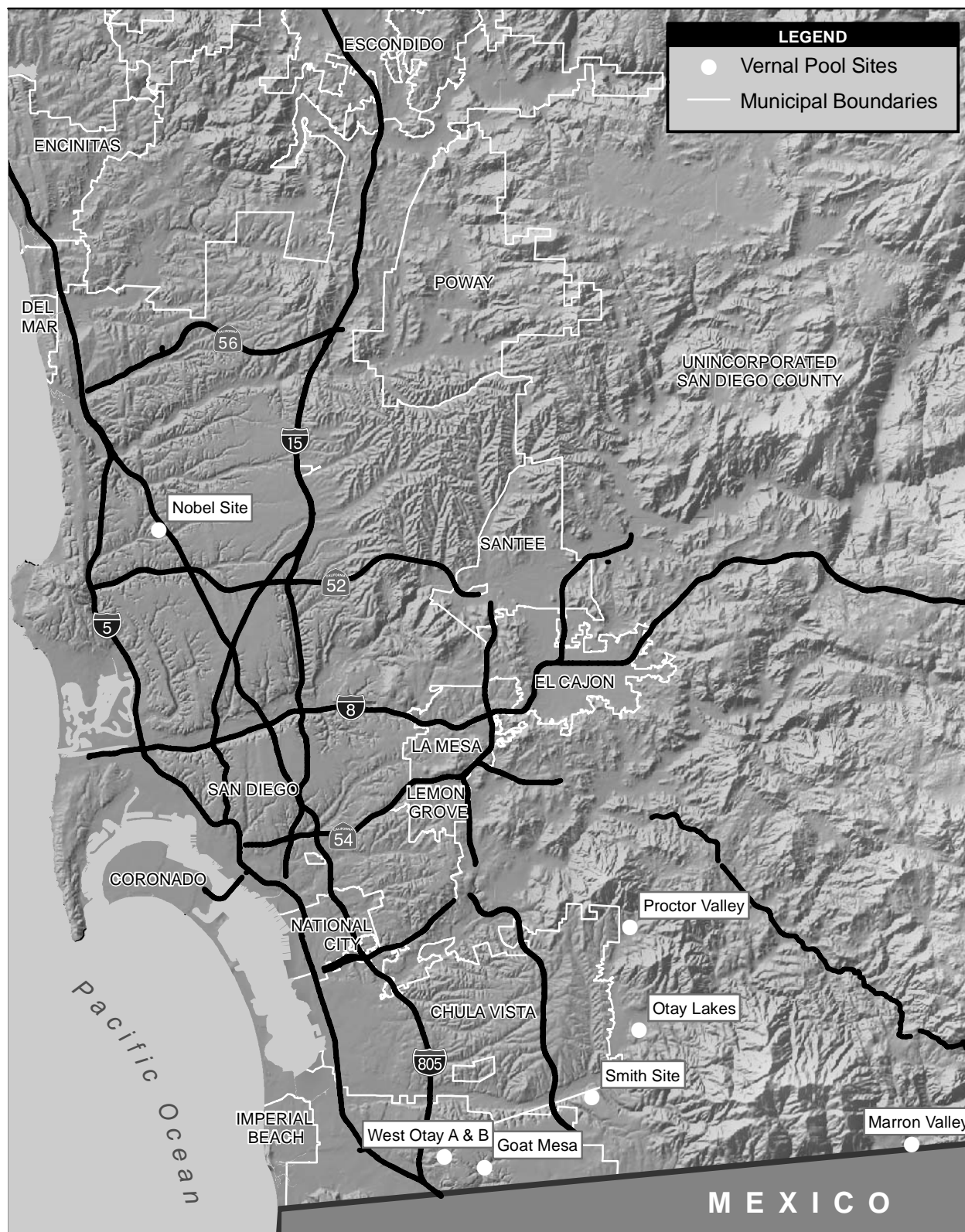
The project involved a historical data review and assessment of seven sites within jurisdiction of County of San Diego or City (Nobel Drive, Goat Mesa, Otay Lakes, Proctor Valley, Marron Valley, West Otay A & B, and the Smith Site). Table 1-1 lists the sites that have been evaluated, their previous classification code if available (Bauder 1986a), and the estimated number of vernal pools at each site based on the site assessment and recent reports, including the City of San Diego's 2002-2003 Vernal Pool Inventory (City of San Diego 2003). Figure 1-1 shows the general location of each site within San Diego County.

Table 1-1
Summary of Vernal Pool Sites

Site	Bauder 1986 Code	Estimated # of Vernal Pools
Nobel Drive	X5	7
Goat Mesa	J16-18	13
Otay Lakes	K3,5,10,13	88 ¹
Proctor Valley	R1	19
Marron Valley	MM1	14
West Otay A & B	J32	57
The Smith Site	J23-26	±700

¹ Includes one new basin identified during the 2007 site assessment

Source: City of San Diego 2003



Source: USGS 2000; SanGIS 2007

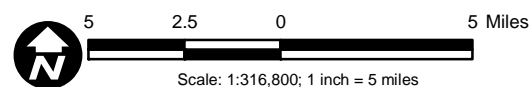


Figure 1-1
Vernal Pool Site Locations

CHAPTER 2.0

SITE ASSESSMENT

The purpose of the site assessment was to identify the sensitive resources that require preservation at each vernal pool site, as well as the existing disturbances that require management actions, such as invasion of exotic species, trespass, altered topography or hydrology, other threats (e.g., grazing, fire). The site assessment was accomplished by field evaluations and supported by review of historic data sources, as described in more detail below.

2.1 METHODOLOGY

A review of previous surveys and data sources was conducted to identify the sensitive species historically known to occur at each site, as well as previously documented disturbances. Historic survey data and site information was obtained from a variety of sources, including the City of San Diego (1996, 1997, 2003, 2005, and 2007) and previous assessments of vernal pool habitat in southern San Diego County (Bauder 1986b; Bauder and McMillan 1996; Dudek & Associates, Inc. 1992), as well as input from local experts in vernal pool systems (McMillan 2007, pers. comm.; Pratt 2006, pers. comm.).

To identify existing sensitive resources and disturbances, field reconnaissance was conducted at six of the seven vernal pool sites within the County or City of San Diego (Nobel Drive, Goat Mesa, Otay Lakes, Proctor Valley, Marron Valley, and West Otay A & B; the Smith Site was not visited due to site access restrictions). The sites were visited one time each during August 2007 to determine site conditions, identify plant presence, and evaluate restoration and other management issues. A copy of the field data form utilized during the site assessment is provided in Appendix A. Results of the site assessment are discussed in Section 2.2 below.

During each visit, a vernal pool basin and upland watershed vegetation assessment was performed. Presence of native vernal pool species and an estimated percent cover for nonnative species were recorded for the vernal pool basins. An estimated percent nonnative cover was also recorded for the upland watersheds. In addition, to assess the level of disturbance and prioritize enhancement needs, nonnative cover in the vernal pools was divided into upland and vernal pool/wetland species. The level and type of disturbance was assessed for each site, which included:

- Nonnative percent cover for both upland areas and vernal pool basins
- Dominant nonnative plant species, including upland and wetland/vernal pool species

-
- Trespassing issues (e.g., ORVs, grazing, and pedestrian or other traffic)
 - Altered topography or hydrology (e.g., from erosion or ORV impacts)
 - Any additional disturbance factors noted while conducting surveys (e.g., evidence of burns from fires)

Since the entire annual growth cycles for vernal pool flora and fauna typically occur in the spring following the rainy season, and because the field reconnaissance was conducted during the dry season (due to contracting issues), it was not possible to detect sensitive wildlife presence in the vernal pool basins, i.e., San Diego fairy shrimp (*Branchinecta sandiegonensis*) and Riverside fairy shrimp (*Streptocephalus woottoni*). In dry years, similar to the 2006/2007 winter season, most vernal pools are not be inundated long enough (2 weeks or more) to allow crustaceans to hatch. San Diego and Riverside fairy shrimp cysts can remain dormant for several years until sufficient rainfall occurs. To accurately incorporate this important resource as part of the overall vernal pool assessments, historic presence and absence data (provided by the City via a digital database) were considered. Despite the seasonally late assessment, vegetative surveys were performed, albeit to a limited extent, due to the relatively larger quantity of certain vernal pool floral remnants.

In addition to assessing watershed and vernal pool basin conditions, suitability for Quino checkerspot butterfly (*Euphydryas editha quino*; Quino) and burrowing owl (*Athene cunicularia*) habitat was evaluated for each site. Plantago (*Plantago erecta*), the primary nectar source for the Quino, is naturally found in the compacted clay soils associated with the southern San Diego County vernal pool landscape. Based on proximity to known Quino populations, each site was evaluated for habitat suitability by surveying for plantago and nectar source species and by determining if seeding is appropriate.

In addition, the rolling landscape of mima mound topography provides opportunity to integrate artificial owl burrows during the site recontouring and restoration process. However, installing an artificial burrow requires soil excavation, which is not desirable in undisturbed soils. Suitability for burrow installation was evaluated based on topographical impacts and recontouring needs seen for a site.

For documentation purposes, representative photographs were taken at each site. In anticipation that future monitoring efforts will be photodocumented, the location for each photograph vantage point has been recorded (refer to Figures 2-1a through 2-6a). Photographs of each site are provided in Figures 2-1b through 2-6b.

2.2 SUMMARY OF RESULTS

This section first provides a description of the seven vernal pool sites that were evaluated during the site assessment, and then summarizes the results of the site assessment performed in 2007 at each of the sites (with the exception of the Smith Site; refer to Section 2.2.7). The evaluation of the conditions at each site was divided into seven key categories: (1) species inventory, (2) nonnative plant cover, (3) fencing, (4) vernal pool reseeding, (5) plantago seeding, (6) recontouring/topographic reconstruction, and (7) artificial owl burrow installation. Because surveys were performed late in the season, the 2007 site assessment was supplemented with historical species occurrence data provided by the City and other data sources, as described in Section 2.1.

2.2.1 Nobel Drive

The Nobel Drive site is located south of Nobel Drive and west of Interstate 805 (I-805) in the University Community Planning Area (Figure 2-1a). Fifty-five acres of a 94-acre parcel are preserved as mitigation for the Eastgate Technology Park (City of San Diego 2007). The Nobel Drive site is owned and managed by the City of San Diego Real Estate Assets and Park and Recreation Departments. The majority of the site is within the City of San Diego's Multi-Habitat Planning Area (MHPA) (City of San Diego 1997) and a portion has been designated as open space. The surrounding area is zoned for scientific research and industrial parks, and adjacent land uses include transportation, multi-family residential, and research parks.

The vernal pools are natural in origin and are underlain by Redding gravelly loam. Upland vegetation is characterized by mixed chaparral, disturbed coastal sage scrub, and disturbed native grasslands. Non-native grasses and forbs are prevalent in both the uplands and vernal pools.

Although the site is located adjacent to roadways and other developed areas, it is connected to relatively large and contiguous preserved lands in Rose Canyon. The City's *Vernal Pool Management Plan* (City of San Diego 1996) noted trespass as a threat and fencing has since been installed around individual vernal pools as well as property boundaries that border streets and other pedestrian corridors. The site may serve as a staging area in the event of a fire (City of San Diego 2007). Although wildfire is unlikely due to the density of surrounding development, the 2003 Cedar Fire came within just a few miles of the site.

Figure 2-1b includes photographs taken during the site assessment at Nobel Drive. The locations of the photograph points are shown in Figure 2-1a.

2.2.1.1 Species Inventory

This section focuses on the sensitive fauna and flora observed during the site assessment and/or known to occur based on historical data. A complete list of fauna and flora observed during the site assessment is included in Appendix A.

Fauna

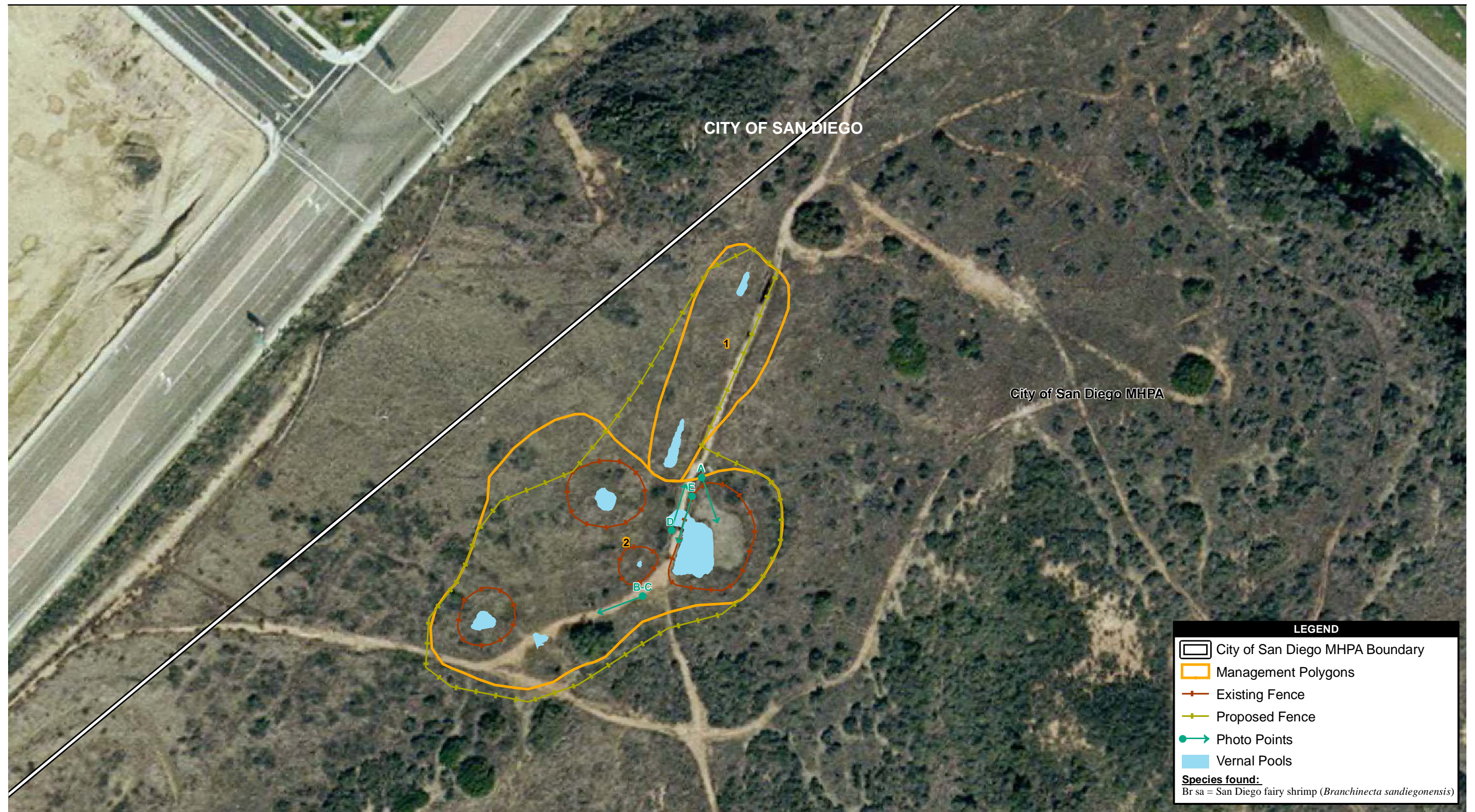
During the site assessment, no evidence of sensitive wildlife was observed at the site. However, a majority of the vernal pool basins at Nobel Drive have records of San Diego fairy shrimp presence (City of San Diego 2003). The adopted *Recovery Plan for Vernal Pools of Southern California* (USFWS 1998) concluded that the site was necessary to stabilize the population of San Diego fairy shrimp. Because the 2007 assessment was conducted during the dry season (as described in Section 2.1), fairy shrimp were not observed in the vernal pools.

Flora

During the 2007 assessment, 11 vernal pool endemic species were observed within the complex (Appendix A). No sensitive species were observed in the vernal pools during the 2007 assessment. Spreading navarretia (*Navarretia fossalis*) was observed by Bauder in 1986 and San Diego button-celery (*Eryngium aristulatum* var. *parishii*) was observed by Pacific Southwest Biological Services in 1993. Spreading navarretia was seen during surveys in 2001 (McMillan 2007, pers. comm.). Neither was observed during the City surveys in 2003 or during the 2007 assessment.

2.2.1.2 Non-Native Plant Evaluation

With an estimated cover of 95 percent, the upland watershed at Nobel Drive is dominated by nonnative annual grasses. Vernal pools in Polygon 1 (Figure 2-1a) have 65 percent nonnative cover, whereas in Polygon 2 the nonnative cover is 25 percent. In both polygons, nonnative cover is composed of the same annual grass species, with the exception of rabbit-foot grass (*Polypogon monspeliensis*), which only occurs in Polygon 2 as one of the dominant nonnative species.



Source: AirPhotoUSA 2006; City of San Diego 2003; MHPA 2003

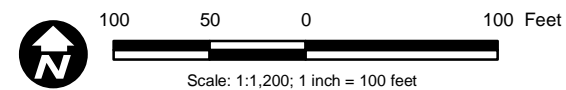


Figure 2-1a
Nobel Drive

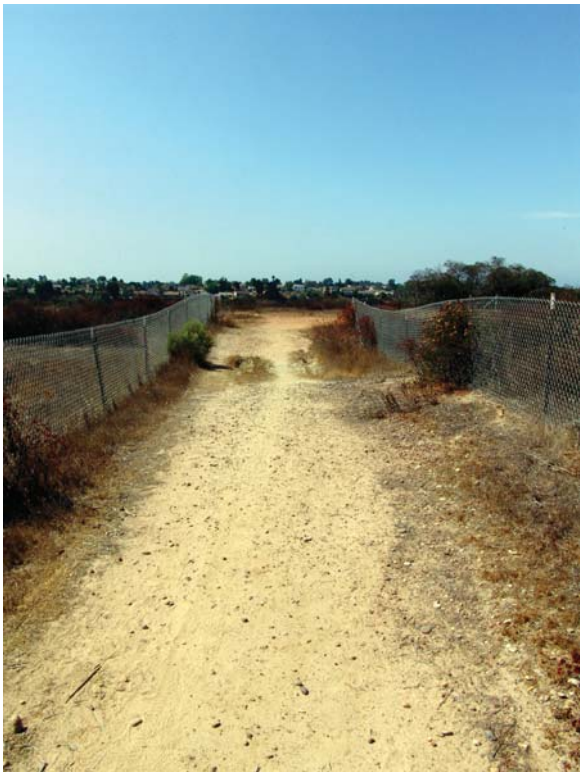
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A. Southeast view of a vernal pool with historical occurrence of spreading navarretia



C. West view showing current fencing around vernal pools



E. South-southwest view of a foot path traversing the site, through vernal pool basin



B. West view along a foot path with an unprotected vernal pool on the left and fenced vernal pools on the right



D. North-northeast view of a foot path with unprotected vernal pools on left side

NOTE: Photograph points are illustrated in Figure 2-1a

Figure 2-1b
Site Assessment Photographs of Nobel Drive

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2.2.1.3 Fencing Evaluation

In Polygon 1, none of the vernal pools are fenced, whereas all but one of the basins are fenced in Polygon 2. Based on the comparison of nonnative cover between the two polygons described above, the protective effects of fencing against invasion of nonnative species is apparent in Polygon 2, which has 40 percent less nonnative cover. Although the existing fencing in Polygon 2 appears adequate to protect the vernal pools from disturbances, as is evident in the relatively high diversity of endemic vernal pool species, several basins continue to be trampled from traffic associated with the foot path that traverses the complex (discussed further below).

2.2.1.4 Vernal Pool Reseeding Evaluation

Due to the apparent limited presence of spreading navarretia at Nobel Drive, reseeded of this species may be necessary to reestablish its historical presence. Since no site specific seed of the species is available, collection from a nearby site (to maintain local genetics) and seed bulking will be required to obtain a sufficient quantity for successful reintroduction. The closest site with a confirmed spreading navarretia population is Carroll Canyon, located approximately 1.3 miles north of the site.

2.2.1.5 Plantago Seeding for Quino Evaluation

Plantago occurs across the site at Nobel Drive, but primarily in areas with relative low nonnative vegetation density, such as the fenced vernal pool basins. The habitat is not considered suitable for Quino due to its relatively urban location and a lack of Quino recent and historical sitings for the surrounding areas.

2.2.1.6 Recontouring/Topographic Reconstruction Evaluation

Several of the vernal pool basins at Nobel Drive have been impacted by foot, bicycle, and vehicle traffic. These paths are visible on the aerial image of the site shown in Figure 2-1a. The foot path traversing the complex has effectively limited the original hydrological functionality of the basins by diverting flows. Site location and the existing foot path allow for easy access and use of mechanized equipment. Mechanized equipment could be used on-site; however, if used in the vernal pool basins biological resources would need to be salvaged.

2.2.1.7 Artificial Burrowing Owl Burrow Evaluation

Because of already existing soil disturbances and potential topographic reconstruction needs to improve the hydrological functionality of the vernal pools, artificial owl burrow construction could possibly be incorporated into restoration efforts. Although owls are not known from the site or adjacent areas, burrowing owl presence has been recorded from the eastern portions of Marine Corps Air Station Miramar in recent years and historically were known in the coastal areas to the north and south of Nobel Drive (McMillan 2007, pers. comm.).

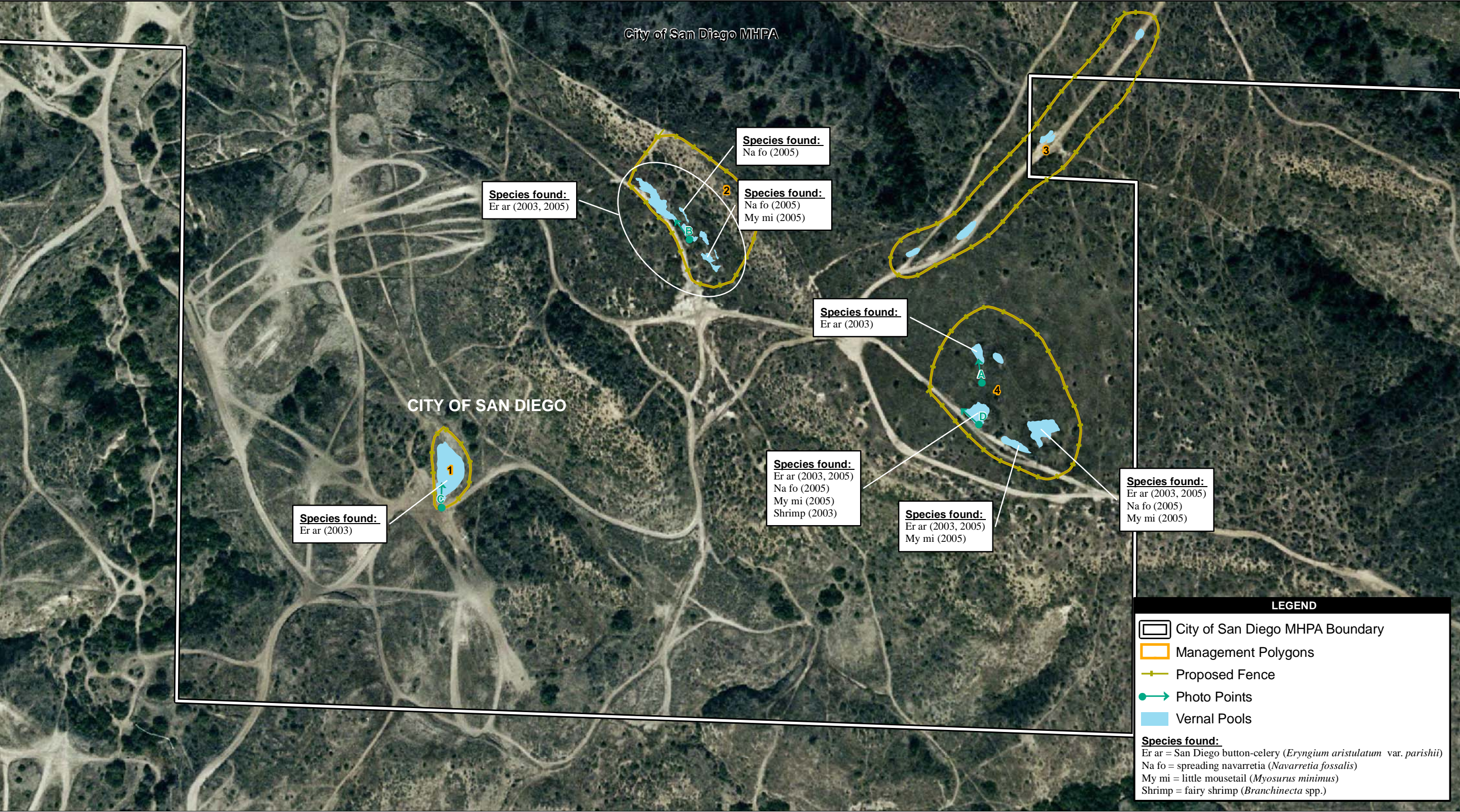
2.2.2 Goat Mesa

The Goat Mesa site is located on three City-owned parcels (totaling 99 acres) in the Spring Canyon area of Otay Mesa along the U.S./Mexican border (Figure 2-2a). The site is managed by the City of San Diego Park and Recreation Open Space Division and is designated open space within the City of San Diego MHPA (City of San Diego 2007). Surrounding land uses include open space, undeveloped land, and the international border. Residential developments have been proposed for several nearby parcels (City of San Diego 2007).

Thirteen vernal pools (0.4 acre combined basin area) were mapped by the City of San Diego in 2003. The basins occur in the Stockpen gravelly clay loam and upland vegetation is primarily nonnative grasslands on the mesa with coastal sage scrub in finger canyons. The adopted *Recovery Plan for Vernal Pools of Southern California* (USFWS 1998) identified the vernal pools at Goat Mesa as necessary to stabilize populations of the following endangered and threatened species: San Diego button-celery, Otay Mesa mint (*Pogogyne nudiuscula*), spreading navarretia, California orcutt grass (*Orcuttia californica*), San Diego fairy shrimp, and Riverside fairy shrimp.

Goat Mesa is conserved open space and will not be developed. However, development of southern Otay Mesa may isolate the site from surrounding open space and nearby vernal pool complexes. Historically, the site was subject to pressure from grazing, land squatters, and illegal grazing by goat herders. Impacts that currently occur on-site are generally related to ORVs, Border Patrol, and foot traffic. The site may serve as a staging area in the event of a fire if defensible structures are developed in the vicinity (City of San Diego 2007).

Figure 2-2b includes photographs taken during the site assessment at Goat Mesa. The locations of the photograph points are shown in Figure 2-2a.



Source: AirPhotoUSA 2006; City of San Diego 2003, 2005; MHPA 2003

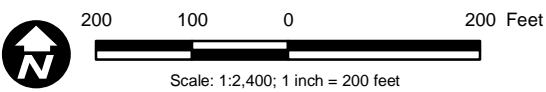


Figure 2-2a
Goat Mesa

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A. North view of vernal pool containing San Diego button-celery



C. North view of a vernal pool basin, containing San Diego button-celery, surrounded by ORV trails



B. Northwest view of vernal pool basin



D. West view of a vernal pool basin with historical occurrence of San Diego button-celery, impacted by vehicle traffic

NOTE: Photograph points are illustrated in Figure 2-2a

Figure 2-2b
Site Assessment Photographs of Goat Mesa

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2.2.2.1 Species Inventory

This section summarizes the observed and historical presence of sensitive species at Goat Mesa. A complete list of fauna and flora observed during the 2007 site assessment is provided in Appendix A.

Fauna

No sensitive species were observed during the site assessment. One vernal pool at Goat Mesa has a historical record of fairy shrimp (*Branchinecta* spp.) presence (City of San Diego 2005).

Flora

Twelve vernal pool endemic species were observed within the complex, including state and federally endangered San Diego button-celery, which was found in five vernal pools. San Diego button-celery and spreading navarretia are historically known from the site (City of San Diego 2003, 2005). State endangered little mousetail and federally threatened spreading navarretia were observed in 2005 by the City, but were not relocated during the 2007 assessment most likely due to the late season. Also present on-site is the state endangered variegated dudleya (*Dudleya variegata*), a species endemic to the rocky clay soils of San Diego County.

2.2.2.2 Non-Native Plant Evaluation

Except for the vernal pools that are found on existing roads within Goat Mesa, where vegetative cover is kept to a minimum due to repeated trampling, the nonnative cover range found in the basins is approximately 20 to 35 percent. It is estimated that over 50 percent of this nonnative cover is composed of wetland species, mainly ryegrass (*Lolium* spp.) and rabbit-foot grass. The upland watershed has approximately 25 to 40 percent nonnative cover.

2.2.2.3 Fencing Evaluation

Heavy disturbance was observed throughout Goat Mesa, primarily as a result of ORVs, Border Patrol traffic, and grazing. With rapid development occurring in the surrounding area, ORV use and possibly grazing are likely to increase as less land becomes accessible to the public for these activities. There is an immediate need to protect the vernal pool hydrology, flora, and fauna still existing at Goat Mesa. To include the pools that are west of the mesa (slump pools), fencing would have to extend well into Spring Canyon.

2.2.2.4 Vernal Pool Reseeding Evaluation

It is unclear whether any sensitive species have been extirpated from Goat Mesa, but it is evident that current grazing and ORV activities have had a negative effect on the existing species diversity. Local seed is available from the site, which could be collected for bulking and to revegetate the impacted basins.

2.2.2.5 Plantago Seeding for Quino Evaluation

Goat Mesa is within a 2-mile range of recently known Quino populations in Spring Canyon and Otay Mesa to the north and presents adequate conditions for functional habitat. Plantago occurs on-site throughout the upland and grassland habitats but would require seed bulking to enhance the population.

2.2.2.6 Recontouring/Topographic Reconstruction Evaluation

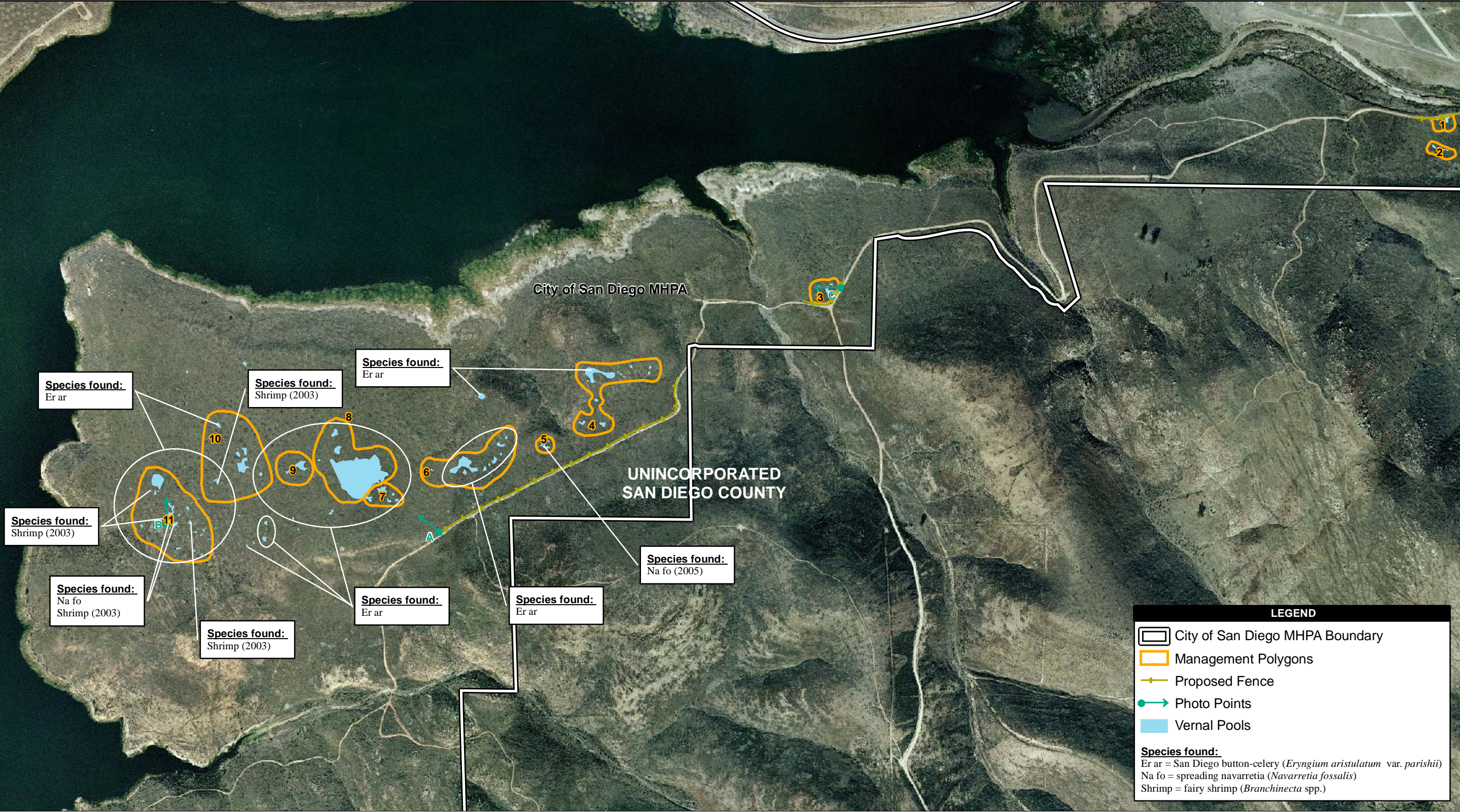
Topographic disturbances from vehicular traffic have had both aesthetic and hydrological impacts at Goat Mesa. Mechanized equipment can be used as the site is easily accessible through the numerous dirt roads traversing the landscape.

2.2.2.7 Artificial Burrowing Owl Burrow Evaluation

Existing soil disturbances and potential topographic reconstruction needs, associated with hydrological functionality of the vernal pools, allows for the incorporation of artificial owl burrows into potential restoration efforts at Goat Mesa. Additional off-site soil may be required, but posts no logistical difficulties as there are multiple site access options.

2.2.3 Otay Lakes

The Otay Lakes vernal pool site is located on 632 acres owned and managed by the City of San Diego Water Department (Figure 2-3a). The site is designated open space as part of the Multiple Species Conservation Program (MSCP) Cornerstone Bank Agreement and is included in the City of San Diego MHPA, although outside the City's jurisdictional boundaries (City of San Diego 2007). Otay Lakes is adjacent to large rural and preserve areas. The site was leased for grazing until 2001, and impacts from cattle (e.g., hoof indentations) are still visible in vernal pool basins (City of San Diego 2007).



Source: AirPhotoUSA 2006; City of San Diego 2003, 2005; MHPA 2003

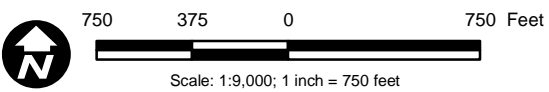


Figure 2-3a
Otay Lakes

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Eighty-eight natural vernal pools (2.9 acres of basin area) have been mapped at Otay Lakes. Soils include loams from the Olivenhain, San Miguel, and Redding series. Upland vegetation is characterized by chamise chaparral with herbaceous cover such as clustered tarweed (*Hemizonia fasciculata*) and filaree (*Erodium* spp.).

Fire plays an important part in the natural ecologic regime of the Otay Lakes site and surrounding area. The vernal pools burned most recently in the October 2003 Otay Fire, and comparison of pre- and post-fire surveys does not appear to reveal damage to sensitive species or their physical habitat (City of San Diego 2007). Therefore, fire does not appear to directly threaten the species' presence or abundance of vernal pool ecosystems, but the increased weed cover that is a result of the fires will continue to threaten these sensitive species populations. As noted in the *Vernal Pool Management Plan* (City of San Diego 1996), fire-fighting activities may disturb this area. Although the site burned in 2003, Lower Otay Reservoir provided a natural fire-break between the open space and nearby development so that destructive fire suppression efforts in sensitive habitat areas were not necessary.

Several management actions recommended by the *City of San Diego Vernal Pool Management Plan* (1996) have been accomplished to date. The 1996 document suggested conducting a thorough investigation of any unidentified resources, which was completed as part of the *City of San Diego 2002-2003 Vernal Pool Inventory* (2003). An assessment of vernal pool resources and an inspection of the physical condition of the site were also included in the inventory.

Figure 2-3b includes photographs taken during the site assessment at Otay Lakes. The locations of the photograph points are shown in Figure 2-3a.

2.2.3.1 Species Inventory

This section summarizes the observed and historical presence of sensitive species at Otay Lakes. A complete list of fauna and flora observed during the 2007 site assessment is provided in Appendix A.

Fauna

Evidence of burrowing owl presence was observed on-site (i.e., burrow tunnels), but no owls were observed during the site assessment. Six vernal pools at Otay Lakes have a historical record of fairy shrimp presence based on surveys conducted by the City in a sample of basins (City of San Diego 2003). Despite fairy shining being known to occur in a limited number of

sampled pods, all basins are located in relative proximity to each other within the same watershed. Thus, the hydrology of the site allows the distribution of fairy shrimp species between pools.

Flora

Historical records indicate the vernal pools support populations of little mousetail, San Diego button-celery, and spreading navarretia, all of which were observed in historic surveys (City of San Diego 2003, 2005). Ten vernal pool endemic species were observed within the complex during the 2007 assessment, including San Diego button-celery and spreading navarretia. San Diego button-celery was observed in numerous pools. Spreading navarretia was found in one pool, compared to the three pools where it was detected in 2005, during City surveys. The large pool at Otay Lakes is the only basin known to support toothed downingia (*Downingia cuspidale*) in southern San Diego County. State sensitive Coast barrel cactus (*Ferocactus viridescens* var. *viridescens*), occurs to a limited extent on the site. Large populations of variegated dudleya and San Diego goldenstar (*Muilla clevelandii*) surround the basins, and one small historical population of thornmint is known from the site.

2.2.3.2 Non-Native Plant Evaluation

Following years of grazing and frequent fires at Otay Lakes, nonnative annual grasses have established across the site. Of the 11 polygons assessed in 2007, 10 have an upland nonnative cover of 50 percent or more. Vernal pool basins in those same polygons show a similar pattern, with 9 of 11 having 50 percent or more nonnative cover. Brome grasses (*Bromus* spp.), wild oat (*Avena fatua*), and filaree are the dominant species on-site.

2.2.3.3 Fencing Evaluation

The threat of trespass (i.e., ORVs) at Otay Lakes is minimal due to natural barriers such as Lower Otay Reservoir and Otay Mountain. In addition, the City of San Diego Water Department has fenced sections of the boundary to discourage access and has provided gates at vehicle entrance points.

Evidence of vehicle traffic was observed in several vernal pool basins and surrounding open areas. Based on the size of the wheelbase tracks and locations of the impacts, trespassing is likely from Border Patrol traffic. Vehicle impacts have occurred in vernal pools adjacent to dirt



A. Northwest landscape view of the biggest vernal pool basin on the mesa outlined by fasciated tarplant (yellow flowers)



C. West view of ORV impacts to a vernal pool basin



B. North view of a vernal pool with spreading navarretia

NOTE: Photograph points are illustrated in Figure 2-3a

Figure 2-3b
Site Assessment Photographs of Otay Lakes

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access roads where natural protective barriers, such as large perennial vegetation and topographical features are minimal. Otay Lakes is gated to prevent public access, but Border Patrol traffic is frequent, which evidently has a moderate impact on the vernal pool basins. Border Patrol generally does not lock the main gate, so potential for illegal off-road activity is not as restricted as it could be.

2.2.3.4 Vernal Pool Reseeding Evaluation

Although there are no known extirpated species from the site, the relative abundance of nonnative grasses poses a threat to native species diversity at Otay Lakes. San Diego button-celery is abundant in several pools, but nonnative thatch appears to be limiting its growth potential throughout the site. During the 2007 site assessment, spreading navarretia was found in only one of the three vernal pool basins it was recorded for in 2005 (City of San Diego 2005). With local seed still available on-site, collection and seed bulking efforts, combined with dethatching of nonnative grasses, could help increase the presence of San Diego button-celery in the basins.

2.2.3.5 Plantago Seeding for Quino Evaluation

Quino is known from the lower slopes of Otay Mesa to the south as well as on property just north of the Lake. Otay Lakes is within a 2-mile range of known Quino populations and presents excellent conditions for restoration of functional Quino habitat. Plantago occurs on-site, but requires seed bulking to enhance the population.

2.2.3.6 Recontouring/Topographic Reconstruction Evaluation

Minor topographic disturbances occur across the site, mainly along existing roads as a result of roadway maintenance or from traffic impacts. However, disturbances in topography do not appear severe enough to affect the hydrological function of the site. Mechanized equipment could readily be used from an access standpoint, but the relatively undisturbed soil structure and its suitability for Quino habitat make use of mechanized equipment undesirable for most parts of the site.

2.2.3.7 Artificial Burrowing Owl Burrow Evaluation

Artificial owl burrows currently exist at Otay Lakes and some already disturbed areas would be appropriate locations to install additional structures during restoration efforts. Since most of the

disturbed areas occur along the already existing access road, mechanized equipment could be readily used. Off-site soil input would be required to create additional burrows.

2.2.4 Proctor Valley

The 157-acre Proctor Valley site is located in Proctor Valley on land owned and managed by the City of San Diego Water Department (Figure 2-4a). Similar to Otay Lakes, it is designated open space as part of the MSCP Cornerstone Bank Agreement and is included in the City of San Diego MHPA (although it is outside City jurisdictional boundaries).

Eighteen vernal pools were previously mapped on the City-owned parcel (0.25 acre of total basin area). All vernal pools are natural and occur on Olivenhain cobbly loam soil. Upland vegetation is characterized by grasslands and coastal sage scrub/chamise chaparral. Proctor Valley has been used for cattle grazing, which resulted in a colonization of the site by exotic plant species, primarily filaree and nonnative grasses.

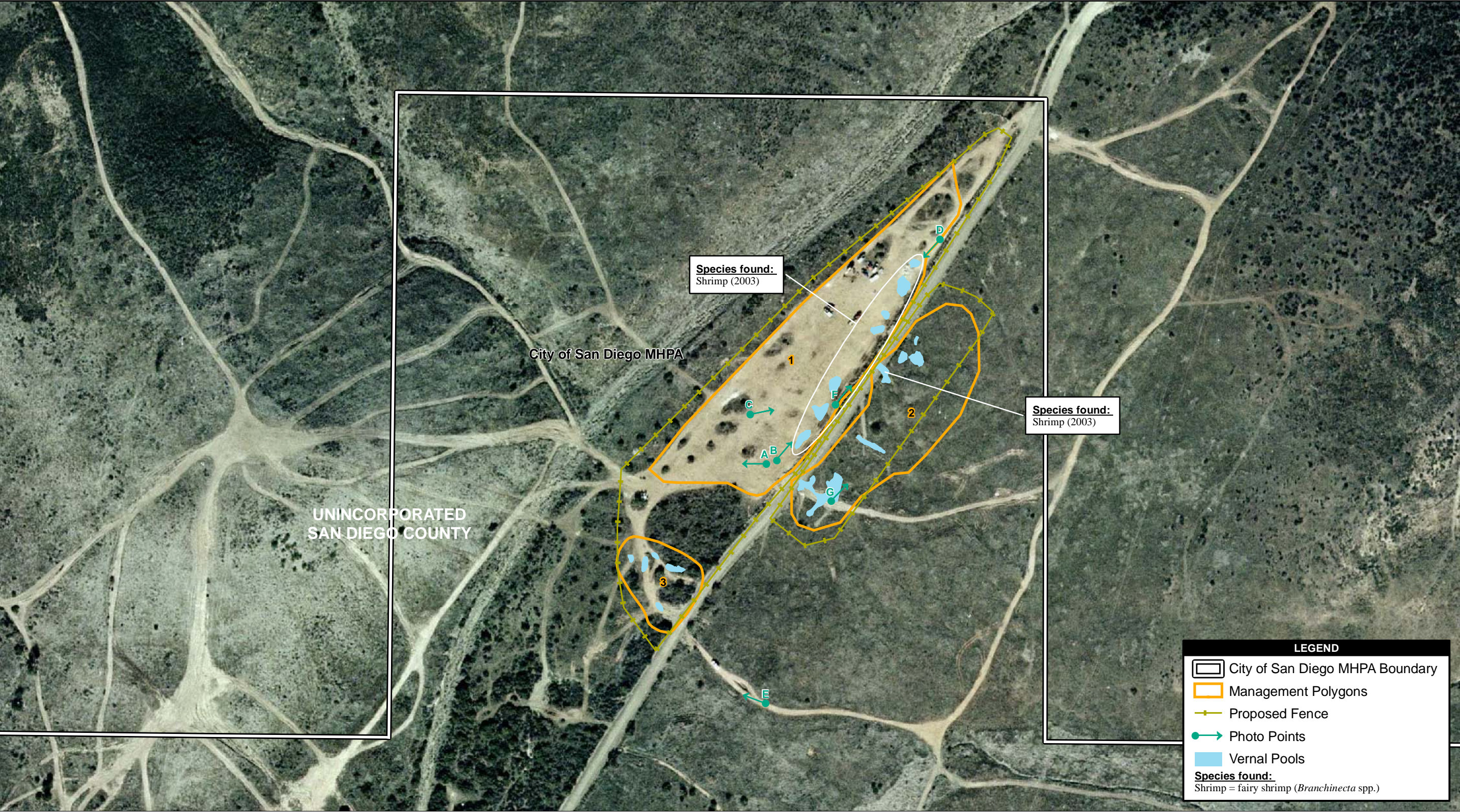
Several management actions recommended by the *City of San Diego Vernal Pool Management Plan* (1996) have been accomplished. The 1996 document suggested a thorough investigation of any unidentified resources, which was completed as part of the *City of San Diego 2002-2003 Vernal Pool Inventory* (2003). An assessment of vernal pool resources and an inspection of the physical condition of the site were also included in the inventory.

This site was at the western edge of the Otay Fire of October 2003. Based on the pre- and post-fire assessment at the nearby Otay Lakes site, fire does not appear to threaten the species' presence or abundance of vernal pool ecosystems. However, fire-fighting activities may disturb this area (City of San Diego 2007).

Figures 2-4b and 2-4c include photographs taken during the site assessment at Proctor Valley. The locations of the photograph points are shown in Figure 2-4a.

2.2.4.1 Species Inventory

This section summarizes the observed and historical presence of sensitive species at Proctor Valley. A complete list of fauna and flora observed during the 2007 site assessment is provided in Appendix A.



Source: AirPhotoUSA 2006; City of San Diego 2003, 2005; MHPA 2003

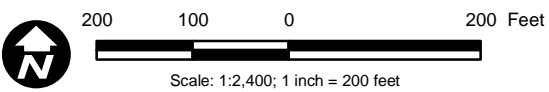


Figure 2-4a
Proctor Valley

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A. West view of a heavily impacted area from ORV use



C. East view of an impacted vernal pool watershed



B. Northeast view of the vernal pool watershed impacted by ORVs



D. Southwest view of impacted vernal pools

NOTE: Photograph points are illustrated in Figure 2-4a

Figure 2-4b
Site Assessment Photographs of Proctor Valley

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E. West facing view of a vernal pool with heavy traffic disturbance from ORV use



G. Northeast view of a vernal pool area east of Proctor Valley Road



F. Northeast view of a fence installed to prevent ORV access

NOTE: Photograph points are illustrated in Figure 2-4a

Figure 2-4c
Site Assessment Photographs of Proctor Valley

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Fauna

Eight vernal pool basins within Proctor Valley have historical records of fairy shrimp presence (City of San Diego 2003). All of the vernal pool basins are adjacent to each other. However, seven of the eight vernal pools are located in the area that has experienced the most devastating impacts to basin topography from ORVs. Because these eight pools are separated from the others on-site by Proctor Valley road, the hydrological qualities necessary to sustain a long-term shrimp population in the pools have been critically altered.

Flora

There were no sensitive species observed in the vernal pools at Proctor Valley during the 2007 assessment. Little mouse tail is historically known from the site (Bauder 1986). During the 2007 assessment, eight vernal pool endemic species were observed within the complex. Approximately 60 to 70 percent of the vernal pool landscape at Proctor Valley is completely void of vegetation due to impacts from ORV activities. The vernal pool area west of Proctor Valley Road is essentially void of any vegetation, whereas on the eastern side the impacts have been less frequent, with a remaining nonnative-dominated vegetative community.

2.2.4.2 Non-Native Plant Evaluation

In the portions of Proctor Valley that are still vegetated, 65 percent of the upland watershed and 35 percent of the vernal pool basins are covered with nonnative annual grasses. Approximately 5 percent of the vegetative cover in the vernal pools is composed of nonnative wetland species, with the remaining 30 percent being upland annual grasses.

2.2.4.3 Fencing Evaluation

Currently, Proctor Valley Road bisects the vernal pool complex and provides access for off-road vehicle users and trash dumping. Major impacts from ORVs were recorded in 1996, 2004, 2005, and 2006. The Water Department is coordinating with the San Diego National Wildlife Refuge and the San Diego Sheriff's Department to enforce trespass laws, in particular relating to ORV use and dumping. Although cattle grazing is not permitted at Proctor Valley, nearby cattle grazing could result in impacts to the site if fencing is not maintained (City of San Diego 2007).

ORV activities have had detrimental effects on this vernal pool complex and surrounding habitat. Although efforts have been made to deter ORV access (i.e., barbed and barbless wire fencing and

rock pile barriers), off-road traffic continues to occur across the site. With vast open areas and numerous dirt roads crisscrossing the entire valley, the area will likely continue to attract ORV users. The existing preventive measures are only considered a temporary deterrent.

2.2.4.4 Vernal Pool Reseeding Evaluation

Despite heavy ORV activity, genetically appropriate plant materials are still available for collection, propagation, and redistribution across the complex. Seed bulking would be required in the areas where vegetation has been eliminated.

2.2.4.5 Plantago Seeding for Quino Evaluation

Proctor Valley is within a 2-mile range of known Quino populations on the USFWS refuge property to the north, as well as on the lower slopes along the north side of Otay Lakes and presents excellent conditions for restoration of functional habitat if ORV activities can be eliminated. *Plantago* occurs on-site, in limited quantities in openings of the nonnative thatch on the east side of Proctor Valley Road, and would require seed bulking to enhance the population.

2.2.4.6 Recontouring/Topographic Reconstruction Evaluation

Heavy ORV traffic has altered the hydrology for the entire site by reshaping its mima mound topography. Salvage of native vegetation and soil from vernal pools harboring fairy shrimp will allow mechanized equipment to be used on much of the site without significant impacts to existing biological resources. Access is readily available from Proctor Valley Road.

2.2.4.7 Artificial Burrowing Owl Burrow Evaluation

Since the on-site hydrology has been negatively affected and will require recontouring, and because current soil disturbances are severe, the site is ideal for artificial owl burrow installation during restoration efforts. Off-site soil input would be required to create additional burrows. The site is dissected by Proctor Valley Road, facilitating mechanized equipment access.

2.2.5 Marron Valley

The Marron Valley vernal pool site is located in San Diego County on 2,644 acres owned and managed by the City of San Diego Water Department. This remote site is located approximately 25 miles east of the Pacific Ocean along the U.S./Mexican border within the Marron Valley

Conservation Bank, which is included in the MSCP Cornerstone Bank Agreement (Figure 2-5a). Marron Valley is within the City of San Diego MHPA; however, the site is outside City's jurisdictional boundaries (City of San Diego 2007).

Fourteen vernal pools (0.18 acre of basin area) were mapped at Marron Valley. All vernal pools are natural. Soils on-site include Huerhuero loam and Visalia gravelly sandy loam, with nonnative grasses and forbs (including filaree) and southern mixed chaparral in the upland areas.

Fire plays an important part in the natural ecologic regime at Marron Valley. The *Marron Valley Preserve Wildland Fire Management Plan* (Tierra Data 2006) describes fire behavior in Marron Valley, recommends actions to restore a more natural fire regime, and facilitates interagency communication in the event of fire to minimize risk of impacts from fire suppression activities. Evidence from data collected between 1969 and 2006 suggests that Marron Valley has a burn frequency of 10 to 15+ years (Tierra Data 2006). Signs to restrict access of fire crews in sensitive resource areas were installed at the site. In addition, fuel management actions are being undertaken by the California Department of Forestry in accordance with the recommendations of the Fire Management Plan.

Figure 2-5b includes photographs taken during the site assessment at Marron Valley. The locations of the photograph points are shown in Figure 2-5a.

2.2.5.1 Species Inventory

This section summarizes the observed and historical presence of sensitive species at Marron Valley. A complete list of fauna and flora observed during the 2007 site assessment is provided in Appendix A.

Fauna

No evidence of sensitive wildlife was observed during the 2007 assessment. Three vernal pool basins have historical records of fairy shrimp presence (City of San Diego 2003). These pools are close to existing roads and one road is frequently trafficked. Little mousetail is also known from the site.

San Diego fairy shrimp are present at basins in all burn frequency locations. Therefore, fire does not appear to have impacted the fairy shrimp populations.

Flora

There were no sensitive species observed in the vernal pools during the 2007 assessment. However, little mousetail was observed in one vernal pool basin in the spring of 2007 (McMillan 2007, pers. comm.). The species was not relocated during the summer 2007 assessment. The incident is an example of the importance of properly timed surveys to accurately assess the species composition in this dynamic habitat, as well as the importance of including historical data to fully understand site conditions when making management recommendations. During the 2007 assessment, five vernal pool endemic species were observed within the complex (Appendix A).

2.2.5.2 Non-Native Plant Evaluation

Approximately 55 to 80 percent of the upland watershed and 20 to 60 percent of the vernal pool basins within Marron Valley are covered by nonnative annual grasses. Approximately 5 percent of the vegetative cover in the vernal pools is composed of nonnative wetland species, with the remaining nonnative cover being upland annual grasses.

2.2.5.3 Fencing Evaluation

There is minimal ORV trespass through this site from ORVs due to locked gates at the perimeter of the site. The surrounding area is frequented by Border Patrol. The major threat to this area results from the high intensity foot traffic of trespassers. Impacts from trampling of sensitive vegetation, litter, and an unnaturally short fire interval are all visible in Marron Valley as a result of trespassers. The site was leased for grazing until 2001, and impacts from cattle (e.g., hoof indentations) are visible in vernal pool basins. Although grazing is prohibited in the valley, cattle from Mexico are able to access the site across the international border, immediately south of the site, and continue to graze and trample the vernal pool basins.

Because the main access road is gated and the valley is surrounded by rugged terrain, the site is relatively protected from unauthorized vehicle traffic. However, continued trampling by cattle has a negative impact on vernal pool hydrology and prohibits survival of floral species on-site.



Figure 2-5a
Marron Valley

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A. South view of two vernal pools hosting fairy shrimp
(City of San Diego 2003)



C. Southwest view of a possible vernal pool basin in Polygon 5



B. East view of a vernal pool basin



D. South view of a vernal pool basin trampled by cattle

NOTE: Photograph points are illustrated in Figure 2-5a

Figure 2-5b
Site Assessment Photographs of Marron Valley

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2.2.5.4 Vernal Pool Reseeding Evaluation

Little mouselink was seen in one of the vernal pool basins during the preliminary site visit by EDAW in the spring of 2007 but was not relocated during the 2007 assessment. Although the species is not technically extirpated, with current cattle impacts and considering the limited quantity of the species that was observed in 2007 (i.e., one specimen), seed bulking and vernal pool protection will be needed to reestablish a healthy population. Other vernal pool endemic species are also being negatively affected by the cattle trampling and could benefit from a seed bulking/cattle prevention effort.

2.2.5.5 Plantago Seeding for Quino Evaluation

The site is within a 2.5-mile range of known Quino populations, including the USFWS Quino reference site along the western slopes of Tecate Mountain. With plantago already occurring on-site, Marron Valley presents excellent conditions for restoration of functional habitat if cattle grazing impacts can be eliminated.

2.2.5.6 Recontouring/Topographic Reconstruction Evaluation

Although cattle trampling has affected the soil structure within individual vernal pools, it has not had a negative effect on the hydrological functionality of the watershed, i.e., trampling has remained within the basins without altering vernal pool contours. Therefore, topographic reconstruction is not necessary.

2.2.5.7 Artificial Burrowing Owl Burrow Evaluation

Burrowing owls are not known from within 5 miles of the site so Marron Valley is not an ideal candidate for installation of artificial burrows. In addition, the soil structure is relatively undisturbed, so the site is not ideal for active excavation for burrow installation.

2.2.6 West Otay A & B

West Otay A & B is located in Otay Mesa near the San Diego Gas and Electric (SDG&E) substation south of Old Otay Mesa Road (Figure 2-6a). The portion of the site that contains vernal pools is approximately 9 acres. The vernal pool basins occur on conserved lands. The parcels were formerly owned and managed by The Environmental Trust, a former nonprofit organization that filed for Chapter 11 Bankruptcy in May 2005. The site is in the process of

being transferred to the City. The site is zoned as Open space and is adjacent to the City of San Diego MHPA (City of San Diego 2007). Surrounding land uses include transportation, residential, utility and open space.

Fifty-seven vernal pools were mapped at West Otay A & B, including 47 created basins, 7 restored basins, 2 natural basins, and 1 road rut, covering a total of 2.86 acres. The seven restored basins (totaling 1,360 m²) were created as part of the mitigation for the Sweetwater Union High School project (USFWS Biological Opinion 1-6-99-F-77 and *Vernal Pool Mitigation Plan for the SUHSD Otay Mesa High School Site* [Helix 2000]). The site is characterized by Stockpen gravelly clay loam on 0 to 2 percent slopes, and the vernal pools are underlain by Huerhuero loam.

Although West Otay A & B is adjacent to an SDG&E substation, the location is relatively remote. The area is connected to City of San Diego MHPA/open space area, including additional vernal pool sites, which minimizes impacts from isolation. Fencing was installed upon conservation of the property; however, it was stolen and has not been replaced. Trespass is primarily due to ORV activities, although Border Patrol and foot traffic by trespassers also impact the site (City of San Diego 2007).

Figure 2-6b includes photographs taken during the site assessment at West Otay A & B. The locations of the photograph points are shown in Figure 2-6a.

2.2.6.1 Species Inventory

This section summarizes the observed and historical presence of sensitive species at West Otay A & B. A complete list of fauna and flora observed during the 2007 site assessment is provided in Appendix A

Fauna

During the site assessment, no evidence of sensitive wildlife was observed at the site. However, several of the vernal pool basins have historical records of San Diego and Riverside fairy shrimp (City of San Diego 2003). Because the 2007 assessment was conducted during the dry season (as described in Section 2.1), fairy shrimp could not be observed in the vernal pools.



Source: AirPhotoUSA 2006; City of San Diego 2003; MHPA 2003

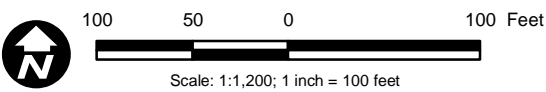


Figure 2-6a
West Otay A & B

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A. Disturbed roadside vernal pool in Polygon 2, looking west



C. Restored vernal pool in Polygon1, looking southeast



B. Restored vernal pool in Polygon1, looking southwest



D. Disturbed trench vernal pools in Polygon 2, looking south

NOTE: Photograph points are illustrated in Figure 2-6a

Figure 2-6b
Site Assessment Photographs of West Otay A and B

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Flora

Upland vegetation is disturbed southern mixed chaparral and non-native grasslands. Nonnative invasive species occur in both the upland areas and vernal pools. Prior to restoration, recreational off-road vehicle and human foot traffic contributed to invasion by exotic species. Several of the vernal pools appear to have been graded and/or trenched, although vernal pool species continue to persist.

During the 2007 assessment, six vernal pool endemic species were observed within the complex, three of which are sensitive species: San Diego button-celery, spreading navarretia, and Otay mesa mint. Little mouse tail, another sensitive species, was historically observed in 20 vernal pool basins (City of San Diego 2003) but was not relocated during the 2007 assessment. Due to its relatively fragile and size-limited morphology it is possible it was present during the spring and early summer season and dried during the hot summer months. During the 2007 assessment, Otay mesa mint and spreading navarretia were observed in approximately 50 percent of the vernal pools where they were observed in 2003 (City of San Diego 2003). Although the flowering remains of these two species typically last longer through the summer season than those of the little mousetail, they remain fragile. Therefore, due to the seasonally late assessment, the lower number of occurrences cannot be assumed to represent a decline in the range of those populations. Flowering remains of San Diego button-celery, which are often observed through the winter season and well into the following growing season, were observed in four vernal pool basins during the 2007 assessment. Only one pool did not have a historical presence of the species.

2.2.6.2 Nonnative Plant Evaluation

During the 2007 assessment, the complex was divided into two management polygons, primarily based on historical management of the site. Polygon 1 constitutes a recently implemented vernal pool restoration site, where regular maintenance and weed control activities have been performed by Helix. Comparably, Polygon 2 has been relatively unmaintained. The difference is apparent in the nonnative plant cover. While upland nonnative cover is above 50 percent in both polygons, vernal pool basin cover for polygon 1 and 2 are 15 and 85 percent, respectively. Although the basins in polygon 1 have a significantly lower nonnative presence than those in polygon 2, vernal pool/wetland species, primarily boccone's sandspurry (*Spergularia bocconii*) make up 5 percent of the vernal pool vegetative cover in both polygons.

2.2.6.3 Fencing Evaluation

Polygon 1 is already fenced, whereas Polygon 2 is not. Polygon 2 was fenced in the past, but most of the fence material has been stolen. Surrounding roads increase the risk of vehicle impacts to the flora and fauna of the vernal pool basins in Polygon 2. Although no current impacts have been observed, ORV activities on the dirt access roads surrounding the West Otay A & B complex pose a potential threat to the complex. ORVs typically utilize the least vegetated areas (i.e., vernal pool basins) as turnarounds and pull-offs. Therefore, the road posts a potential future threat to the vernal pool basins and watershed. A visual barrier installed prior to any impacts occurring, such as a split rail, may be a more effective long-term protective measure of the resources than a post-impact-installed fence.

2.2.6.4 Vernal Pool Reseeding Evaluation

There are no known extirpated species from the site. Although not required at this time, site-specific seed is available for collection should seed bulking be required in the future.

2.2.6.5 Plantago Seeding for Quino Evaluation

Quino is known to still occur within 2 miles of the site. Seed bulking and redistribution, using site available plantago, will help the site to develop appropriate conditions for Quino habitat.

2.2.6.6 Recontouring/Topographic Reconstruction Evaluation

Topographic disturbance from ORV traffic has resulted in both aesthetic and hydrological impacts at West Otay A & B. There are opportunities for recontouring/topographic reconstruction to address impacts to hydrological function of the basins.

2.2.6.7 Artificial Burrowing Owl Burrow Evaluation

Known populations of burrowing owls still occur on Otay Mesa. Areas where previous disturbances have occurred, i.e., along dirt access roads and to parts of the mima mound topography, are suitable for installment of artificial burrows. Off-site soil input would be required but would not post a logistical challenge since the site is accessible via the dirt road.

2.2.7 The Smith Site

Due to access restrictions for safety reasons, a site assessment was not performed at the Smith Site. Site descriptions are based on historical information and data sources (Dudek & Associates, Inc. 1992; Bauder 1986b). Appendix B provides a map of historic data from previous survey reports (Dudek & Associates, Inc. 1992).

The Smith Site is located on County-owned land in Otay Mesa, east of Brownfield Auxiliary Airport and generally west of the East Mesa California State Correctional Facility (Figure 2-7). Although the site is adjacent to the prison, access to the site is limited. Portions of the Smith Site are within the County's MSCP Hardline Preserve. The vernal pools on Otay Mesa have the only natural occurrence of Otay Mesa mint in the United States (Bauder 1986b). The site is composed of what were once considered the most extensive and least disturbed vernal pool complexes on Otay Mesa (J23-24, J25, and J26), which are described in more detail below. Almost all of the extant occurrences for Otay Mesa mint are in the vernal pools in the J23-26 complexes, with less than 5 vernal pools known to naturally support this species in other areas of Otay Mesa.

J23-34

The J23-24 complex is located on a large finger mesa extending to the west of the prison. The topography is generally undisturbed with the exception of a dirt access road along the boundary of the prison property. The complex has historically been grazed by cattle. Many bomb craters and bomb debris have been observed scattered across the mesa on mima mounds and in the vernal pool basins (Dudek & Associates, Inc. 1992).

The complex includes 533 vernal pools, 19 of which occur in the dirt access road. During historic surveys, 11 vernal pool species were present on J23-24, including the state and federally endangered species San Diego button-celery (found in 28 pools) and Otay mesa mint (found in 24 pools) (Dudek & Associates, Inc. 1992).

Previous management recommendations have included fencing to minimize grazing impacts and weeding to remove nonnative grasses (Bauder 1986b), which have not been implemented to date. Currently, cattle grazing has been restricted from this area, but some unauthorized grazing by horses has been documented in recent years (EDAW 2007a).

J25

The J25 complex is located on a mesa bounded by Otay Valley on the northwest, O'Neal Canyon on the north, and a smaller unnamed canyon that separates the mesa from J23-24 to the south. The mesa was historically used as a test bombing range in the 1940s. Test bombing created deeper craters in some of the vernal pool basins (Dudek & Associates, Inc. 1992). Additional disturbances include a dirt road and cattle tracks from historical grazing.

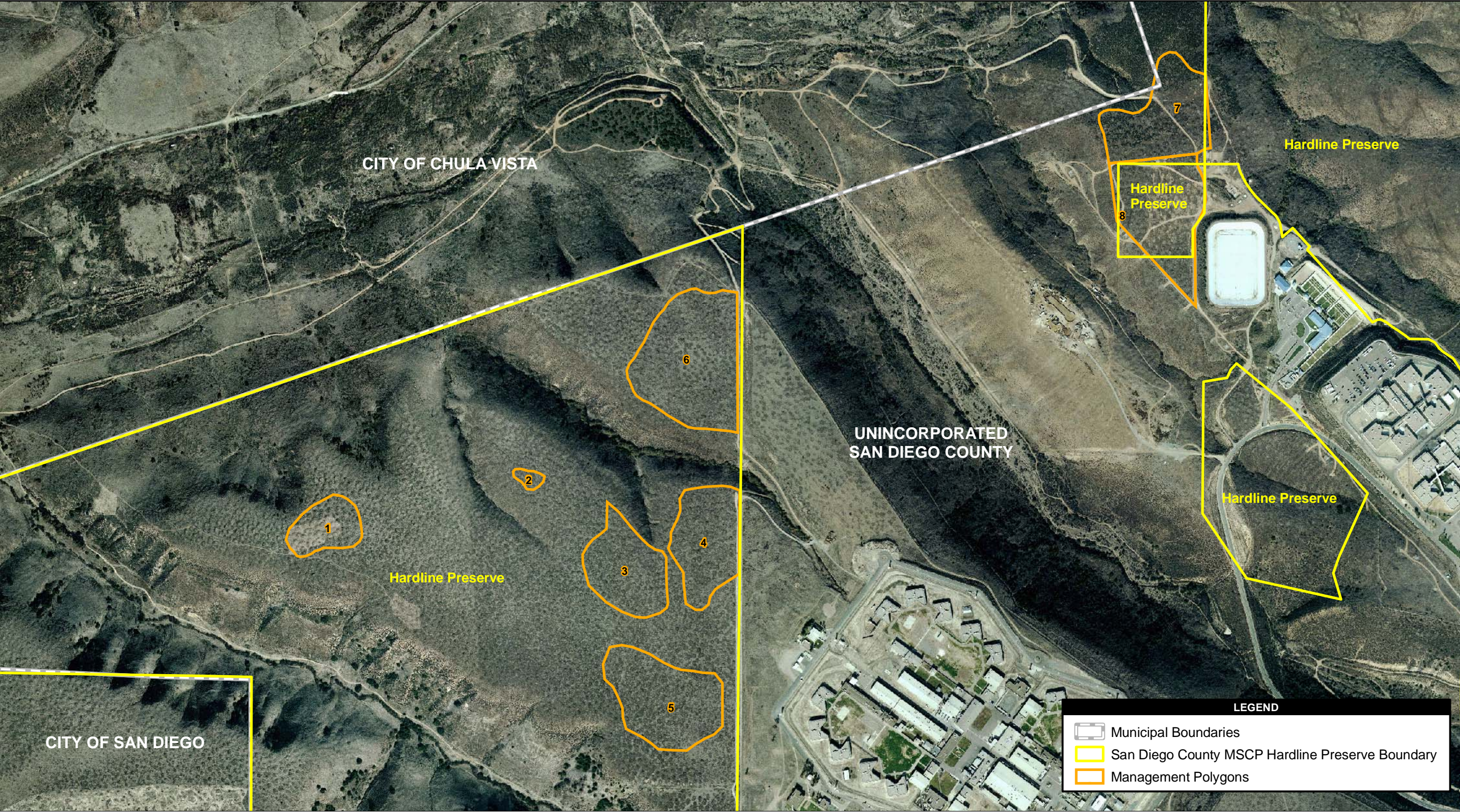
A total of 151 vernal pool basins occur on the J25 mesa, 11 of which lie within the dirt road and 53 of which appear to have been deepened by impacts of test bombing. The mesa has the most extensive population of San Diego button-celery on Otay Mesa; it was present in 55 pools in historic surveys. Otay Mesa mint occurred in 55 pools, of which 22 had been deepened by bomb impacts. San Diego fairy shrimp was also historically observed at J25 (Dudek & Associates, Inc. 1992).

Previous management recommendations have included fencing to minimize grazing impacts and weeding to remove nonnative grasses (Bauder 1986b), which have not been implemented to date. Currently, cattle grazing has been restricted from this area, but some unauthorized grazing by horses has been documented in recent years (EDAW 2007a).

J26

Historical survey data at J26 indicated a significant population of Otay Mesa mint, as well as the presence of San Diego button-celery, with few nonnative species (Bauder 1986b). At the time of the surveys, pools were embedded in dense undisturbed chamise. The mounded topography is generally undisturbed. A dirt access road occurs across the site, with somewhat disturbed San Diego button-celery populations to the east of the road. Limited access to the site may have accounted for the relatively low level of disturbance in the past, but the site was burned repeatedly during the 1990's and the upland chamise chaparral vegetation has been converted to disturbed chaparral and nonnative grassland with a level of weed cover. Currently, the J26 complex has the most extensive population of Otay Mesa mint remaining on Otay, even with the extensive weed invasion that has occurred as a result of the fires (McMillan 2007, pers. comm.).

Previous management recommendations have included fencing to minimize grazing impacts and rehabilitation of the San Diego button-celery population near the dirt access road, which have not been implemented to date.



Source: AirPhotoUSA 2006; MSCP 2006; SanGIS 2007 Note: Digital vernal pool basin and species data are not available for the Smith Site. Maps from previous reports are provided in Appendix B.

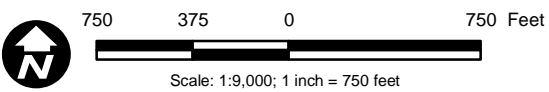


Figure 2-7
Smith Site

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CHAPTER 3.0

RESTORATION AND MANAGEMENT ACTIVITIES

3.1 OBJECTIVES

Following the site assessment, restoration and management recommendations were developed for each site. The recommendations prioritize site-specific management and restoration actions at the vernal pool sites to stabilize and aid recovery of vernal pools and vernal pool sensitive species in San Diego County. Restoration of habitat for Quino and burrowing owl is also a priority of the project. Prioritization of site-specific restoration and management activities has been conducted in collaboration with the City, County, SANDAG, and regulatory agencies, and was based on the following principles:

- **Concentration of Effort:** Concentrating recommended restoration and management activities in a subset of the sites and/or a subset of the vernal pools may be necessary to achieve project goals. The intent is to concentrate efforts at sites with the greatest opportunity to achieve long-term restoration success for sustainability of sensitive resources and ecosystem function.
- **Priority for Sensitive Species Populations:** Sites and basins with sensitive species are a priority over sites that do not contain listed species. First priority is given to sites that have had potential extirpation of sensitive species, and second priority is given to sites or basins with extant sensitive species that require stabilization or improvement.
- **Recontouring of Basins:** Basin and mound recontouring have been prioritized based on hydrology. Basin recontouring that is necessary to maintain or restore the natural hydrological conditions of a pool is a priority over recontouring that is designed to improve the appearance of the pool rather than its function. If ruts, berms, or other artificial features do not appear to be affecting hydrology or flow patterns, then those basins will have a reduced priority for recontouring.

Restoration of each site will involve implementation of up to six key activities: (1) fencing and access control; (2) weed control; (3) seeding of plantago and sensitive species; (4) recontouring of vernal pools; (5) installation of artificial burrowing owl burrows; and (6) planting of native species. These activities are described in more detail in Section 3.2 below. The restoration effort will involve an adaptive implementation and management approach. That is, the restoration goals and management recommendations will act as guidelines for actions at each

site. However, as implementation proceeds on the ground at each site, specific restoration and management actions may be adjusted based on site conditions and needs.

Chapters 4.0 and 5.0 include the restoration and management recommendations for each site, as well as a preliminary schedule and fee estimate for implementation of specific recommendations.

3.2 METHODOLOGY

The following section provides an overview of the approach to implementation of restoration and management efforts at the vernal pool sites. The specific combination of methods used will be based on site conditions and weather patterns and will be determined by the project's Restoration Ecologist.

3.2.1 Fencing

Fencing will be installed at sites as needed based on the results of the site assessment. The type and length of fencing at each site will depend on the site needs. Typical fence types include:

- 3-stranded barbless wire
- 2-plank woodcrete
- ORV deterrent fencing
- 6-foot chain-link

Fence installation will occur outside the breeding season, so installation does not disturb nesting birds or other wildlife. If possible, fencing installation will be timed with site dethatching (see below), so the cost of crews and equipment on-site can be utilized for both tasks. If possible, fencing material will be brought in and the thatch will be hauled out for disposal during the same site visits. Only existing roads will be used to access the areas that will be fenced (new disturbance areas will not be created during the installation of fencing).

3.2.2 Weed Control

A weed control program will be developed for specific sites. This program will include dethatching, followed by site visits as necessary to apply herbicide and other weed control measures.

Dethatching is most appropriately performed in the winter season, prior to the breeding season, with follow-up visits during the spring and early summer. Dethatching will be timed with the installation of fencing. Timing of spring and summer herbicide application and other weed control measures (e.g., use of weed-eating equipment) will be based on rainfall patterns and site conditions. The timing of this work will be based on the germination and development of the nonnative target species at each site, not on a predetermined schedule, but the expected range of dates for each trip is given in the implementation schedule included in Chapter 6.0 of this report.

Hand seeding of plantago will follow the completion of fence installation and dethatching, so that disturbances are complete and the site has been prepared for maximum seed set and germination.

Dethatching

Dethatching consists of removing dead biomass from previous years' growth of nonnative annual species, especially nonnative annual grasses. Within the vernal pools and upland habitats at the project sites, sensitive biological resources are being suppressed due to the thatch accumulation. The primary purpose of dethatching is to remove this biomass, creating more exposed soil within the vernal pool basins or in the upland watersheds. The increased exposure will improve the germination of native vernal pool and upland plant species, as well as reduce competition for light, water, and other nutrient resources.

Another benefit to dethatching is that it does not carry the same risks as weed eating, mowing, and herbicide use. Dethatching is usually most effective when it follows spring flowering and seed set, so the risk of damaging developing native plant species is substantially reduced. This reduction of the seed bank can be very effective for species that retain seed late into the spring and summer. If dethatching is done while the nonnative seed heads are still on the stalks, then weed seed can be effectively removed along with the thatch. Thatch removed from the vernal pool or upland habitat will be transported off-site and disposed of at an appropriate disposal facility.

Dethatching not only opens up the available habitat for native species, but it also makes other weed control measures more effective and efficient. Efforts to apply herbicide to weed populations are made more difficult by thatch, as the germinating weed seedlings are hidden under the thatch, restricting the herbicide penetration. Therefore, herbicide treatment cannot be effective until later in the season, when the weed populations have become established and the native species have already faced heavy competition. Once an area has been dethatched, the

habitat becomes more open. This allows better exposure of the germinating weed species for herbicide application or hand weeding. The more open habitat following dethatching is also beneficial to reseeding and/or replanting efforts.

One important task that should be accomplished prior to dethatching is the collection of any target native plant seed. When native plants are distributed in and amongst otherwise nonnative vegetation, the seed and other types of propagules should be collected prior to dethatching. This collection of native seed will minimize the removal of the native seed bank. This seed can be stored until the next growing season, or it can simply be put back on-site following completion of dethatching and cleanup.

Hand Weeding

Weeding by hand is the least efficient method that can be used on vernal pool and Quino habitats. Hand weeding is difficult and expensive relative to the area that can be covered. Although hand weeding does not have the risks of herbicide or weed eating and moving, it does have some risks. Because hand weeding is slow and time consuming, the area being weeded can be disturbed by trampling, which can be very difficult to control. In addition, pulling the weeds from the ground can cause a substantial amount of soil disturbance in and around the area of weeding, especially when the clay soils are moist or saturated from the spring rains. This disturbance can often be substantial enough to counter the effects of the initial weeding, and in some cases can allow nonnative plant species to invade where they previously had not been found. Hand weeding should only be used when and where it is too difficult to use other methods, or where the area to be managed is small enough that hand weeding can be accomplished efficiently.

Weed Eating and Mowing

Weed eating and mowing can be effective tools to prevent species, such as nonnative annual grasses, from flowering and thus producing seeds. Weed eating is appropriate in both the vernal pools and their surrounding watersheds. Mowing is appropriate in the surrounding upland watersheds and is not recommended for vernal pools (e.g., wheeled or tracked vehicles should not be used within the vernal pools). A combination of weed eating and mowing can be effective and efficient if done correctly, especially when sensitive native plants are surrounded by larger areas of weed-dominated cover. Both methods can be efficient and cost-effective when implemented by properly trained crews. Care will be taken to verify a “high” mow is enacted (i.e., no weed eating or mowing shorter than 6 to 8 inches). This is important so that desirable

native species, especially sensitive vernal pool plant species, are not accidentally destroyed or damaged by weed eating or mowing. When coupled with dethatching and herbicide use (see below), weed eating and mowing can contribute to successful control of weeds, allowing native plants to persist or establish.

Each year, the appropriate timing for weed eating and mowing may vary based on annual rainfall. In general, regular weed eating or mowing treatments should begin in later winter and early spring, when nonnative species have grown tall enough for these methods to be effective, but the majority of individuals have not yet begun to flower. The key is to perform weed eating and mowing just as individuals begin to flower, but before the seeds begin to form. In a typical year, nonnative grasses will be ready for weed eating and mowing in January and February. In general, by the end of March or April seeds have developed and weed eating and mowing are less effective. In years with late rainfall, this timing can be pushed back as much as 2 months if rains arrive in March or April. Appropriately timing weed eating and mowing will depend on the species being controlled and the rainfall received that year. These methods are most effective when the cut material is removed from the site either by using mowing bags or hand cleanup.

In general, weed eating and mowing are not a significant threat to invertebrate wildlife, as long as the mowing and weed eating do not disturb the soil. Weed eating and mowing can, however, be a risk to some vertebrate species, especially those species that are foraging in the vegetation to be mowed. To minimize the risk to ground-foraging wildlife, weed eating will be kept at least 6 inches from the ground, and care will be taken to avoid wildlife dens or nests. Care will be taken to avoid sensitive species and alternative weed control methods may be used if necessary, such as hand application of herbicide, as described below.

Herbicide Use

In many cases, herbicide use can be the single most effective method available for weed control in native habitats, even though its cost may be higher than other methods (e.g., grazing, dethatching). As required by law, specific herbicides to be used must be recommended by a licensed pest control advisor and applied under the supervision of a licensed pest control applicator. It is important that the herbicide is appropriate for use around aquatic invertebrates, as the herbicide may get into the water table of ponded vernal pools. Misuse of herbicides can cause substantial damage to native plant species, habitats, and wildlife, especially in aquatic environments. When used properly, herbicide use can be the factor that determines success or failure of weed control. When working on very sensitive habitats such as vernal pools or native grasslands, both the risks of herbicide mistakes as well as the benefits increase.

It is critical to minimize the level of exotics prior to the emergence of vernal pool plant species. Removing competitors at this stage allows for the persistence of greater availability of soil moisture and nutrients later into the growing season. Reducing the height of competitors, once vernal pool plant species have emerged, will increase the quality and quantity of solar radiation and increase floral visibility for pollinators. Because of this, herbicide use is most effective in the earlier stages of plant germination and establishment. In addition, it is easier for herbicide applicators to avoid spraying native species early in the season, as the native and nonnative species have more spatial separation early in the growth cycles. This is especially true if the herbicide treatment area has been dethatched prior to fall-winter germination.

Herbicides will only be used under conditions authorized by the regulatory agencies. Any and all herbicide or pesticide use will be applied in accordance with all federal and state laws. All herbicide and pesticide use will be under the direction of a licensed pest control advisor and will be applied by a licensed applicator, under the supervision of a qualified restoration biologist/ecologist. Application of glyphosate-based herbicides such as RoundUp or Aquamaster, will be accomplished on all areas that have been dethatched. Herbicide will only be applied when wind speed is less than 5 miles per hour, to reduce the potential for drift. Spray nozzles will be of a design to maximize the size of droplets and thus reduce the potential for drift of herbicide to nontarget plants. Where feasible, a 10-foot buffer will be maintained between concentrations of any sensitive plant species and application of herbicide will not occur if rain is projected within 24 hours of the application.

Herbicide will be sprayed, or it can be applied by hand with various specialized applicators. An herbicide wick staff can be used to reach plants by hand; the application is done by contact, not spray, so concerns for overspray are eliminated. A similar method that has been developed by EDAW on some vernal pool restoration projects in San Diego uses specialized gloves that can be soaked in herbicide and applied by hand (EDAW 2006). This method allows for very detailed application and the risk of herbicide accident is greatly reduced. Both of these methods will be applied as part of the weed control program in areas with sensitive habitats and species populations, especially the vernal pools.

When using herbicide, it is always important to stay away from standing water, as the water can transfer herbicide (in a reduced concentration) to the wrong species, both plants and animals. Some aquatic invertebrate species can be especially sensitive to some herbicides. When vernal pools are ponding or close to saturation, only hand herbicide application will be used in the pools. Herbicide spraying will be allowed, but applicators will stay at least 3 feet from the edge

of the vernal pools. The saturated glove technique will be used around the edges of pools that are ponded by specially trained herbicide applicators under the direct supervision of the restoration biologist. This method has obvious risks, but when done properly can have tremendous impacts on vernal pool weeds, such as grass poly (*Lythrum hyssopifolia*), brass buttons (*Cotula coronopifolia*), or sand-spurry (*Spergularia* spp.). Without the use of hand herbicide application, it can be very difficult to control these vernal pool weed species, even if hand weeding is used.

3.2.3 Reintroduction of Native Seed

The following describes the general approach for collecting, propagating, and broadcasting plantago seed and seed from other sensitive species.

Seeding of Plantago

Plantago seed will be hand dispersed over sites with historic and potential Quino habitat as discussed further in Chapter 5.0. The method for seed dispersal will be a combination of hand broadcast as well as using small mechanical broadcasters. As with the weed control, all seeding will be accomplished under direction of the restoration ecologist.

If it is necessary to collect plantago seed from existing populations, then this will be accomplished immediately prior to any dethatching or other weed control efforts. Seed will be collected by hand and taken to a seed bulking facility for propagation.

An important issue that will be taken into account before any plantago seed is collected, purchased, or broadcasted, will be the need to maintain the local plant population genetics. Numerous studies have shown that many butterfly species are ecologically tied to local plant population genetics, so that if a particular butterfly species is fed host plant material from a different genetic population of host plants, the butterflies may not find the new genetic population palatable or even worse may suffer mortality (Longcore et al. 1997; DeVries and Baker 1989). The association of Quino populations with their associated host plant populations is not completely studied, but some palatability reduction has been noted (Pratt 2006, pers. comm.). In an effort to maintain strict quality of both the Quino population genetics as well as the plantago population genetics, plantago seed used in the seeding of the project site will be from appropriate local sources.

Attempts will be made to purchase commercially available plantago from one of the native seed providers (e.g., S&S Seeds), as this option will be most effective. Most of these seed providers do not have extensive seed available from all portions of San Diego County, especially the southwestern areas.

Based on biogeography and known distribution of plantago, EDAW will combine the seven project sites into the following four seed management units:

- Unit 1: Otay Mesa (Goat Mesa, West Otay A & B, Smith Site)
- Unit 2: Otay Lakes/Proctor Valley
- Unit 3: Nobel Drive
- Unit 4: Marron Valley

If any one of these units is not available commercially, then a seed bulking program will be necessary. This program will require seed to be collected in the fall, where it will be taken to a seed bulking facility (e.g., S&S Seeds) and grown out for seed bulking. No more than 10 percent of any given population will be collected, and individual population collections from the same unit will be combined during the seed bulking process.

Seed bulking should take place in the fall and early winter, so that seed is ready for site broadcast by the spring of the following year. The implementation schedule in Chapter 5.0 includes a general schedule for seeding bulking and seed dispersal.

Seeding of Other Sensitive Species

During the assessment, the need for reintroduction of sensitive species has been determined for each site. Very few of the necessary sensitive plant species are available commercially, so it is anticipated that a seed collection and bulking program, similar to the plantago program discussed above, will be necessary to develop enough seed for reintroduction. Any seed collected from state or federally listed plant species will be done under the guidance of the City and the regulatory agencies. Sensitive species seed collection, handling, and reintroduction will be performed by an EDAW biologist or restoration ecologist. (It is assumed that the City will be responsible for acquiring any necessary permits and getting permission from the various potential land managers and property owners prior to seed collection.)

Upon approval, seed will be collected during the fall and taken to a seed storage facility or a seed bulking facility. If adequate amounts of seed are collected then seed will be taken from storage

and reintroduced based on the implementation schedule included in Chapter 5.0. If it is determined that inadequate amounts of seed are available for reintroduction, then the seed will be taken to a seed bulking facility to increase seed quantity. This seed will then be reintroduced to the sites and pools, as approved by the City and resources agencies.

3.2.4 Recontouring of Pools

After dethatching is completed, topography will be sufficiently exposed to reveal the potential for pooling offered by the existing topography. As discussed in Chapter 2.0, the results of the site assessment determined if there is any potential to use equipment for recontouring, while still maintaining and protecting endangered fairy shrimp populations and cyst banks. Use of mechanized equipment will only be used with approval from the City and regulatory agencies.

Recontouring will involve the reshaping of mima mounds as well as excavation of basin areas to mimic natural vernal pool/mima mound topography. Recontouring may include all or some of the following methods:

- excavation/creation of new basins and contouring of new mounds using a small bulldozer in historical mima mound fields;
- decompaction and recontouring of vernal pools in dirt trails using a small bulldozer or hand tools where equipment is not allowed; and/or
- recontouring to remove vehicle tracks and other disturbances using a small bulldozer or hand tools where equipment is not allowed.

If grading or excavation is required for recontouring, a grading plan will be developed as guideline. Grading would be performed during the dry season with a bulldozer small enough to access and maneuver within the site. The limit of work will be graded as indicated on the grading plan. Mima mounds that function biologically and appropriately and contain sensitive biological resources will be left in tact. Vernal pools will be slightly (1 to 2 inches) overgraded and backfilled with topsoil to promote plant propagation.

A final pregrading field visit will be conducted to delineate areas of cut and fill using a trail of flour and/or pin flagging. No spray paint will be used. A complete set of preconstruction photographs will also be taken at this time. The grading operator will be familiarized with the site and issues involved during a preconstruction site visit.

Areas to be manipulated with grading equipment or hand tools shall be graded before the saturation of soils. Site grading and construction of mima mounds shall be performed by using no less than one-third of the cut soil as fill material for mima mounds (0.3:1). Ideally, all cut and fill shall be balanced to avoid off-site export of usable soil. Work will be monitored with a laser transit to ensure that the design is followed and that the depths and flow patterns are correctly maintained or modified.

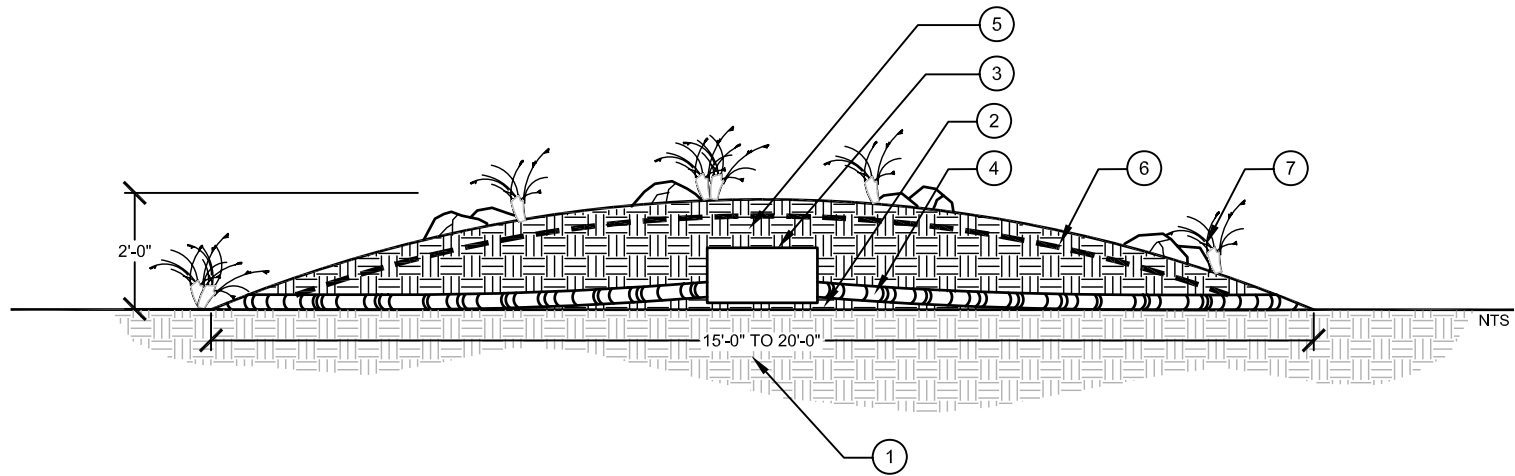
3.2.5 Installation of Artificial Burrowing Owl Burrows

Whenever possible, attempts will be made to incorporate artificial burrowing owl burrows into the mounds and upland areas where recontouring is conducted. When designed correctly, mima mound areas can provide excellent potential for the inclusion of artificial burrows. The design of the artificial owl burrows will follow the agency-approved design used on the State Route 125 Vernal Pool and Quino Habitat Restoration site (EDAW 2007). Figure 3-1 is a schematic of the artificial burrowing owl burrow design, which was developed for this site. This design has proven very successful in attracting and maintaining burrowing owl populations. This design uses weather-resistant irrigation boxes as the nest box, and 6-inch-diameter corrugated plastic pipe for the tunnels. Each nest box has two entrances and is covered in aviary wire before being covered in soil. This aviary wire layer has proven very important in keeping predators such as coyotes and foxes from excavating the burrow and harming the birds or their nests. The final design and location of owl burrows will be approved by the City, County, and Wildlife Agencies.

3.2.6 Planting of Native Species

Where necessary, container plants of vernal pool species will be installed in the basins to increase native plant cover and diversity. Native species will also be installed in the upland watersheds. Container plants will be purchased from a native nursery (e.g., RECON). Where appropriate, coastal cholla (*Opuntia prolifera*) and prickley pear (*Optina littoralis*) cactus cuttings will be installed to reestablish or enhance habitat for coastal cactus wren (*Campylorhynchus brunneicapillus*), an MSCP-covered species onsite, if available, or purchased from a native nursery. Cactus cuttings will either be collected on-site (if available) or purchased from a native plant nursery.

Prior to plant material installation, the soil around the vernal pool basins shall be decompacted to promote successful rooting. Where possible, upland soils shall be tilled with a tractor or hand tools to a soil surface depth of approximately 4 inches in two directions.



LEGEND

- | | |
|---|---|
| ① NATIVE SOIL HORIZONS (TOPSOIL & CLAY PAN) | ⑤ MOUND OF SOIL (APPROXIMATELY 20 - 25 CUBIC YARDS) |
| ② 2" - 3" ADDITIONAL TOPSOIL UNDER IRRIGATION BOX | ⑥ GEO-MESH COVERING MOUND TO DETER PREDATION
APPROXIMATELY 4" - 6" BELOW TOPSOIL HORIZON OF MOUND
SMALL HOLES CUT IN MESH TO ACCOMMODATE PLANT MATERIAL |
| ③ PLASTIC IRRIGATION VALVE BOX
APPROXIMATELY 2'x1.5'x1' | ⑦ LANDSCAPING CONSISTING OF LOW GROWING PLANTS AND ROCKS |
| ④ CORRUGATED PLASTIC PIPE (6" DIAMETER)
ABOVE CLAY PAN TO PREVENT FLOODING | |

Not to Scale

Figure 3-1
Schematic of Artificial Burrowing Owl Burrow Design

Planting of container plants will be performed during or immediately prior to the winter rainy period to maximize success of the installation effort (October to January, and no later than March 1st). The transport of plants will be restricted to periods of cool cloudy weather to increase plant survivorship. If this is not possible, plants shall be watered immediately before and after installation. Plants will be inspected and specimens not deemed viable shall not be installed. Plants will be free of Argentine ants. Planting locations will mimic the plant composition and structure of natural habitats in the area. Desired plant locations will be flagged and direct the transplanting effort.

The following provides general guidance for installation of container plants:

1. Dig a hole twice as deep and three times as wide as the container. Break up soil clods and avoid a smooth-sided “bathtub” effect in the hole. Fill the planting hole with water and allow to drain completely into the soil.
2. Partially backfill the hole with native soil to allow planting at the proper depth. Moisten and gently tamp the backfill into place. Remove the plant from its container and place on top of the moistened backfill so the plant collar is approximately 1 inch above finish grade. Then backfill the remaining hole with native soil.
3. Create a planting basin berm, roughly 2 feet in diameter around the plant, and apply 1 to 2 inches of coarse, organic, weed-free mulch inside the berm. Then thoroughly water and allow to drain.

CHAPTER 4.0

RESTORATION AND MANAGEMENT RECOMMENDATIONS

Prioritization of restoration and management recommendations for each site is based on review of historical data, 2007 site reconnaissance surveys, as well as input from local experts in vernal pool systems and ecologically appropriate methods to improve these systems. This prioritization takes into account the project's logistical constraints, as well as the specific agency directives for pools at each site.

Costs are provided for suggested management activities at each site in Sections 4.1 through 4.5, even if those activities are not recommended to be funded as part of this project. Table 4-1 summarizes the tasks and estimated cost for each site (expressed in 2007 dollars). These costs assume restoration oversight by the lead restoration ecologist and a minimal amount of agency coordination. A report summarizing results of implementation of restoration and management recommendations is not included in these costs. These costs may be used to help reviewers understand the budgets that were evaluated, as well as to an estimate for future funding opportunities. Priority restoration and management recommendations are provided in Chapter 5.0 to direct where and when to conduct work at specific sites. For future budget planning purposes, costs are also provided for the sites that are not included in this current program (i.e., J26 complex).

The intent of the restoration program is to maximize the use of available funds for recommended restoration and management activities. Cost estimates provided in this chapter are conservative (i.e., it is possible that work could be completed for a lower cost than assumed for some activities). If additional funding is available following implementation of recommended priority activities, additional work may be performed at certain sites based on recommendations in Chapter 5.

Weed control recommendations are separated into three different effort and cost levels. Weed Control 1 is the lowest level of effort for sites do not have extensive weed cover and will involve approximately 2 site visits by weed control crews. Weed Control 2 and Weed Control 3 represents approximately 3 and 4 site visits by weed control crews, respectively. Weed Control 2 and 3 are recommended where weed covers are high or expected by be more difficult to manage.

4.1 NOBEL DRIVE

The vernal pool and upland habitat value at Nobel Drive is relatively high, with most of the vernal pool habitat protected by the current fencing and management. The larger open space area that Nobel Drive is part of is actively utilized by hikers, mountain bikers, and other visitors. This site is intended for some recreational uses, so the current site access must be maintained, except where it is affecting the vernal pools or the vernal pool watershed.

4.1.1 Dethatching

The entire complex of vernal pools at Nobel Drive should be dethatched along with a buffer area surrounding the basins. Dethatching should occur prior to any recontouring, seeding, or other restoration activities and will follow the approach outlined in Chapter 3.0.

Estimated Cost: \$5,400

4.1.2 Weeding

The site should be dethatched in the fall, followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will conduct at least four site visits and the timing will be based on the current rainfall, germination, and growth patterns. The vernal pools at Nobel Drive do not have extensive weed cover, but the pools do have populations of weed species that will require hand herbicide application with the glove method. The upland areas of the site are primarily disturbed native grassland, so native grasses, bulbs, and other species are present in the understory of the thatch. Once the thatch is cleared, more areas of the site will be available for follow-up methods of herbicide application and mowing.

Estimated Cost: \$2,700 (*Weed Control 1*)

4.1.3 Seed Dispersal

Vernal Pools

Nobel Drive has one sensitive plant species that has possibly been extirpated from the pools: spreading navarretia. The population was last seen in the spring of 2001 (McMillan 2007, pers.

Table 4-1
Estimated Site-Specific Polygon Restoration and Management Recommendation Costs

Location		Size and Quantities									Recommended Restoration and Management Costs										TOTAL
Site	Polygon	Area (acre)	Vernal Pools	Vernal Pool Area (acre)	Vernal Pools with Erar	Vernal Pools with Mymi	Vernal Pools with Nafo	Vernal Pools with Ponu	Vernal Pools with Brspp.	Upland Watershed Sensitive Species	Dethatching	Weed Control 1 (two visits)	Weed Control 2 (three visits)	Weed Control 3 (four visits)	Reseed Sensitive Species	Reseed Plantago	Recontouring	Owl Burrow Installation	Fencing	Container Plant Installation	
Nobel Drive	1	0.4	2	0.01					1		\$1,200	\$600	\$1,000	\$1,600					3-strand wire to discourage pedestrian traffic		
	2	1.4	5	0.07					5		\$4,200	\$2,100	\$3,500	\$5,600					1,385 linear feet x \$5.50/foot		
	Total	1.8	7	0.09					6		\$5,400	\$2,700*	\$4,500	\$7,200	\$2,500	not recommended	\$2,700	\$5,000	\$7,600		\$30,400
Goat Mesa	1	0.2	1	0.11	1						\$600	\$300	\$500	\$800					Fencing would need to be 6' chain-link for the goats and also post and cable for off-road vehicles		
	2	1.1	6	0.08	6	1	2				\$3,300	\$1,650	\$2,750	\$4,400					3,975 linear feet x \$33/foot = \$131,175 + 4 gates at \$2,500 per = \$10,000		
	3	1.5	7	0.04							\$4,500	\$2,250	\$3,750	\$6,000							
	4	1.7	5	0.10	4	3	2		1		\$5,100	\$2,550	\$4,250	\$6,800							
	Total	4.5	19	0.33	11	4	4		1		\$13,500	\$6,750	\$11,250	\$18,000*	\$2,500	\$5,000	\$5,500	\$7,500	\$141,175		\$193,175
Otay Lakes	1	0.5	2	0.04							\$1,500	\$750	\$1,250	\$2,000				3 sets of 5 burrows	3-strand wire only at roadside to discourage off-road use		
	2	0.4	2	0.03							\$1,200	\$600	\$1,000	\$1,600					3,155 linear feet x \$5.50/foot		
	3	0.8	4	0.05							\$2,400	\$1,200	\$2,000	\$3,200							
	4	3.8	9	0.33	1						\$11,400	\$5,700	\$9,500	\$15,200							
	5	0.3	3	0.02			1				\$900	\$450	\$750	\$1,200							
	6	4.3	10	0.33	9						\$12,900	\$6,450	\$10,750	\$17,200							
	7	0.9	5	0.10	5						\$2,700	\$1,350	\$2,250	\$3,600							
	8	5.7	5	1.41	4						\$17,100	\$8,550	\$14,250	\$22,800							
	9	1.4	2	0.10	2						\$4,200	\$2,100	\$3,500	\$5,600							
	10	6.9	9	0.24	6				1		\$20,700	\$10,350	\$17,250	\$27,600							
	11	7.1	17	0.39	15		2		5		\$21,300	\$10,650	\$17,750	\$28,400							
	Total	32.1	68	3.03	42		3		6		\$96,300	\$48,150	\$80,250*	\$128,400	\$5,000	\$5,000	not recommended	\$15,000	\$17,350	\$1,000	\$219,900

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Location		Size and Quantities									Recommended Restoration and Management Costs										TOTAL
Site	Polygon	Area (acre)	Vernal Pools	Vernal Pool Area (acre)	Vernal Pools with Erar	Vernal Pools with Mymi	Vernal Pools with Nafo	Vernal Pools with Ponu	Vernal Pools with Brspp.	Upland Watershed Sensitive Species	Dethatching	Weed Control 1 (two visits)	Weed Control 2 (three visits)	Weed Control 3 (four visits)	Reseed Sensitive Species	Reseed Plantago	Recontouring	Owl Burrow Installation	Fencing	Container Plant Installation	
Proctor Valley	1	3.2	7	0.00					7		\$9,600	\$4,800	\$8,000	\$12,800	Includes hydroseed in uplands				Due to severe off-road use 6' chain-link + post and cable		
	2	1.8	6	0.13					1		\$5,400	\$2,700	\$4,500	\$7,200					4,208 linear feet x \$33/foot = \$138,864 + 2 gates at \$2,500 per = \$5,000		
	3	0.5	5	0.03							\$1,500	\$750	\$1,250	\$2,000							
	Total	5.5	18	0.25							\$16,500	\$8,250	\$13,750	\$22,000*	\$15,000	\$5,000	\$36,750**	\$15,000	\$143,864	\$5,000	\$259,114
Marron Valley	1	0.7	4	0.05					1		\$2,100	\$1,050	\$1,750	\$2,800		Need to use site collected seed from proposed 2008 collection and reseed			3-strand wire fencing to keep Mexican cows out of pools and off-road vehicles out		
	2	0.7	3	0.02							\$2,100	\$550	\$1,750	\$2,800					4,794 feet x \$5.50		
	3	3.1	4	0.08							\$9,300	\$4,650	\$7,750	\$12,400							
	4	< 0.1	2	0.01					2												
	5	< 0.1	1	0.00																	
	Total	4.5	14	0.17							\$13,500	\$6,250	\$11,250	\$18,000*	\$2,500	\$5,000	\$1,000 minor hand work	\$24,000	\$26,367	\$1,000	\$91,367
West Otay A & B	1	1.3	9	0.15	3	7	3	6	9		\$3,900	\$1,950	\$3,250	\$5,200							
	2	4.6	34	0.19	2	12		2			\$13,800	\$6,900	\$11,500	\$18,400							
	Total	5.9	43	0.34							\$17,700	\$8,850	\$14,750	\$23,600*	\$10,000	\$5,000	\$32,000**	\$15,000		\$1,000	\$104,300
Smith Site	1	4.3	—		5						\$12,900	\$6,450	\$10,750	\$17,200							
	2	0.6	—					1			\$1,800	\$900	\$1,500	\$2,400							
	3	8.3	—		4			2			\$24,500	\$12,450	\$20,750	\$33,200							
	4	8.9	—		15			10			\$26,700	\$13,350	\$22,250	\$35,600							
	5	11.7	—					7			\$35,100	\$17,550	\$29,250	\$46,800							
	6	16.4	—		12			51			\$49,200	\$24,600	\$41,000	\$65,600							
	7	10.3	—								\$30,900	\$15,450	\$25,750	\$41,200							
	8	12.2	—								\$36,600	\$18,300	\$30,000	\$48,800							
	Total	72.7	—		36			71			\$218,100	\$109,050	\$181,750	\$290,800*	\$7,500	\$15,000		\$15,000		\$5,000	\$551,400

*Recommended weed control option (cost included in total)
 **Includes \$20,000 for a plan and microtopographical pre- and post-mapping

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comm.), and since that time, the population has not been relocated. Only 2 years since 2001 have had normal or better rainfall, and the 2007 assessment surveys were conducted late in the season. A seed collection and bulking program should be initiated utilizing seed from the closest appropriate population to maintain the proper genetics, which in this case would be the City's Carroll Canyon site. If possible, seed should be collected from this site to be utilized in a seed bulking program. This program would involve growing one generation of spreading navarretia from seed in greenhouse conditions. Spreading navarretia is known to self pollinate effectively, so plants may be kept at the greenhouse at flowering time and seed can be collected directly from the container plants and stored for dispersal or additional seed bulking. Several other species, such as annual hairgrass (*Deschampsia danthonioides*) and toothed downingia, will be considered for seed bulking (assuming that seed is available for collection). If this species is found at Nobel Drive during the 2008 season, then the seed collected from the Carroll Canyon site will be returned and redispersed.

Estimated Cost: \$2,500

Quino Habitat

A large portion of Nobel Drive has scattered populations of plantago. Although plantago will be available for a reseed program, Quino is not known from the general area of Miramar and La Jolla, especially in the last 20 years. Therefore, due to the lack of butterfly populations in the area, plantago reseedling is not recommended for Nobel Drive.

4.1.4 Recontouring/Topographic Reconstruction

Most of Nobel Drive is protected by existing fencing so the vernal pool basins are relatively undisturbed. Three vernal pools were identified from the trail and road areas that are not within the fenced areas. These three pools are impacted by past vehicle activity, as well as current hiking and mountain biking activities. These three pools should be recontoured so that they are more natural in shape. This work should follow the dethatching program but should precede the seeding, planting, and weed control activities.

Estimated Cost: \$2,700

4.1.5 Artificial Burrowing Owl Burrow Installation

Artificial owl burrows should be considered wherever topographic reconstruction is to occurring order to restrict the disturbance of existing conditions, as well as to maximize the use of equipment and crews on-site. With the addition of off-site soil, approximately three to five artificial owl burrows can be incorporated into the topographic reconstruction at Nobel Drive.

Estimated Cost: \$5,000

4.1.6 Fencing

The current fencing at Nobel Drive has adequately protected most of the vernal pools from direct impacts and disturbance, but not all of the pools are currently protected by the fence. In addition, the upland habitat that surrounds the pools is currently unprotected from illegal foot and vehicle traffic. To protect the entire complex of pools, a fence should be installed that encompasses all areas of vernal pool habitat and a buffer zone around the pools. Figure 2-1a shows the proposed fence, which should be constructed using three-strand wire, consistent with the fencing currently in place at the site. Three-strand barbless wire provides moderate protection from vehicles and foot traffic, while allowing for wildlife movement. Signage will help to educate the public about the importance of the site for species conservation and habitat protection. Prior to fence installation, an alternate trail route that avoids sensitive habitat would be provided to prevent additional habitat disturbance.

Estimated Cost: \$7,600

Total Estimated Implementation Cost for Nobel Drive: \$30,400

4.2 GOAT MESA

The vernal pool and upland habitats at the Goat Mesa site are heavily impacted by both grazing (goat herds) and illegal off-road activities. The grazing of Goat Mesa has been occurring for over 10 years, and in that time the pools have gone from virtually pristine pools to very degraded habitat. The grazing has helped to maintain a lower cover of nonnative plants, especially nonnative grasses, but this benefit has come at the cost of the native plant cover. Both vernal pool (e.g., San Diego button-celery) and upland (e.g., Jojoba) plant species have been reduced in cover and density because of the goat grazing. In recent years, the disturbance from illegal off-road activity in Spring Canyon and the associated mesas has become the biggest threat to the

habitat, with some areas completely devoid of vegetation as a result of ORVs. This problem is not unique to Goat Mesa, as most of Spring Canyon and the adjacent mesas have suffered from the recent high levels of ORV activity. Without adequate fencing and/or enforcement, these areas will continue to decline.

Even with the high level of off-road activity and grazing, Goat Mesa still supports vernal pools and upland areas with sensitive plant and animal species.

4.2.1 Dethatching

The entire complex of vernal pools at the Goat Mesa site should be dethatched along with a buffer area surrounding the basins. Dethatching should occur prior to any recontouring, seeding, or other restoration activities.

Estimated Cost: \$13,500

4.2.2 Weeding

Vernal pool and grassland habitats that are being grazed typically show lower weed cover levels, but this lower cover is often a false indicator. The 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.

Currently at Goat Mesa, thatch build-up is not excessive in most areas, but a dethatching program should still be implemented to remove what is remaining. The dethatching program should be followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will conduct up to four site visits, and the timing will be based on the current rainfall, germination, and growth patterns. The vernal pools at Goat Mesa do not have extensive weed cover, but the pools do have populations of weed species that will require hand herbicide application with the glove method. Once the thatch is cleared, the site will be more available for the follow-up methods of herbicide application and mowing.

Estimated Cost: \$18,000 (Weed Control 3)

4.2.3 Seed Dispersal

Vernal Pools

The Goat Mesa vernal pool site supports multiple sensitive plant and animal species, both in the vernal pools and in the upland habitat (Chapters 4.0). San Diego button-celery should be collected and redistributed in pools that are lacking presence or have low cover of the species. The site is also known to have spreading navarretia and little mouselail, both of which were not relocated during the 2007 assessment surveys. These two species will need to be collected for a seed bulking program in order to expand the seed bank for this site. Both of these species are known to produce seed in greenhouse conditions, so the plants will not need to be brought to the site for pollination. Seed produced from the seed bulking program should be redistributed throughout the vernal pools at the Goat Mesa site.

Estimated Cost: \$2,500

Quino Habitat

The existing Quino habitat area at Goat Mesa is still intact with scattered population of plantago on the site, especially along the edges of the canyons. Plantago will be available for a seed bulking and reseeding program. Quino has been seen near the Spring Canyon area within the last 10 years, so there is potential for the butterfly to utilize the site. The populations of Quino on Otay Mesa appear to be on the brink of extirpation, so a program of reintroduction could be initiated once the site has been restored and protected from the disturbance factors that are currently present on the site.

Estimated Cost: \$5,000

4.2.4 Recontouring/Topographic Reconstruction

Almost all of the pools at the Goat Mesa site are disturbed by ORV activity, but most have only suffered aesthetic impacts and not problems associated with an altered hydrology. Approximately five basins should be topographically recontoured to reestablish a more natural inundation regime and reshape the slopes of the pools to allow for better vegetation diversity. This work should follow the dethatching program but should precede the seeding, planting, and weed control activities.

Estimated Cost: \$5,500

4.2.5 Artificial Burrowing Owl Burrow Installation

Although owls are not known from the site, burrowing owls are known from numerous historical and current localities. Otay Mesa 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 on Otay Mesa, and this site would be an excellent addition to that program. Approximately 10 burrows should be installed along with the topographic reconstruction of the basins. Even with the basin excavation, input of off-site soil will be required in order to build owl burrows well insulated from heat, noise, and predators.

Estimated Cost: \$7,500

4.2.6 Fencing

No restoration or enhancement work should be conducted at the Goat Mesa site until there is a secure fence in place with adequate signage. The Goat Mesa site continues to suffer from a high level of Border Patrol traffic, ORV use, and grazing activities, both of which need to be restricted by fencing. The proposed location of fencing is illustrated in Figure 2-2a. It has been demonstrated at other preserve sites on Otay Mesa that typical chain-link fence is not adequate to prohibit ORV activity. Because of this, the fence should be a combination of chain link on the inside and post and cable on the outside. The post and cable fence is designed to keep vehicles out, while the chain link will keep out grazing goat herds. This type of fence installation can cause substantial habitat disturbance when installed, so the restoration ecologist should oversee the exact location and installation method in the field.

Estimated Cost: \$141,175

Total Estimated Implementation Cost for Goat Mesa: \$193,175

4.3 OTAY LAKES

Otay Lakes 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 year ago, and the site was burned as part of 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 Border Patrol occasional drives though the vernal pool habitat. In addition, the Border Patrol does not generally lock the access gate to the site, so the potential for future off-road trespass is moderate.

There are numerous sensitive species in both the vernal pools and the upland watershed areas that will benefit from the restoration and enhancement actions described below. No single vernal pool site within the City's MSCP preserve lands has more sensitive species than the Otay Lakes site.

4.3.1 Dethatching

Currently, the thatch problem at Otay Lakes is not severe, but it could worsen over time if weed control and dethatching are not conducted. All of the polygons identified at Otay Lakes should be dethatched along with a substantial area of the upland watershed. Dethatching the pools will help to stabilize populations of San Diego button-celery, San Diego fairy shrimp, and spreading navarretia, while the watershed dethatching will improve populations of species such as variegated dudleya, San Diego goldenstar, and San Diego thornmint.

Estimated Cost: \$96,300

4.3.2 Weeding

Following dethatching at Otay Lakes, a weed control program should be implemented that includes all of the identified polygons. The dethatching program discussed above should be followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will conduct at least four site visits and the timing will be based on the current rainfall, germination, and growth patterns. The vernal pools at Otay Lakes do not have extensive weed cover, but the pools do have populations of weed species that will require hand herbicide application with the glove method. The glove method will also be used around some of the upland areas that support sensitive species, such as the San Diego thornmint population. Once the thatch is cleared, the site will be more available for the follow-up methods of herbicide application and mowing.

Estimated Cost: \$80,250 (Weed Control 2)

4.3.3 Seed Dispersal

Vernal Pools

The Otay Lakes vernal pool site supports multiple sensitive plant and animal species, both in the vernal pools and in the upland habitat. San Diego button-celery should be collected and redistributed in pools that are lacking the species or have the species in low cover. The site is also known to have at least three pools with spreading navarretia, one of which was relocated during the 2007 assessment surveys. This species will need to be collected for a seed bulking program in order to expand the seed bank for this site. Spreading navarretia is known to produce seed in greenhouse conditions, so the plants will not need to be brought to the site for pollination. Seed produced from the seed bulking program should be redistributed throughout the vernal pool at Otay Lakes. A seed bulking program for San Diego thornmint should also be implemented to avoid extirpation of the population.

Estimated Cost: \$5,000

Quino Habitat

The existing Quino habitat area at Otay Lakes is still intact with scattered populations of plantago on the site. Plantago will be available for a seed bulking and reseeding program. Quino has been seen both south and north of the vernal pool area within the last 5 years, so there is excellent potential for the butterfly to utilize the site. The population of Quino in the area appears to be larger than that of Otay Mesa, so a program for reintroduction will probably not be necessary.

Estimated Cost: \$5,000

4.3.4 Recontouring/Topographic Reconstruction

The Otay Lakes site does have some topographic disturbances due to vehicle activity, but most of the areas of disturbance are minor and only result in aesthetic impacts. None of the topographically disturbed areas are affecting the hydrology or ponding capabilities of the basins, so topographic reconstruction at the Otay Lakes site is not recommended.

4.3.5 Artificial Burrowing Owl Burrow Installation

Otay Mesa is recognized as an ideal location for restoration of regional burrowing owl habitat due to the known and historic presence of owls in the area. Therefore, the Otay Lakes site presents an opportunity to establish artificial burrowing owl burrows. Although topographic reconstruction is not necessary for the Otay Mesa Lakes site, the potential to place artificial owl burrows exists along the access road to the site. Soil would need to be brought from off-site locations, but with this soil input, approximately 15 burrows could be installed along the access road that is adjacent to all of the polygons. Vehicle traffic on this road is restricted to the Border Patrol, so the potential for the owls to use these roadside burrows is good.

Estimated Cost: \$15,000

4.3.6 Fencing

Although there has been some unauthorized vehicle activity in the vernal pool areas, this activity most likely is from the Border Patrol. These disturbances are not common and have not caused adverse impacts yet, so heavy-duty fencing of the site is not recommended. Adequate signage along the access road will likely be sufficient to deter most vehicle traffic, but it may not be enough to completely eliminate ORV activity. To best protect the site, three-strand barbed wire fencing is recommended to be installed along the access road at strategic points to keep vehicle traffic out of the pools (Figure 2-3a). Communication with the Border Patrol will be important to confirm that they understand the boundaries of the preserve areas, as well as the importance in keeping the access gate locked for general entry.

Estimated Cost: \$17,350

4.3.7 Container Plants

Reestablishment of little mousetail is necessary at Otay Lakes. Attempt to establish little mousetail strictly from seed dispersal has had mixed success in past projects, so this species will also have container plants used. Seed will be germinated in the greenhouse where plants will be cared for until they can be planted directly into the pool basins. The use of container plants along with the seeding of little mousetail will help ensure establishment of this species.

Estimated Cost: \$1,000

Total Estimated Implementation Cost for Otay Lakes: \$219,900

4.4 PROCTOR VALLEY

The pools at the Proctor Valley site have suffered extensively from off-road activities, especially those on the west side of Proctor Valley Road. This site has been used as a staging area for off-road use and has almost no vegetation (native or nonnative) on the west side. Not only has the vegetation been completely removed, but the basin areas have been heavily impacted by vehicle ruts and excavation. Essentially, the western portion of the site will need to be completely restored, including a complete recontouring of the vernal pools and mima mounds. The eastern portion of the site is in much better condition, although vehicle activity has disturbed portions of it as well. It does not appear that this site was affected by the Otay Mountain or Cedar fires in 2003, but certainly fire is a potential threat for the site.

In addition to the heavily disturbed nature of the site, mounds of debris are piled along the road that were placed there in an attempt to hinder off-road access. While these debris piles have not stopped ORV activity, they have negatively affected the pools by altering the hydrology and establishing weed populations.

4.4.1 Dethatching

Currently, the thatch problem at Proctor Valley is not severe, especially on the west side where very little native or nonnative vegetation is established. The east side has denser areas of thatch, especially in some of the vernal pools that are dominated by nonnative grasses. The entire Proctor Valley site should be dethatched along with a substantial area of watershed. Dethatching the pools will help to stabilize populations of San Diego fairy shrimp and endemic plant species, while dethatching the upland watershed areas will help to recover habitat for the Quino.

Estimated Cost: \$16,500

4.4.2 Weeding

Following dethatching, a weed control program should be implemented at Proctor Valley that encompasses all of the vernal pools and the surrounding watershed areas.. The dethatching program discussed above should be followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will visit the site at least four times and the timing will be based on the current rainfall, germination, and growth patterns. The

vernal pools at Proctor Valley do not have extensive weed cover, but the pools do have populations of weed species that will require hand herbicide application with the glove method.

Estimated Cost: \$22,000 (Weed Control 3)

4.4.3 Seed Dispersal

Vernal Pools

No sensitive plant species are known to occur at Proctor Valley, but some of the species that do occur (woolly marbles, air grass, etc.) will need to be collected for a seed bulking program. Because the site is limited in species diversity, off-site seed will be collected to supplement the species currently found at the site. Geographically and ecologically, the most appropriate location to collect seed for Proctor Valley is the Otay Lakes vernal pool complex. Numerous species are found at Otay Lakes that are currently not known from the Proctor Valley site, but only the nonsensitive species will be collected for this program.

Estimated Cost: \$15,000

Quino Habitat

The existing Quino habitat areas at Proctor Valley are still intact with scattered populations of plantago on the site and in many areas around the vernal pool complex. Plantago will be available for a seed bulking and reseeding program. Quino has been seen in multiple locations in and around the Proctor Valley area, with populations along the southern slope of San Miguel Mountain. These populations are considered extant, so any Quino habitat reestablished at Proctor Valley would have potential for recolonization by the Quino.

Estimated Cost: \$5,000

4.4.4 Recontouring/Topographic Reconstruction

The western portion of the Proctor Valley site will need substantial topographic recontouring and grading. Not only will the pools need to be reshaped and altered, but also the mima mound watershed areas. The recontouring at this site is so substantial that a grading plan should be developed and reviewed prior to conducting equipment use. This plan should be approved by the City and the regulatory agencies and should point out the pool shapes, depths, and flow patterns.

Using this plan, the restoration ecologist will direct the grading in the field to ensure that the topography reflects what was planned and approved. In addition, the debris piles along the road will need to be removed and hauled away. This is needed prior to any recontouring of the site.

The east side of the site does have some topographic disturbance, but this can be fixed by hand without the need for the grading plan or other directives.

Estimated Cost: \$36,750 (includes the removal of debris piles and \$20,000 for a grading plan)

4.4.5 Artificial Burrowing Owl Burrow Installation

As substantial topographic reconstruction of the site will be necessary, artificial owl burrows will be installed on the west side of the road. Essentially, every mima mound that is built or restored should have a burrow installed in it. The burrow locations and design will be included in the grading plan and will include at least 15 burrows.

Estimated Cost: \$15,000

4.4.6 Fencing

No restoration or enhancement work should be conducted at the Proctor Valley site until there is a secure fence in place with adequate signage. The Proctor Valley site continues to suffer from a high level of off-road and grazing activities, both of which need to be restricted by fencing. The proposed location of fencing is illustrated in Figure 2-4a. It has been shown from other preserve sites on Otay Mesa that typical chain-link fence is not adequate to prohibit off-road activity. The fence should be a combination of chain-link on the inside and post and cable on the outside. The post and cable fence is designed to keep vehicles out, while the chain-link will keep out grazing goat herds. This type of fence installation can cause substantial habitat disturbance when installed, so the restoration ecologist should oversee the exact location and installation method in the field.

Estimated Cost: \$143,864

4.4.7 Container Plants

Reconstruction of the west side of the Proctor Valley site will mean that no vernal pool vegetation will be present in any of these reconstructed basins. A seed collection, bulking, and

dispersal program will be conducted for this site, but a container plant program will also be required to jump-start this restoration.

A number of species will be grown for container stock, but the pale spike sedge is the most important, as this species is a perennial that has the ability to fill in and stabilize reconstructed basins quickly, helping to reestablish habitat for other plant and animal species. Other species like woolly marbles and annual air grass will also benefit from container stock that is planted directly into the basins. Seed of other species can be scattered in and around these container plugs, helping the seed to find a stable area for germination.

Estimated Cost: \$5,000

Total Estimated Implementation Cost for Proctor Valley: \$259,114

4.5 MARRON VALLEY

The pools at Marron Valley have suffered some ORV and grazing disturbance, but they continue to support vernal pool species. Officially, cattle grazing has been suspended for the area, but cattle herds from across the U.S./Mexican border continue to utilize the site for grazing. Although the pools have damage from the cattle trampling, vernal pool indicators have reestablished on most of the damaged area.

Just like other sites, Marron Valley has weed species in both the pools and the upland areas of the watershed. The site was burned in the Otay Mountain fire in 2003, and the effect of this fire has been an increase in the nonnative cover, especially in the upland grassland areas.

4.5.1 Dethatching

Currently, the thatch problem at Marron Valley is not severe, but it will worsen over time if weed control and dethatching are not conducted. The entire Marron Valley site should be dethatched along with a substantial area of the upland watershed. Dethatching the pools will help to stabilize populations of San Diego fairy shrimp and little mousetail, while dethatching the upland watershed areas will help to recover habitat for the Quino.

Estimated Cost: \$13,500

4.5.2 Weeding

Following dethatching, a weed control program should be implemented at Marron Valley that encompasses all of the vernal pools and the surrounding watershed areas. The dethatching program discussed above should be followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will visit the site at least four times and the timing will be based on the current rainfall, germination, and growth patterns. The vernal pools at Marron Valley do not have extensive weed cover, but the pools do have populations of weed species that will require hand herbicide application with the glove method. Sand spurry (*Spergularia* spp.) is particularly high in cover at the Marron Valley site and will require the glove method.

Estimated Cost: \$18,000 (*Weed Control 3*)

4.5.3 Seed Dispersal

Vernal Pools

The only sensitive plant species known to occur at Marron Valley is the little mousetail. This species was believed to be extirpated from the site, but surveys in 2007 were able to relocate it. The numbers of plants were very low in 2007, so any available seed will be very limited in quantity. To increase the available seed, a seed bulking program will be conducted for this species as well as other vernal pool species (e.g., annual hair grass). Reseeding this species has had mixed results in past projects, so container plants for this species will also be utilized (see below) in addition to direct reseeding of the site.

Estimated Cost: \$2,500

Quino Habitat

The existing Quino habitat areas at Marron Valley are still intact with scattered populations of plantago on the site and in many areas around the vernal pool complex. Plantago will be available for a seed bulking and reseeding program. Quino has been observed in multiple locations in and around the Marron Valley area, with substantial populations along the western slope of Tecate Mountain. These populations are considered to be some of the most consistent locations for Quino in San Diego County, which is why the site is used as a reference location for the USFWS.

Estimated Cost: \$5,000

4.5.4 Recontouring/Topographic Reconstruction

The Marron Valley site does have some topographic disturbances that are a result of vehicle activity and cattle grazing, but most of the areas of disturbance are minor and only result in aesthetic impacts. None of the topographically disturbed areas are affecting the hydrology or ponding capabilities of the basins, so equipment-based topographic reconstruction at the Marron Valley site is not recommended. A few of the ruts will be removed by hand, but this recontouring will be very minor in effort and extent.

Estimated Cost: \$1,000

4.5.5 Artificial Burrowing Owl Burrow Installation

Although topographic reconstruction is not necessary for the Marron Valley site, the potential to place artificial owl burrows exists along the access road to the site as well as in Polygon 5 (Figure 2-5a). Soil would need to be brought from off-site locations. With additional soil, approximately 10 burrows could be installed along the access road adjacent to the vernal pools and another 15 burrows in and adjacent to Polygone 5. Vehicle traffic on this road is restricted to the Border Patrol, so the potential for the owls to use these roadside burrows is good.

Estimated Cost: \$9,000

4.5.6 Fencing

Although there has been some unauthorized vehicle activity in the vernal pool areas, this activity is most likely from the Border Patrol. These disturbances are not common and have not caused adverse impacts yet, so heavy-duty fencing of the site is not recommended. Adequate signage along the access road will likely be sufficient to deter most vehicle traffic, but it may not be enough to completely eliminate ORV activity. To best protect the site, three-strand barbless wire fencing is recommended to be installed along the access road at strategic points to keep vehicle traffic out of the pools (Figure 2-5a). Communication with the Border Patrol will be important to confirm that they understand the boundaries of the preserve areas, as well as the importance in keeping the access gate locked for general entry.

Estimated Cost: \$26,367

4.5.7 Container Plants

The Marron Valley site has a need for the reestablishment of little mousetail. The attempt to establish little mousetail strictly from seed dispersal has had mixed success in past projects, so this species will also have container plants used. Seed will be germinated in the greenhouse where plants will be cared for until they can be planted directly into the pool basins. The use of container plants along with the seeding of little mousetail will help ensure that this species is established.

Estimated Cost: \$1,000

Total Estimated Implementation Cost for Marron Valley: \$91,367

4.6 WEST OTAY A & B

The pools at Otay A & B are separated into two distinct management areas, designated here as Polygon 1 and 2. One of these management areas, Polygon 1, has been restored and managed, and currently supports numerous sensitive species with relatively low covers of weed species. The second management area, Polygon 2 has had some management and restoration, but the level of effort has not been sufficient to provide quality vernal pool habitat. The basins in Polygon 2 were not recontoured, and currently support very few vernal pool indicator species. Both the vernal pool and upland habitats of Polygon 2 have a very high cover of weed species.

4.6.1 Dethatching

Currently, the thatch problem at Otay A & B is minor in Polygon 1, but is more serious in the relatively unmanaged Polygon 2. Both Polygons should be dethatched, but Polygon 2 will require the greatest effort. Dethatching the pools and upland areas will help to stabilize sensitive species populations, while dethatching the upland watershed areas will help to recover habitat for the Quino.

Estimated Cost: \$17,700

4.6.2 Weeding

Following dethatching, a weed control program should be implemented at Otay A & B that encompasses all of the vernal pools and the surrounding watershed areas. The dethatching

program discussed above should be followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will visit the site at least four times and the timing will be based on the current rainfall, germination, and growth patterns. As with the dethatching program, the weed control efforts will be greater for Polygon 2 than Polygon 1. Herbicide treatment for Polygon 1 should concentrate on the basin areas, utilizing the glove method of application, while the treatment for Polygon 2 will require spraying upland areas as well.

Estimated Cost: \$23,600 (Weed Control 3)

4.6.3 Seed Dispersal

Vernal Pools

The pools in Polygon 1 have good populations of Otay mesa mint, San Diego button-celery, spreading Navarretia, and little mousetail. These pools will benefit from a redistribution on-site, but seed collection and bulking is not needed. Some of the seed from Polygon 1 should be collected for seed bulking and redistribution into Polygon 2, when these pools are recontoured and restored.

Estimated Cost: \$10,000

Quino Habitat

The existing Quino habitat areas at Otay A & B are primarily along the canyon edges and slope, where Quino habitat is in relatively good shape. Quino has been seen near Spring Canyon in recent years in very low numbers, so there is potential for Quino to utilized the site. On the mesa, the habitat is all but gone, except in Polygon 1 where open soils are now available, but Plantago is currently not found. Utilizing the seed from the surrounding habitat areas, a seed bulking program should be implemented to increase seed quantities for reseeding Polygon 1 and eventually Polygon 2, once it has been recontoured and restored.

Estimated Cost: \$5,000

4.6.4 Recontouring/Topographic Reconstruction

As mentioned above, Polygon 1 has been recontoured and restored appropriately, but the remainder of the site (Polygon 2) is still in need of substantial topographic reconstruction. In some areas (the central road), this recontouring is simple and does not involve substantial changes to the depths or flow patterns, but in other portions of Polygon 2, the recontouring will involve substantial changes to the depths, shapes, and flow pattern. Mechanized equipment can be used as the site is accessible via the dirt road running south of the complex. The vernal pool basins where topographical disturbances have occurred have a relatively low occurrence of sensitive species, and utilizing proper salvaging methods of these resources would allow mechanized equipment to be used without impacting these sensitive species populations. Care would be taken to avoid impacts to sensitive species (e.g. little mouselink). In order to recontour the entire site, a topographic reconstruction plan should be developed in order to properly direct implementation of this work.

Estimated Cost: \$32,000

4.6.5 Artificial Burrowing Owl Burrow Installation

Topographic reconstruction is proposed for the site, primarily in Polygon 2, so the potential to place artificial owl burrows exists in these areas. Soil would need to be brought from off-site locations, but with this soil input, approximately 15 burrows could be installed along the road at the northern boundary of Polygon 2, as well as at the east end of Polygon 2.

Estimated Cost: \$15,000

4.6.6 Fencing

Although there has been some unauthorized vehicle activity in the vernal pool areas, this activity is most likely from the Border Patrol. These disturbances are not common and have not caused adverse impacts yet, so heavy-duty fencing of the site is not recommended. Adequate signage along the access road will likely be sufficient to deter most vehicle traffic. Recent fencing of the western end of the Spring Canyon open space area has had a very positive impact on reducing illegal off-road activity in the western portions of the preserve, including the West Otay A & B site. Given these recent fence installations, fences the West Otay A & B site is not recommended.

4.6.7 Container Plants

Any recontouring and restoration of Polygon 2 should include container planting for both upland and vernal pool species in order to help ensure the establishment of a native flora. Vernal pool species can be grown in a greenhouse utilizing seed collected from Polygon 2, and upland species can be grown from seed collected on the adjacent canyon slopes and remaining mesa habitat.

Estimated Cost: \$1,000

Total Estimated Implementation Cost for West Otay A & B: \$104,300

4.7 SMITH SITE

The pools at the Smith Site are heavily impacted by non-native plant species. The development and the weed populations is due to the heavy cattle grazing that occurred on this site in the past. This grazing pressure has been removed, but the weed cover has become well established and continues to threaten these pools even though grazing is no longer an issue.

Historically, this site has been considered the primary location for the Otay Mesa mint, and currently the J23-25 complexes remain one of the few places that the species is known to occur. The J23-25 complexes also support numerous populations of San Diego button-celery and San Diego fairy shrimp. The upland habitats at the J23-25 complexes also supports sensitive species, including variegated Dudleya, San Diego goldenstar, and the Quino checkerspot butterfly.

It is important to note that the J23-25 complexes was not included in the 2007 assessment surveys because of the unexploded ordinance issues. The site has been determined to have some potential for unexploded ordinance, so work at the site will not be allowed until this issue is resolved.

4.7.1 Dethatching

The most serious problem at the J23-25 complexes is the thatch buildup that is a result of non-native plant establishment, especially the grasses. The thatch is restricting the ability of the native vernal pool plant species to not only germinate, but also to successfully develop flowers and set seed. In addition, the heavy thatch also absorbs the rainfall so that it takes more water to achieve ponding, and therefore takes more water to maintain San Diego fairy shrimp populations.

All of the J23-25 complexes should be dethatched as part of the weed control measures. Dethatching the pools and upland areas will help to stabilize sensitive species populations, while dethatching the upland watershed areas will help to recover habitat for the Quino.

Estimated Cost: \$218,100

4.7.2 Weeding

Following dethatching, a weed control program should be implemented at J23-25 that encompasses all of the vernal pools and the surrounding watershed areas. The dethatching program discussed above should be followed by herbicide application and weed eating/mowing during the spring and early summer. The herbicide/mowing crew will visit the site at least four times and the timing will be based on the current rainfall, germination, and growth patterns. Herbicide treatment for J23-25 should also concentrate on the basin areas, utilizing the glove method of application, while the upland areas will require spraying and mowing.

Estimated Cost: \$290,800 (Weed Control 3)

4.7.3 Seed Dispersal

Vernal Pools

Although the assessment surveys did not include the J23-25 complexes, EDAW biologist have visited the site in recent years as part of other monitoring project. These recent site visits have found only a small portion of the sensitive species occurrences documented in the last 15 years (Dudek, 1992). Dethatching the basins on other portions of Otay Mesa with similar weed cover has shown that sensitive seed can often still be present and viable in pools that were thought to be too degraded.

Currently, San Diego button-celery is available for seed collection and bulking, the status of Otay mesa mint remains unknown. Once the basins have been dethatched, these pools will be monitored during the spring in order to determine where Otay Mesa mint can still be found. If seed is available for collection, then seed will be collected and bulked for redispersal into the complex. If seed is no longer available on-site, then off-site collection from J26 will be considered.

Estimated Cost: \$7,500

Quino Habitat

Existing Quino habitat areas can be found at the J23-25 complexes, but much of this habitat is threatened by weed invasion and thatch cover. Quino has been seen on the mesas of J23-25 in the last ten years, so there is potential for colonization from existing populations. Plantago can be found both on the mesas and slopes of J23-25, so seed can be collected and seed bulked to increase seed quantities for reseeding the upland areas that have been dethatched.

Estimated Cost: \$15,000

4.7.4 Recontouring/Topographic Reconstruction

The J23-25 complexes does not have a need for any recontouring or reconstruction. Most of the pools do not have any topographic disturbances, and those that do are primarily aesthetic in nature, so recontouring of this site is not recommended.

4.7.5 Artificial Burrowing Owl Burrow Installation

There is potential for installation of up to 15 artificial owl burrows within the J23-25 complexes where habitat is disturbed (i.e., along roads). However, potential threats to burrowing owls exist from the electrified prison fence immediately to the east of the site. Artificial burrows would not be installed until the site is evaluated and the fence is modified to eliminate the threat to the owls. Coordination will occur with the Wildlife Agencies to determine the feasibility of and appropriate locations for artificial owl burrows.

Estimated Cost: \$15,000

4.7.6 Fencing

Although there has been some unauthorized vehicle activity in the vernal pool areas, this activity is most likely from the Border Patrol. These disturbances are not common and have not caused adverse impacts yet, so fencing of the site is not recommended. Adequate signage along the access road will likely be sufficient to deter most vehicle traffic.

4.7.7 Container Plants

The current status of vernal pool species at the J23-25 complexes is not known, so the need for container plants is unknown. If it is determined that one or more of the species will not reestablish without planting, then a container plant program may be initiated for some of the vernal pool species (e.g., pale spike-rush) and potentially cactus wren habitat (e.g., cholla and pickley pear cactus).

Estimated Cost: \$5,000

Total Estimated Implementation Cost for the Smith Site: \$651,400

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CHAPTER 5.0

PRIORITY SITE RECOMMENDATIONS

One of the objectives of the restoration and management recommendations is to concentrate the restoration efforts at certain sites where efforts are most needed. Priority recommendations are focused where there is the greatest potential for achieving long-term success for sustainability of sensitive resources and ecosystem function. The current grant funding for this project is not substantial enough to implement all of the comprehensive activities recommended in Chapter 4.0, so prioritization of management activities is necessary. Costs provided for recommended priority actions were developed within the available funding for the project.

The prioritization of sites focuses activities on sites that have more sensitive species and would benefit most from restoration and management. Each site has important populations of sensitive plant and wildlife species, but based on the results of the site assessment, certain sites have more potential for successful long-term restoration than others. Two sites clearly require more effort due to their large size and the known occurrences for sensitive vernal pool plant and animal species. Both Otay Lakes and the Smith Site sites support more sensitive species populations than the other sites combined, and both sites can be protected without fencing (refer to Section 2.2). Installing effective fencing is costly, especially for fencing that is designed to keep out vehicles (post and cable combined with chain-link). Therefore, it is recommended to concentrate the majority of restoration and management efforts on these sites, where sensitive species can be restored without spending the majority of the funds on fencing.

In addition to the vernal pool restoration needs, habitat restoration for Quino and burrowing owls is also a priority for restoration and management and is incorporated wherever it will provide the most benefit while still accomplishing the vernal pool restoration goals.

Based on the prioritization methodology described above, the 2007 site assessments, and EDAW's understanding of vernal pool systems and vernal pool restoration, the following activities in Table 5-1 are recommended as priorities for each site. An estimated cost for each activity is also provided. Restoration and management activities are assumed for implementation during the 2007/2008 fiscal year, possibly with the exception of the Smith Site and West Otay A & B, where implementation will occur following access clearance to these sites (assumed before 2010).

Table 5-1
Summary of Recommended Task for Each Site

Site	Task	Task Cost	Total Cost
Nobel Drive	Dethatch	\$ 5,400	\$ 10,300
	Weed Control 1	\$ 2,700	
	Reseeding	\$ 2,200	
Goat Mesa	Fencing	\$10,000	\$ 19,100
	Dethatch	\$ 2,350*	
	Weed Control 1	\$ 6,750	
Otay Lakes (Polygons 6-11 only)	Dethatch	\$77,000	\$168,000
	Weed Control 2	\$65,000	
	Owl Burrows	\$15,000	
	Reseeding	\$10,000	
	Container Plants	\$ 1,000	
Proctor Valley	Reseeding	\$ 2,500	\$ 2,500
Marron Valley	Fencing	\$ 5,000	\$ 13,600
	Weed Control 1	\$ 6,100	
	Reseeding	\$ 2,500	
West Otay A & B	Owl Burrows and Recontouring	\$15,000	\$ 20,000
	Reseeding	\$ 5,000	
Smith Site (Polygons 4 & 6 only)	Dethatch	\$76,000	\$167,000
	Weed Control 2	\$63,500	
	Reseeding	\$22,500	
	Container Plants	\$ 5,000	
TOTAL			\$400,500

*(Polygons 1 & 2 only)

The justification for the cost and priorities listed in Table 5-1 is discussed in the following sections. These costs assume restoration oversight by the lead restoration ecologist and a minimal amount of agency coordination. A report summarizing results of implementation of restoration and management recommendations is not included in these costs.

5.1 NOBEL DRIVE (TOTAL BUDGET: \$10,300)

Dethatch (Budget: \$5,400)

The vernal pools at Nobel Drive do not have extensive weed cover, but the upland areas do. Therefore, a dethatching program covering the polygons will be implemented.

Weed Control 1 (Budget: \$2,700)

Currently the site has low weed cover. With a program of dethatching, it is recommended that Weed Control 1 be implemented for the polygons. Weed Control 1 (two visits) will be implemented at Nobel Drive. Some of the effort will be directed toward the glove method in the pools with sensitive species.

Reseeding (Budget: \$2,200)

Seed collection and bulking for both vernal pool species and upland species will be conducted at Nobel Drive. In particular, an effort to relocate and collect spreading navarretia will be implemented so that the low seed count can be increased in the greenhouse, providing a greater quantity of seed for reseeding the basins.

5.2 GOAT MESA (TOTAL BUDGET: \$19,100)

Fencing (Budget: \$10,000)

Fencing costs that are provided in Table 4-1 reflect a plan to fence the entire site with high security fencing (post and cable with chainlink). ORV activity at Goat Mesa is extensive, but a high security fence is not recommended in fiscal year 2007/2008. High security fencing would require approximately 33 percent of the budget for this fiscal year, create substantial impacts to the native habitat during installation, and greatly restrict wildlife movements. The entire Spring Canyon open space area needs to be protected by fencing, not just the areas with sensitive species populations. The type and level of fencing that has been recently installed at the west end of Spring Canyon is the kind of protection that is recommended to be extended around the perimeter of the entire preserve area.

To redirect ORV activity away from the pools and to restrict grazing by goats, 3-strand barbless wire fencing will be installed around the basin areas, including the slump pools in Polygons 1 and 2. This fencing will provide protection for the pools at a minimal cost and can be removed in the future if ORV activity in the Spring Canyon area is eliminated by improved preserve fencing or law enforcement.

Dethatch (Budget: \$2,350)

Because of the goat grazing, most of the vernal pools at Goat Mesa do not have extensive weed cover. The exception are the slump pools to the west (Polygons 1 and 2), where grazing does not appear to be common. The pools in Polygons 1 and 2 will be dethatched, but not the pools on the mesa.

Weed Control 1 (Budget: \$6,750)

Currently the site has low weed cover. In combination with a program of dethatching, it is recommended that Weed Control 1 be implemented for all of the polygons. Weed Control 1 (two visits) implementation at Goat Mesa site will include some treatment of the pools with the glove technique of herbicide application.

5.3 OTAY LAKES (TOTAL BUDGET: \$168,000)

Otay Lakes is a large site (approximately 632 acres) with over 10 polygons delineated. To conserve portions of the existing project budget for other sites, a subset of the polygons will be restored and managed with the current program. Polygons 6 through 11 will be restored, providing management of a total of 26 acres and nearly 50 basins. These basins support the majority of the sensitive vernal pool species populations known from the site. The upland area around these basins supports numerous sensitive species including variegated dudleya, San Diego goldenstar, and San Diego thornmint. Weed control of these 26 acres of upland and basin area will improve habitat for Quino. To the extent feasible, separate polygons will be joined and managed as one larger polygon (e.g., polygons 8 through 11).

Dethatch (Budget: \$77,000)

The vernal pool and upland habitat at Otay Lakes is in relatively good condition, with a typical weed cover that is less than most of the other sites. Dethatching will occur on the 26 acres in Polygons 6 through 11.

Weed Control 2 (Budget: \$65,000)

Currently the site has low weed cover. In combination with a program of dethatching, it is recommended that Weed Control 2 (three visits) be implemented for all of the polygons. Some

of the weeding will utilize the glove method of herbicide application in and around the vernal pools and other sensitive habitats.

Owl Burrow Installation (Budget: \$15,000)

Although topographic recontouring is not recommended for Otay Lakes, there is an opportunity to install artificial owl burrows along the access road. Border Patrol activity along the road is minor; given the tolerance this species has to vehicle traffic, the installed burrows are expected to become occupied. At least five clusters comprised of three burrows each will be installed along the edge of the access road leading into the management area.

Reseeding (Budget: \$10,000)

Otay Lakes has an extensive seed bank for most of the sensitive plant species, but the populations of a few species are not large enough to simply collect seed and redistribute. Plant species that will be collected for seed bulking include spreading navarretia, San Diego thornmint, and plantago (for Quino habitat). San Diego button-celery is extensive enough to collect and redistribute without bulking.

Container Plants (Budget: \$1,000)

Purchase and installation of container plants is recommended at Otay Lakes to transplant little mousetail or other species that potentially do not establish well from seed.

5.4 PROCTOR VALLEY (TOTAL BUDGET: \$2,500)

Proctor Valley is heavily impacted by ORV activity and will require extensive grading and recontouring to establish natural vernal pool conditions. In addition, the piles of debris along the road will need to be removed and the site requires high security fencing to protect it from future ORV disturbances. In order to perform these tasks, approximately 50 percent of the available funding for 2007/2008 fiscal year would be required, and that would not include reseeding, container plants, and weed control. Given that the site does not have any known sensitive plant species, and does not have extensive populations of fairy shrimp, it is recommended that this work be conducted as a separate project in the future. In an effort to build the seed bank available for this site when it is restored in the future, seed collection and bulking is recommended.

Reseeding (Budget: \$2,500)

Proctor Valley has a few vernal pool species that are available for collection, but most of the seed needed to restore these pools would be collected from off-site locations. Based on distance, soil type, and other factors, the most appropriate site for seed collection is the Otay Lakes vernal pools. Seed will be collected from the Otay Lakes basins and will be used in a seed bulking program that will build a seed bank for use in future restoration efforts. Until these restoration efforts take place, this seed will be stored at an appropriate native seed storage facility (e.g., S&S Seed).

5.5 MARRON VALLEY (TOTAL BUDGET: \$13,600)

Fencing (Budget: \$5,000)

Fencing costs that are provided in Table 4-1 reflect a plan to fence the entire Marron Valley site. Given the limited project funding and the fact that ORV activity is limited in at the site, a reduced fence design is recommended. As discussed in Chapter 2.0, cattle grazing is the primary threat to the resources at Marron Valley, so a 3-strand barbless wire fence will be installed around the pools (approximately 909 linear feet) but will not include the entire site. This fence can be removed in the future if the threat of cattle grazing is eliminated.

Weed Control 1 (Budget: \$6,100)

The cattle grazing has helped to keep the upland weed cover down, but has impacted the basins considerably, as described in Chapter 2.0. Weed Control 1 (two visits) will be implemented at Marron Valley, with most of the effort directed toward the glove method in the pools due to the presence of sensitive vernal pool species.

Reseeding (Budget: \$2,500)

Seed collection and bulking for both vernal pool species (e.g. annual hair grass) and plantago seed will be conducted at Marron Valley. In particular, effort to relocate and collect little mousetail will be implemented so that the low seed count can be increased in the greenhouse, providing a greater quantity of seed available for reseeding the site.

5.6 WEST OTAY A & B (TOTAL BUDGET: \$20,000)

Owl Burrow Installation and Recontouring (Budget: \$15,000)

The West Otay A & B Polygon 2 has a disturbed road bed along the northern portion of the site available for burrow construction. The road bed is not used so the disturbed area is appropriate for excavation and soil mounding for artificial owl burrows. Approximately 15 burrows will be installed along this road and associated disturbed areas. Care will be taken to avoid impacting sensitive species that occur in the adjacent basins (i.e., little mouselink).

The northern road bed area in Polygon 2 proposed for owl burrows is adjacent to approximately 10 highly disturbed basins. These basins could be moderately reshaped and deepened along with the construction of the owl burrows. This recontouring will be minimal, and in most case will involve minimal soil movement, so a detailed recontouring plan will not be required.

Reseeding (Budget: \$5,000)

Following installation of the artificial owl burrows and minor basin recontouring, the reconstructed areas will be seeded with both vernal pool and upland species where appropriate. This seed will come from a seed bulking program that utilizes seed collected on-site.

5.7 SMITH SITE (TOTAL BUDGET: \$167,000)

The Smith Site is recognized as important regional vernal pool and Quino habitat. Over 40 percent of the overall budget for the project is recommended to be used at this site. As with Otay Lakes, the project funds can not support restoration and management of all of the identified polygons. Therefore, a subset of polygons will be managed and restored under the current program. Polygons 4 and 6 will be restored because the majority of the sensitive species (San Diego button-celery and Otay Mesa mint) occur at these areas. Polygons 4 and 6 include over 25 acres and approximately 75 basins with sensitive species. The upland areas around these basins support numerous sensitive species including variegated dudleya and San Diego goldenstar. Weed control of these 25 acres of upland and basin area will provide habitat for Quino, a species that may potentially be present on the Smith Site.

Dethatch (Budget: \$76,000)

Unlike Otay Lakes, the vernal pools and upland habitat at the Smith Site have a heavy thatch cover. A dethatching program will be implemented to remove this thatch prior to any other weed control or restoration efforts. Dethatching will occur over the 25 acres of proposed management.

Weed Control 2 (Budget: \$63,500)

Currently, the Smith Site has extensive weed cover. In combination with a program of dethatching, it is recommended that Weed Control 2 (three visits) be implemented for all of the polygons. Given the extensive weed cover at the Smith Site, a program of Weed Control 3 would be recommended, but the cost prohibits working on both Polygons 4 and 6. To conduct weed control on both of these polygons, Weed Control 2 will be implemented. Some of the weeding will utilize the glove method of herbicide application in and around the vernal pools and other sensitive habitats.

Reseeding (Budget: \$22,500)

The Smith Site does not have the extensive seed bank for most of the sensitive species like Otay Lakes, but seed is available for these species in low quantity. To increase the seed bank for this species, an extensive seed collection and seed bulking program will be implemented. This seed bulking program will include Otay Mesa mint, San Diego button-celery, and other sensitive plant species. The seed bulking program for this site will also include plantago for Quino habitat, which will be redistributed throughout the dethatched upland habitat of the site.

Container Plants (Budget: \$5,000)

Purchase and installation of container plants is recommended at the Smith Site to transplant little mousetail or other species that potentially do not establish well from seed.

5.8 SCHEDULE OF IMPLEMENTATION

The proposed schedule for implementation of recommended priority restoration and management activities is included in Table 5-2. It is important to recognize that the timing of these priority restoration activities (seeding, weed control, etc.) is affected by the occurrence and amount of rainfall. Seasonal rainfall patterns may result in a need to initiate certain tasks earlier or later

than anticipated. The project Restoration Ecologist will determine the appropriate timing based on site and weather conditions.

Table 5-2
Proposed Implementation¹ Schedule

DATE	TASK	SITE²
November 2007	Seed collection and initiation of seed bulking program	OL, ND, MV, PV, OM, S
November 2007	Initiation of container plant program	OL, S
November-December 2007	Dethatching of sites	GM, ND, OL, S
November-December 2007	Recontouring of sites/owl burrow installation	OM, OL
December 2007-January 2008	Fence installation	MV, GM
January-February 2008	1 st weed control visit	OL, ND, MV, S, GM
January-February 2008	Seed dispersal (vernal pool)	OL, ND, MV, PV, OM, S
January-February 2008	Seed dispersal (plantago)	OL, ND, MV, PV, OM, S
March-April 2008	2 nd weed control visit	OL, ND, MV, S, GM
May-July 2008	3 rd weed control visit	OL, S
July-August 2008	Seed collection for additional seed bulking	ALL SITES

¹ Schedule is based on access granted to West Otay A & B and the Smith Site in 2007. If access is not granted in 2007, it is anticipated that work will be performed in the 2008/2009 fiscal year.

² GM = Goat Mesa, MV = Marron Valley, ND = Nobel Drive, OL = Otay Lakes, PV = Proctor Valley, OM = West Otay A & B, S = Smith Site

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CHAPTER 6.0

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APPENDIX A

SITE ASSESSMENT DATA

APPENDIX A-1

SITE ASSESSMENT DATA TABLE

APPENDIX A-1
SITE ASSESSMENT DATA TABLE

City of San Diego Vernal Pool Restoration Assessment Field Data

Site Name:	Otay Lakes										Otay West		Smith Site		
Site Ownership:	City Of San Diego										City Of San Diego				
Assessment Date:	7/31/2007					8/2/2007					9/7/2007				
Staff:	SM, BH, JP					BH, JP, DM, BM					SM, BH				
New Vernal Pool GPS ID (if any):	622, 623, 624		621, 1663, 619,	610-12, 614-15, 1654-57		1661, 1662, 165	282, 283, 293, 292								
Photo:			4337 - 38												
Parcel Sequence Number:	1		2		3		4		5						
Polygon Number:	1	2	3	4	5	6	7	8	9	10	11	1	2	1-8	

SENSITIVE ANIMAL SPECIES OCCURRENCES

<i>Branchinecta</i> spp.						6						
Number of pools known to occur												
<i>Branchinecta sandiegonensis</i>											10	
Number of pools known to occur												
<i>Branchinecta lindahli</i>												
Number of pools known to occur												
<i>Streptocephalus woottonii</i>												
Number of pools known to occur												

SENSITITVE VERNAL POOL PLANT SPECIES OCCURRENCES

<i>Eryngium aristulatum</i> ssp. <i>parishii</i>			x	1	5					4	
Number of pools known to occur					4					3	36
<i>Myosurus minimus</i>										20	
Number of pools known to occur											
<i>Navaretia fossalis</i>					1					1	
Number of pools known to occur			1		1					3	
<i>Orcuttia californica</i>											
Number of pools known to occur											
<i>Pogogyne abramsii</i>											
Number of pools known to occur											
<i>Pogogyne nudiuscula</i>										4	
Number of pools known to occur										8	

OTHER VERNAL POOL PLANTS OBSERVED

<i>Alopecurus saccatus</i>					x						
<i>Brodiaea jolonensis</i>			x								
<i>Brodiaea orcuttii</i>											
<i>Callitriche marginata</i>											
<i>Centunculus minimus</i>											
<i>Crassula aquatica</i>		x									
<i>Deschampsia danthoniodes</i>				x	x						
<i>Downingia cuspidata</i>											
<i>Elatine brachysperma</i>											
<i>Elatine californica</i>											
<i>Eleocharis acicularis</i>											
<i>Eleocharis macrostachya</i>	x		x	x	x						
<i>Epilobium pygmaeum</i>											
<i>Isoetes howellii</i>											
<i>Isoetes orcuttii</i>											
<i>Juncus bufonius</i>											
<i>Lilaea scilloides</i>											
<i>Marsilea vestita</i>											
<i>Malvella leprosa</i>											
<i>Nama stenocarpum</i>											
<i>Phalaris lemmonii</i>											
<i>Pilularia americana</i>											
<i>Plagiobothrys acanthocarpus</i>			x	x	x					x	
<i>Plantago bigelovii</i>											
<i>Plantago elongata</i>										x	
<i>Psilocarphus brevissimus</i>		x	x	x	x					x	
<i>Psilocarphus tenellus</i>	historic										
<i>Lythrum hysopifolium</i>	x	x									

OTHER SENSITIVE PLANT SPECIES OCCURRENCES

<i>Ferocactus viridescens</i>					x						
<i>Dudleva Variegata</i>											

APPENDIX A-1
SITE ASSESSMENT DATA TABLE

NONNATIVE PLANT SPECIES EVALUATION

Upland Total %	80	100	55	35	70	50	70	60	60	75	75	50	80	
VP Total %	80	100	35	30	90	80	50	25	70	60	70	15	85	
VP/Wetland %		1	5					5		5		5	5	
VP/Wetland Weed Rank	1st	Lol spp.	Lyt hys					Lyt hys		Lyt hys		Spe boc	Spe boc	
	2nd											Lyt hys		
	3rd													
	4th													
Upland Weed % in VP	80	99	30	30	90	80	50	20	70	55	70	10	80	
Upland Weed Rank	1st	Bro hor	Bro hor	Ero spp.	Ero spp.	Bro hor	Bro hor	Bro mad	Ero spp.	Bro hor	Bro hor	Bro mad	Bro mad	
	2nd	Ero spp.	Ave spp.	Hym gl	Bro hor	Ero spp.	Ero spp.	Bro hor	Bro hor	Ero cic	Ero cic	Bro hor	Bro hor	
	3rd	Cen mel	Ero spp.	Bro hor			Bro mad	Bro mad	Sal tra		Bro mad	Bro mad	Ero spp.	Ero spp.
	4th	Hym gl	Bro mad				Cen mel	Ero cic		Sal tra	Sal tra		Ave fat	

FENCING EVALUATION

Notes: Gophers nave impacted 25-30% of VP #1659

Off-road	x	100	100	100		75	
Grazing							
Utility						25	
Foot/Bike							
Threat Level (1-3)	3	3	3	2	2	2	
Mapped		x	x	x		x	
Type (1-3)	1	1	1	1		1	
Linear Feet of Fencing Recommended				3155			6620

Type: 1= Visual Barrier, 2= :Low security, 3= high security

Notes: Fire and grazing past disturbance

Threat Level: 1= none or low potential, 2= potential future threat, 3= current or immediate

Notes: some border patrol traffic in vernal pools and surrounding areas (minor)

VERNAL POOL RESEEDING EVALUATION

Extirpated Species							
Most Recent Occurrence							
Local Collection Source			Ery ari	x	Nav fos	x	
Seed Bulking Required					x		

Notes: Navarettia fossalis collected (less than 10%). Eryngium aristulatum seed av:

Notes: seed available for Eryngium aristulatum in VP #1659, but a very limited amount

Notes: Potential to seed pool with Eryngium aristulatum, even though not known from all the pools

PLANTAGO SEEDING FOR QUINO EVALUATION

Quino known from within 2 miles	x	x	x	x	x	x	
Plantago known from site	x	x	x	?		x	
Seed bulking required	x	x	x	x		x	
Potential/Appropriate Quino Habitat	x	x	x	x		x	

Notes: excellent quino restoration potential

ARTIFICIAL BURROWING OWL BURROW EVALUATION

BUOW known from within 5 miles	x	x	x	x	x	x	
Areas available for active excavation	x			x		x	
Potential for mechanized equipment	x	x	x	x		x	
Off-site soil input required	x	x	x	x		x	

TOPOGRAPHIC RECONSTRUCTION EVALUATION

topographic disturbances	x	x	x	x		x	
Aesthetic or Hydrological importance	A	A	A	A		A and H	
Potential for mechanized equipment	x	x	x	x		x	
Will recontouring impact sensitive species	No	x	x	x		x	

Notes: recontouring may impact quino

APPENDIX A-1
SITE ASSESSMENT DATA TABLE

City of San Diego Vernal Pool Restoration Assessment Field Data

SITE SURVEY INFO

Site Name:	Nobel Drive	Goat Mesa	Marron Valley	Proctor Valley
Site Ownership:	City of San Diego		SD Water Department	
Assessment Date:	8/3/2007	8/15/2007	8/7/2007	
Staff:	BM, SM, JP	SM, BH	BM, BH, LSL, JP, +2	
New Vernal Pool GPS ID (if any):			628	
Photo:				
"Focus Area" Number:	6	7	7	9
Polygon Number:	12	1234	12345	123

SENSITIVE ANIMAL SPECIES OCCURRENCES

<i>Branchinecta</i> spp.				
Number of pools known to occur		1	3	8
<i>Branchinecta sandiegonensis</i>				
Number of pools known to occur	6			
<i>Branchinecta lindahli</i>				
Number of pools known to occur				
<i>Streptocephalus woottonii</i>				
Number of pools known to occur				

SENSITITVE VERNAL POOL PLANT SPECIES OCCURRENCES

<i>Eryngium aristulatum</i> ssp. <i>parishii</i>		5		
Number of pools known to occur				
<i>Myosurus minimus</i>				
Number of pools known to occur			3	
<i>Navaretia fossalis</i>				
Number of pools known to occur	1		4	
<i>Orcuttia californica</i>				
Number of pools known to occur				
<i>Pogogyne abramsii</i>				
Number of pools known to occur				
<i>Pogogyne nudiuscula</i>				
Number of pools known to occur				

OTHER VERNAL POOL PLANTS OBSERVED

<i>Alopecurus saccatus</i>	x			
<i>Brodiaea jolonensis</i>		x		x
<i>Brodiaea orcuttii</i>				
<i>Callitriche marginata</i>			x	
<i>Centunculus minimus</i>				
<i>Crassula aquatica</i>	x	x		
<i>Deschampsia danthoniodes</i>	x	x	x	x
<i>Downingia cuspidata</i>				
<i>Elatine brachysperma</i>		x		
<i>Elatine californica</i>				
<i>Eleocharis acicularis</i>	x			
<i>Eleocharis macrostachya</i>	x	x		x
<i>Epilobium pygmaeum</i>		x		
<i>Isoetes howellii</i>				
<i>Isoetes orcuttii</i>				
<i>Juncus bufonius</i>	x	x	x	x
<i>Lilaea scilloides</i>	x			
<i>Marsilea vestita</i>				
<i>Malvella leprosa</i>		x		
<i>Nama stenocarpum</i>		x		
<i>Phalaris lemmonii</i>				
<i>Pilularia americana</i>				
<i>Plagiobothrys acanthocarpus</i>	x	x		x
<i>Plantago bigelovii</i>			x	
<i>Plantago elongata</i>	x			x
<i>Psilocarphus brevissimus</i>	x	x	x	x
<i>Psilocarphus tenellus</i>				
<i>Lythrum hysopifolium</i>	x			x

OTHER SENSITIVE PLANT SPECIES OCCURRENCES

<i>Ferocactus viridescens</i>				
<i>Dudleya Variegata</i>		x		

APPENDIX A-1
SITE ASSESSMENT DATA TABLE

NONNATIVE PLANT SPECIES EVALUATION

Upland Total %	95	95	35	40	35	25	75	70	55	60	80	5	65	5
VP Total %	65	25	30	35	5	20	50	60	45	20	25	<1	35	<1
VP/Wetland %	5	5	20	20	5	10	5			5		<1	5	
VP/Wetland Weed Rank	1st	Pol mo	Ero spp.	Lol spp.	Lol spp.	Spe bo	Lol spp.	Lyt hys		Spe bo		Lyt hys	Lol sp.	
	2nd	Bro hor	Bro hor	Pol mon	Pol mon		Bro hor	Spe bo					Rum cri	
	3rd	Ave spp.	Ave spp.	Rum cri	Lyt hys								Spe boc	
	4th	Ero spp.		Lyt hys									Lyt hys	
Upland Weed % in VP		20	10	15		10	45	60		15	25	<1	30	Negligible
Upland Weed Rank	1st			Ave sp.	Bro mad		Ero spp.	Ero spp.	Ero spp.	Lol mul	Ero spp.	Ero spp.	Bra sp.	Lol mul
	2nd			Ero spp.	Bro hor		Ave spp.	Gas ve	Bro hor	Bro hor		Bro hor	Cen mel	Bro hor
	3rd				Ero spp.			Li hy		Ero spp.				Ero sp.
	4th												Bro mad	

FENCING EVALUATION

Off-road		50	50	100
Grazing		50	50	
Utility				
Foot/Bike	x			
Threat Level (1-3)	2	3	3	3
Mapped	x			
Type (1-3)		3		3
Linear Feet of Fencing Recommended		3975		

Type: 1= Visual Barrier, 2= :Low security, 3= high security Threat Level: 1= none or low potential, 2= potential future threat, 3= current or immediate
Notes: 1 pool not fenced, f Notes: Off aerial vernal pools 2435 singel pool

VERNAL POOL RESEEDING EVALUATION

Extirpated Species	Nav fos	?	Myo min	Ery ari?
Most Recent Occurrence	2001(03?)		2007	?
Local Collection Source	Carrol Canyon	x		
Seed Bulking Required	x		x	

Notes: No bulking required for Eryngium aristulatum Notes: Myosurus minimus could not be relocated

PLANTAGO SEEDING FOR QUINO EVALUATION

Quino known from within 2 miles	x	x	x	x
Plantago known from site	x	x	x	x
Seed bulking required	?	x		x
Potential/Appropriate Quino Habitat		x	x	x

ARTIFICIAL BURROWING OWL BURROW EVALUATION

BUOW known from within 5 miles	?	x		x
Areas available for active excavation	x	x		x
Potential for mechanized equipment	x	x	x	x
Off-site soil input required	x	x	x	x

Notes: High quality grassland

TOPOGRAPHIC RECONSTRUCTION EVALUATION

topographic disturbances	x	x		x
Aesthetic or Hydrological importance	H	H and A		A and H
Potential for mechanized equipment	x	x		x
Will recontouring impact sensitive species	?	?		?

Notes: in one pool only

APPENDIX A-2

EXAMPLE OF SITE ASSESSMENT FIELD FORM

Site Survey Information

Evaluation of Each Mapped Polygon

Non-Native Plant Species Evaluation

Polygon	Upland Total %	VP Total %	VP/ Wetland Weed %	Weed Rank				Upland Weed %	Weed Rank			
				1st	2nd	3rd	4th		1st	2nd	3rd	4th

Notes:

Restoration Recommendation Evaluation

Fencing Evaluation

% Off-road	% Grazing	% Utility	% Foot/Bike	Threat Level (1-3)	Mapped?	Type (1-3)

Type:

- 1 = Visual barrier (split rail, etc.)
- 2 = Low security (chainlink, etc.)
- 3 = High security (post and cable, etc.)

Threat Level:

- 1 = No current threat or low potential for future threat to vernal pools or vernal pool watershed
- 2 = Potential future threat to vernal pools or vernal pool watershed
- 3 = Current and immediate threat to vernal pools or vernal pool watershed

Notes:

Vernal Pool Reseeding Evaluation

Extirpated Species	Most Recent Occurrence	Local Collection Source	Seed Bulking Required?

Notes:

Plantago Seeding for Quino Evaluation

Quino Known from within 2 Miles?	Plantago Known from Site?	Seed Bulking Required?	Areas of Potential/Appropriate Habitat for Quino?

Notes:

Artificial Burrowing Owl Burrow Evaluation

BUOW Known from within 5 Miles?	Areas Available for Active Excavation?	Potential for Mechanized Equipment?	Off-site Soil Input Required?

Notes:

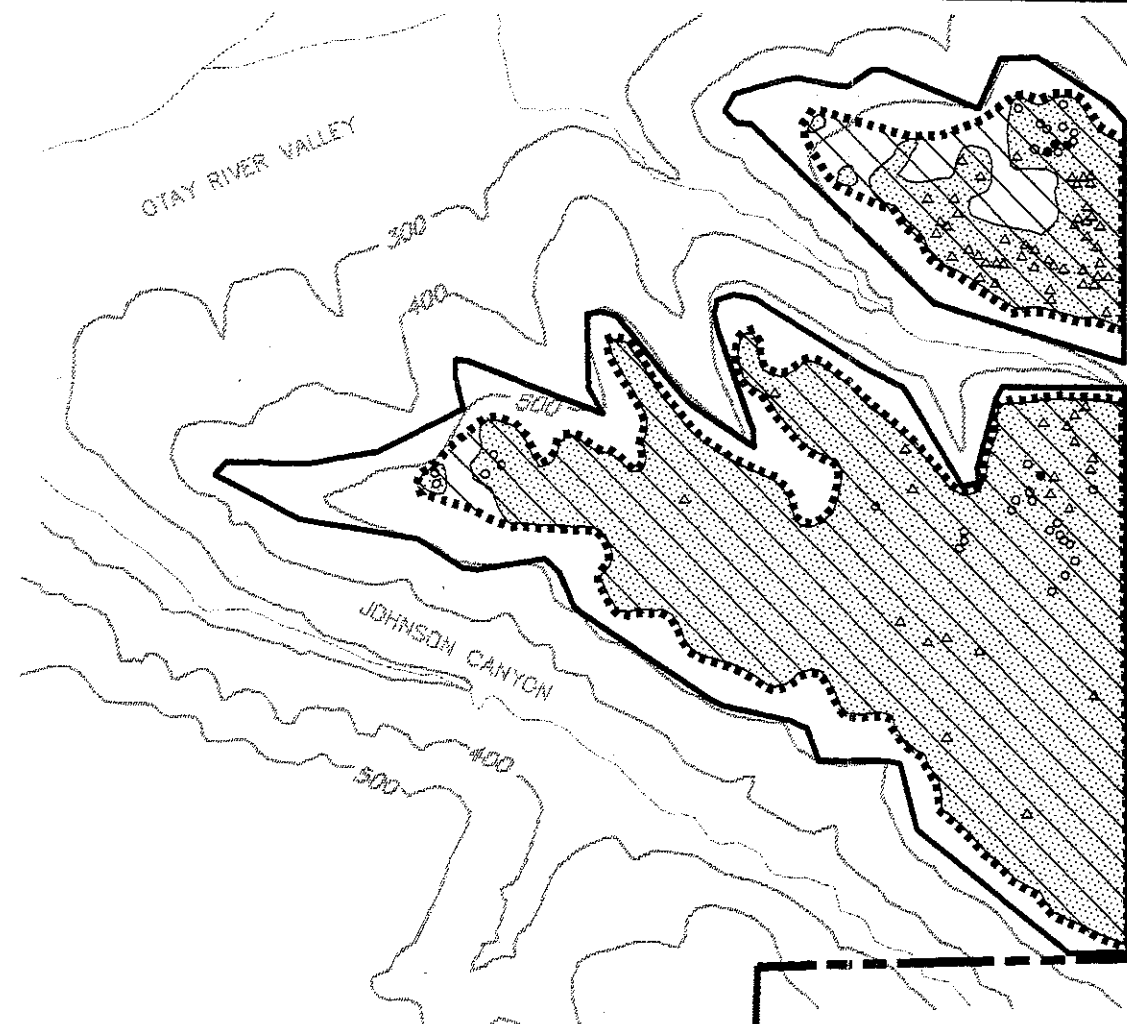
Recontouring/Topographic Reconstruction Evaluation

Are There Topographic Disturbances?	Aesthetic or Hydrologically Important?	Can Equipment Be Used?	Will Recontouring Impact Sensitive Species?

Notes:

APPENDIX B

**HISTORIC MAP OF THE COUNTY SMITH SITE (J23-J25)
(DUDEK & ASSOCIATES, INC. 1992)**



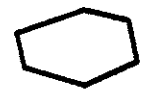
J25

151 basins with indicator species. Only the 59 basins with rare species are shown.

J23-24

533 basins with indicator species. Only the 45 basins with rare species are shown.

Legend



Area surveyed for vernal pools



Area of vernal pool habitat with indicator species

- Individual vernal pool with *Eryngium aristulatum*
- △ Individual vernal pool with *Pogogyne nudiuscula*
- Individual vernal pool with both *Eryngium* and *Pogogyne*

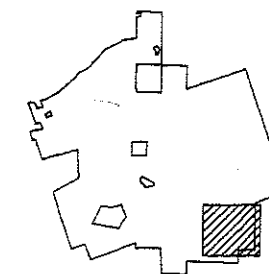
K6 Vernal pool group code

18-21

I.D. numbers of all basins staked



Area Available for Restoration



INDEX MAP



1" = 1000'

