

City of San Diego

Vernal Pool Inventory





2002-2003



THE CITY OF SAN DIEGO

The City of San Diego is pleased to provide you with a copy of its 2002-2003 Vernal Pool Inventory. This inventory builds off of seminal work completed by R. Mitchel Beauchamp (1979) and Dr. Ellen Bauder (1986), as well as over 2500 hours of City staff conducting site specific vernal pool surveys.

This inventory was the product of a grant from the U.S. Fish and Wildlife Service to improve understanding of the current distribution and conservation status of vernal pools within the jurisdiction or ownership of the City of San Diego. The inventory will serve as the foundation for the Citywide Vernal Pool Management Plan currently underway.

While the inventory focused on identifying the location and size of vernal pool basins, and five sensitive vernal pool plants, it is my hope that it will serve as the basis for future monitoring and research efforts. Because all of the information was collected with a sub-meter differential Global Positioning System and stored in a Geographic Information System, the data can be easily aggregated with other vernal pool inventories currently underway by the County of San Diego and Marine Corps Air Station Miramar. This will allow a regional perspective on the status of these unique ecosystems.

It is my sincere belief that through proper management, vernal pool habitat can be protected, enhanced and restored. While we cannot undo the tremendous loss of vernal pool habitat that has occurred over the last century, we can strive to maintain and manage what remains. It is in this light that the Inventory and the pending Citywide Vernal Pool Management Plan are presented for your use.

Sincerely,

Keith A. Greer

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1.0 INTRODUCTION

1.1 *Background*

Vernal pools are seasonal, depression-type wetlands that result from a unique set of physical parameters and support a specific biological assemblage. These ecosystems have been greatly reduced due to development and other anthropogenic factors, and several plants and animals endemic to vernal pools have been listed as federal and/or state endangered species. As habitat for these species, vernal pools are considered to be critical environmental resources.

Several physical factors combine to create a functional vernal pool ecosystem. Vernal pools form in small, shallow, oval or circular basins from one to 700 square meters (Zedler, 1987). In this document, the term "basin" will refer to the physical depression in which ponding occurs. Although such basins may occur on level surfaces, they are often associated with hillocks known as Mima mounds. In San Diego county, these circular features range from three to 20 meters in diameter and 0.4 to 1.2 meters in height and function as water catchments with vernal pools forming in inter-mound swales (Zedler, et al., 1979). The basins are sealed by impermeable hardpan soils or a clay layer that expands during saturation (Greenwood and Abbot, 1980).

Although seasonal wetlands are found worldwide, vernal pools sharing physical and biological parameters occur within the Mediterranean climate zone of the western United States, from southern Oregon, U.S.A., to northern Baja California, Mexico. In southern California, remnants of historic vernal pool complexes occur on coastal mesas in Santa Barbara, Los Angeles, Orange and San Diego counties, as well as inland in the San Diego foothills and Riverside basalt terraces. Within the City of San Diego, groups of vernal pools called "series" are found in the following areas: Del Mar Mesa, Mira Mesa, Carmel Mountain, Kearny Mesa, Mission Trails Regional Park, Otay Mesa and nearby Otay Lakes, and Marron Valley (Figure 1). Series are spatially associated clusters of basins found on a single soil type and supporting similar biological assemblages. "Complex" refers to a designation of geographically grouped vernal pools by Beauchamp (1979) and Bauder (1986) commonly used by management agencies today. For example, J 12 located in Otay Mesa refers to series J complex 12 and contains four vernal pool basins.

Vernal pools are habitat for a mix of species adapted to a highly dynamic ecosystem. Many plants and animals, including several threatened/endangered species, rely on the water and nutrients provided by vernal pools. Vernal pools are also influential in local hydrology as surface water conveyance and storage mechanisms (Zedler, 1987).

The extent and quality of these specialized ecosystems have been substantially reduced by grazing, agriculture, and development (Bauder, 1986). Bauder and McMillan (1998) estimated that vernal pool soils historically covered nearly 200 square miles of San Diego county. Approximately 5% of southern California vernal pool basins remained in 1998 (USFWS, 1998). The majority of these have been degraded or are threatened by grazing, agriculture, off-road vehicles and urban development. Urbanization has also increased the occurance of edge effects, invasion by exotic species, pollution, and changes in basin hydrology (Bauder, 1986b).

In 2002, the City of San Diego (City) received funding through a U. S. Fish and Wildlife Service (USFWS) Section 6 Planning Grant to complete an inventory and management plan of vernal pools within the City's jurisdiction (refer to Fig. 1).

Figure 1 – Regional distribution of San Diego vernal pools



This inventory builds on several previous studies and surveys, which were used to determine the general locations of individual vernal pools and complexes. Beauchamp (1979) and Bauder (1986) covered the greater portion of San Diego County, and represent complexes as polygons. Villasenor and Riggan (1979) and Zedler and Ebert (1979) mapped the boundaries of individual vernal pool basins within Kearny Mesa and Del Mar Mesa, respectively. Much of the area currently owned by the City and other jurisdictions has never been surveyed for specific vernal pools and, in many cases, historical maps do not accurately represent the existing basins. This inventory does not, however, include vernal pools known to occur on military lands (i.e., MCAS Miramar, Navy Chollas Heights) within the City but not under City jurisdiction.

1.2 *Purpose of project*

This project utilized advanced geospatial technology to update information on the location of individual vernal pools and complexes, including documentation of changes in vernal pool distribution due to development and restoration efforts subsequent to Bauder's report (1986). Specialized software combined with a sub-meter global positioning system (GPS) were used to precisely record each basin. This inventory expands and updates existing information, and provides the basis for a gap analysis of vernal pool conservation efforts within the City of San Diego.

Genetic sampling of San Diego fairy shrimp (*Branchinecta sandiegonensis*) has been used to estimate current population size and breeding structure, improve understanding of species evolution, and calculate the genetic diversity within a population or genetic divergence between populations. Dr. Andrew Bohonak (San Diego State University) and Dr. Marie Simovich (University of San Diego) are currently sequencing mitochondrial DNA of *B. sandiegonensis* to determine the evolutionary relationships between series. The genetic data analyses are being used to evaluate the status of *B. sandiegonensis* and identification of ecologically significant units for conservation.

Presence/absence of juvenile amphibians in all basins were noted to ascertain the localized ranges of Western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), and Western spadefoot toad (*Spea hammondii*), and assess the importance of vernal pools as habitat for tadpoles of these species. Additional grant monies are being sought to conduct genetic research using tadpoles sampled from vernal pools in conjunction with the U. S. Geological Survey (USGS).

A comprehensive vernal pool plant survey has been completed for each complex within the City. City staff estimated percent cover for the six vernal pool species listed as endangered or threatened by the state and/or federal government, or considered covered (ie. adequately conserved) by the Multiple Species Conservation Program (MSCP).

The updated inventory provides current and expanded information regarding the location of vernal pool basins and rare, threatened, and endangered biota within the City of San Diego. The resulting data, which includes vernal pools on private and public lands, will be analyzed to determine the extent of vernal pool protection, as well as current preservation and management needs. This new information will serve as the basis for updating the City of San Diego Vernal Pool Management Plan (1996), which

identifies and prioritizes management activities for vernal pools on land owned by the City of San Diego.

2.0 METHODS

2.1 *Research on existing vernal pool inventories*

In fall 2002, City staff researched historical and recent reports and current expert knowledge to determine locations and existing survey data for vernal pools within the City's jurisdiction. Site names reflecting location, ownership, or project were assigned to series and/or complexes, and all areas were reviewed using aerial photographs to determine their current status. A Geographic Information System (GIS) was then utilized to document all sites containing extant vernal pools. Unnatural pools formed in tire tracks, called road ruts, were included when vernal pool indicator species were present. The following general geographic areas of interest were identified: Del Mar Mesa, Carmel Mountain, Mira Mesa, Nobel Drive, Kearny Mesa, Mission Trails Regional Park, urban San Diego areas, Otay Mesa, Otay Lakes, and Marron Valley (refer to Fig. 1). Vernal pool complexes within each area were identified, and data were compiled for each complex, including previous site designation and recent survey information, such as number of vernal pools, plants and/or animals present, and specific threats to the site.

2.2 *Field data collection*

Each site was visited following storm events with recorded rainfall of 0.33 inches or more from January through May 2003. At or near maximum inundation, individual basin boundaries were recorded using a differential sub-meter GPS, and the following attributes were documented: site name; Bauder identification number (if any); vernal pool identification number (assigned by series at time of survey); date; time; state of inundation; comments; presence/absence and percent cover for *Eryngium aristulatum* (San Diego button celery), *Navarretia fossalis* (spreading prostrate navarretia), *Orcuttia californica* (California Orcutt grass), *Myosurus minimus* (little mousetail), *Pogogyne abramsii* (San Diego mesa mint), and *Pogogyne nudiscula* (Otay mesa mint); presence/absence for *Branchinecta* spp. (unidentified fairy shrimp), *Branchinecta sandiegonensis* (San Diego fairy shrimp), *Branchinecta lindahli* (versatile fairy shrimp), *Streptocephalus woottoni* (Riverside fairy shrimp), tadpoles/metamorphs (unidentified), *Spea hammondi* (tadpole/metamorph/adult Western spadefoot toad), *Bufo boreas* (tadpole/metamorph/adult Western toad), and *Hyla regilla* (tadpole/metamorph/adult Pacific tree frog). Where possible, the spatial and/or biological data were obtained from current consultant survey information. In cases when such data were not available, information was collected during site visits by City staff. Dates and personnel information for data collection are available in Appendix A.

Two hand-held devices were used in spatial data collection: Trimble TSC1 datalogger using Asset Surveyor version 5.00, and Compaq iPaq running ESRI's ArcPad 6.0. Each collection device was linked to a Trimble Pro XR sub-meter GPS receiver. The Pro XR utilizes real-time differential GPS correction which results in increased field accuracy while eliminating the need for post-processing data correction. In the office, spatial data and attributes from each collection system were combined using Trimble's Pathfinder Office 3.00 and ESRI's ArcView 3.3 software, respectively.

Fairy shrimp were sampled from 84 basins as dormant cysts or live adults. Cysts were collected in soil samples and grown under laboratory conditions. Mature shrimp were collected from inundated basins and preserved in 95% ethanol. All sampling was conducted by members of the Branchiopod Research Group of USD appropriately permitted by USFWS under the direction of Dr. Simovich (Appendix B).

Fairy shrimp collection was based on a nested design: in most cases, ten individuals were sampled from each of three basins per complex (six at some larger complexes) across the species range within the City of San Diego. A matrix of the Eucladian distance between sampled basins was determined from the vernal pool inventory, and will be used to assess the possible correlation between distance and genetic similarity. Collection at 24 locations within the City resulted in 1000 *B. sandiegonensis* samples which will be analyzed as described below.

Extracted DNA was amplified for the mitochondrial gene Cytochrome Oxidase I, using novel primers designed by Bohonak for work on other arthropods. Amplifications were screened on a 2% agarose gel, and successful amplifications were cycle sequenced using ABI BigDye v.3 with manufacturer's suggested protocols. Sequences were visualized on an ABI 377 automated sequencer. Preliminary sequences were used to verify the accuracy of this protocol with *B. sandiegonensis*.

These data were analyzed using the standard summary statistics A (number of alleles in a sample), H_e (expected heterozygosity) and π (average pairwise sequence divergence) at the levels of the basin, complex and species. Genetic differences among populations were analyzed in terms of F_{ST}, patterns of isolation by distance, nested clade analysis, standard phylogeography and maximum likelihood and coalescent estimates of gene flow. These analyses provide inferences into historical and contemporary processes that have shaped population genetic structure in *B. sandiegonensis.*

When observed, the presence/absence of the following amphibians (tadpoles, metamorphs, and adults) were noted at each basin: *Bufo boreas, Hyla regilla*, and *Spea hammondii*. A total of 44 basins at 11 sites were randomly sampled with the assistance of USGS Biological Resources Division staff. Ten individuals were taken from each sampled basin, and a total of 440 individuals were collected and preserved in 95% ethanol. Samples were used to verify field identification and in future genetic testing not associated with this project. All samples are stored at the San Diego office of the USGS.

Helix Environmental has prepared a comprehensive list of vernal pool plant species present by series per Corps vernal pool indicator guidelines (U.S. Army Corps of Engineers, Los Angeles District, Regulatory Branch, November 1997) and vernal pool plant species listed in Tables 6a and 6b in Zedler's *Ecology of Southern California Vernal Pools: A Community Profile* (1987). Each site was surveyed twice by an experienced vernal pool biologist during the winter and spring of 2003. Surveys were timed to coincide with 1) the highest level of basin inundation, and 2) optimal flowering time later in the season for detection and identification of both early and late showing vernal pool species. Wetland and upland species present at each complex were also surveyed.

At sites where one or more of the following endangered, threatened, or MSCP covered species occur, City staff estimated percent cover for each species in each

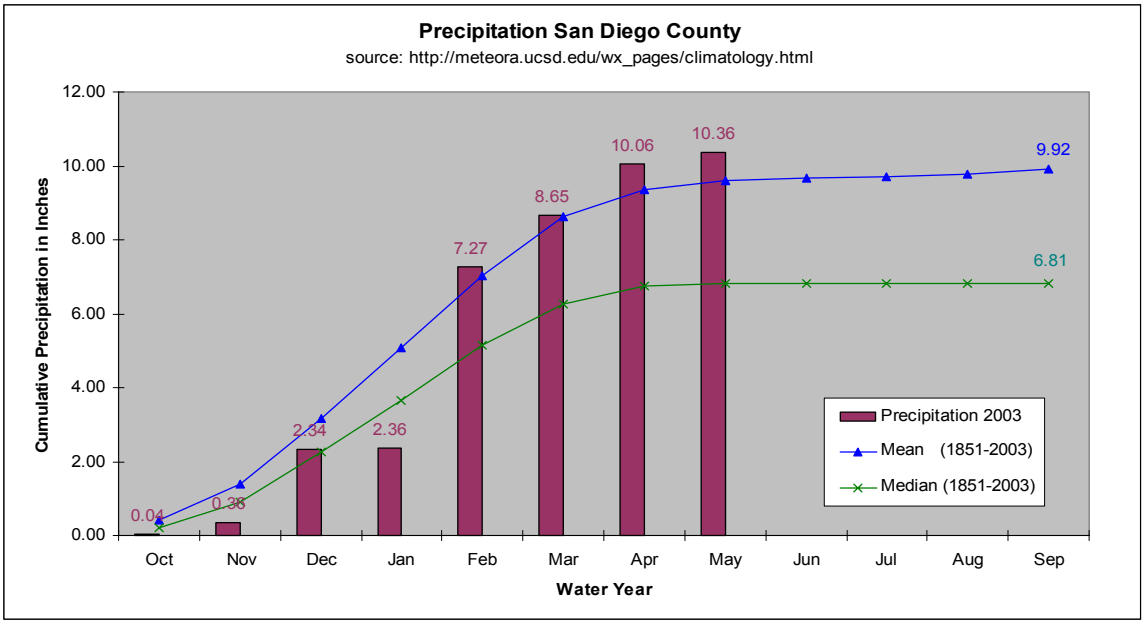
vernal pool: *Eryngium aristulatum* spp. *parishii*, *Navarretia fossalis*, *Orcuttia californica*, *Myosurus minimus*, *Pogogyne abramsii*, and/or *Pogogyne nudiscula*. Staff visits were scheduled to coincide with the maximum foliage of vegetation, and multiple visits were necessary in many cases. Estimates were derived from the California Native Plant Society percent cover worksheet, and were calculated based on vernal pool basin area. Estimated relative percent cover was grouped in the following classes to track major changes in population size over time: <1%, 1-5%, 5-10%, 10-25%, 25-50%, 50-75%, 75%+.

City staff has completed nearly 3500 hours of research and field surveys for this project and have mapped 2516 individual vernal pool basins within the City of San Diego.

2.3 *Limitations*

Vernal pool ecosystems are extremely sensitive to inter- and intra-annual environmental variability. The size and number of inundated basins, and therefore their associated biota, are directly correlated to the amount and timing of precipitation. Rainfall during the 2003 water year has been consistent with average recorded precipitation in San Diego over the past 153 years (Figure 2), and the majority of basin areas were recorded during March when cumulative precipitation for 2003 equaled cumulative average rainfall. Based upon the amount and timing of rainfall, it is believed that the data gathered for 2003 represents a "typical" year for vernal pool biota.

Figure 2: Precipitation in San Diego County for the 2002-2003 rainfall year



The use of GPS technology greatly improved the spatial precision of this inventory over previous vernal pool research efforts. The system utilized for this survey represents the best available technology; however, the submeter resolution can become problematic in certain situations. Spatial inaccuracies of up to one meter are

considered precise for larger basins but may off-set the boundaries of small vernal pools (i.e., basins with diameters less than two meters). In addition, basins that are close together may appear to overlap due to changes in the angle of the receiver beacon and/or number of positional satellites available. Even with the described errors, the data are considered to be accurate to less than one meter, and provide the most comprehensive and spatially accurate information within the City to date.

Due to the lack of a federal recovery permit, City staff was unable to verify visual identification of fairy shrimp. The size of the inventoried areas was also prohibitive to the identification of all fairy shrimp species present in every basin. Because of these factors, it was impossible to conclusively determine presence of fairy shrimp. As such, the current inventory may under-represent the true number of vernal pools with fairy shrimp and should only be used for large scale planning purposes.

The size of the survey area and staff scheduling proved to be an obstacle to completing plant surveys and cover estimates. A comprehensive plant survey per vernal pool was not possible due to the high number of basins; therefore, these surveys were conducted at the series scale. In addition, vernal pool plants species tend to occur at different sites at different times throughout the spring. Cover estimates for the endangered, rare, or MSCP covered species at a given site were timed to coincide with maximum foliage of each species; however, due to rainfall, scheduling, etc., certain complexes may have shown greater cover of a given species before or after the estimate was completed. Because of the longevity of the species, it is felt that the cover estimate classes adequately represent the basins for the year surveyed.

Although the inventory represents an extensive and thorough effort, it does not provide a complete record of vernal pools and vernal pool species found within the City of San Diego. Military lands, including the Miramar Mounds National Natural Landmark at MCAS Miramar, are excluded. Efforts to work in cooperation with the military, including a formal written request, went unanswered. Private lands inaccessible to the City (e.g., posted "No Trespassing") were also not surveyed. A minimal number of additional vernal pools may have been overlooked due to their location in the midst of dense vegetation or other access issues. To help evaluate this limitation, the following project is underway to determine the usefulness of remote sensing to detect vernal pools in such areas.

Vernal pool preserves at Del Mar Mesa are characterized by thick upland vegetation of chaparral and scrub oak that hindered a comprehensive survey. Research has shown high resolution, multi-spectral imagery, such as Airborne Data Acquisition and Registration (ADAR), to be the preferred remote sensing option in high detail land cover detection and classification over relatively small areas (Stow, et al., 1998.) ADAR is a visible spectrum and near-infrared aerial digital imaging system which has been used successfully to detect recently created vernal pools (surrounded by bare ground) through visual and software-directed image classification (Hope, et al., 2002.) ADAR images of the study sites within the City were taken shortly after a major rain event late in the rainy season in an attempt to image the inundated basins. The contrast in spectral reflectance between the soil, vegetation, and water (vernal pools) has been used to detect nearly 40 vernal pools located in the inaccessible uplands. This basin detection effort will be compared to the vernal pool inventory to determine the accuracy

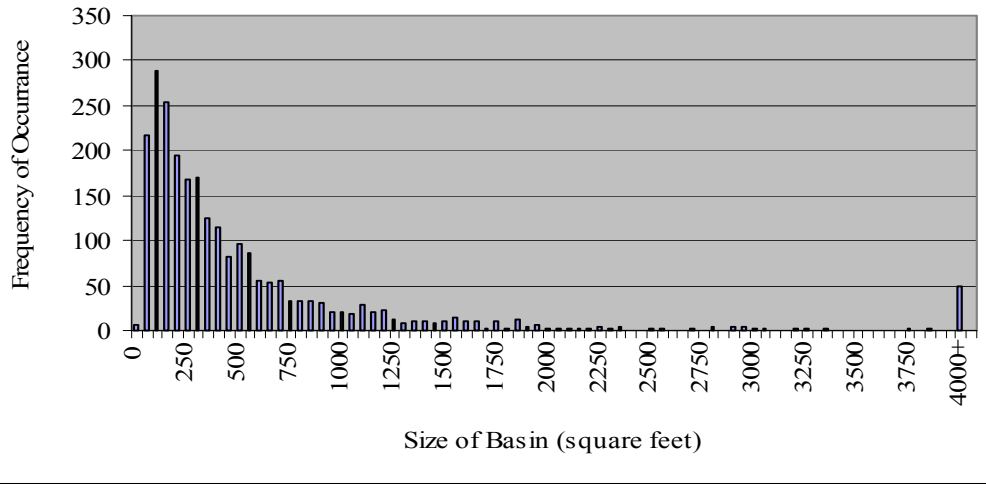
of the procedure and assess the utility of remote sensing to detect or monitor vernal pools in the future.

3.0 RESULTS

3.1 *Inventory summary*

A total of 2516 vernal pool basins at 62 sites were mapped during the 2002-2003 rainy season. For this study, a vernal pool basin was defined as the extent of land surface covered by ponding water following a large rain event during an average rainfall year. Watershed area is not included in the basin area. Basin areas were highly variable—from 2.13 to 68,364 square feet—with a standard deviation of 2,138 around the mean of 668. The frequency distribution of basin areas is given in Figure 3.

Figure 3
Histogram of Vernal Pool Basin Area



The sites and associated Bauder identification numbers are listed with the number of mapped basins in Table 1. Sites in this inventory that were not recognized by the Bauder survey have been assigned a Bauder-type identification number in the following manner: Sites located adjacent to Bauder complexes were included in the existing designation, while isolated sites were assigned to the nearest complex and given a series number subsequent to those of historical designations. These revised Bauder identification numbers are shown in bold in Table 1.

Sites are designated as conserved according to the following criteria: vernal pool basin area occurring on land covered by a conservation easement, dedicated in fee title to the City for mitigation purposes, or designated City open space. A total of 1,369 vernal pools within the City of San Diego are conserved; this represents 54% of the basins mapped in this inventory. Of the remaining 1,193 vernal pools, 419 (17% of total basins) are located on publicly owned parcels but are not considered conserved according to the stated criteria; these sites are noted by an asterisk in Table 1. Note that site acreage for unconserved sites is based on parcel boundaries and is not indicative of natural habitat and/or vernal pool watershed. Site acreage for conserved sites corresponds to the preserved area surrounding the vernal pool basins.

Table 1 – Summary of Inventoried Vernal Pools

Area	Revised Bauder ID	Site*	Number of Basins	Site Acreage	Basin Acreage	Conserved	Lambert Coordinate Map
Del Mar Mesa							
	H 1-15	Del Mar Mesa	344	779	5.50	Yes	282-1713
	H 17	Shaw Texas	26	200	0.23	No**	274-1701 274-1713
	H 18-23	Rhodes	152	102	0.75	No**	282-1713
	H 39	Greystone Torrey Highlands	19	3.5	0.68	Yes	282-1713
	H 40	Li Collins	2	0.3	0.38	Yes	290-1725
Carmel Mountain							
	H 31-32 **H 38**	Carmel Mountain	30	300	0.32	Yes	274-1701 266-1701
Mira Mesa							
	B 5-6	Tierra Alta	1	0.1	0.0055	Yes	274-1713
	B 5-8	Lopez Ridge	13	12.4	0.48	Yes	274-1713
	B 5-8	Crescent Heights	7	36	0.042	No	274-1713
	B 11	Mesa Norte	45	5	0.58	Yes	274-1713
	C 10-16	Winterwood	61	20	0.81	Partial	266-1713
	C 17-18	Fieldstone	9	4.3	0.32	Yes	266-1713
	C 27	Mira Mesa Market Center	1	0.29	0.057	Yes	266-1725
	C 28	Maddox	82	13	0.97	No	266-1713
	D 5-8	Parkdale Carroll Canyon	4	19	0.021	No	266-1713
	D 5-8	Carroll Canyon Preserve	119	19	1.19	Yes	266-1713
	I 1	Arjons	34	8.7	0.73	Yes	258-1713
Nobel Drive							
	I 6 B	Bob Baker	8	0.5	0.077	No	258-1713
	I 6 C	Bob Baker 2	15	2	0.24	No	258-1713
	I 12	Pueblo Lands	3	10.3	0.017	No***	258-1701
	X 5	Nobel Drive	7	94	0.085	Yes	250-1701
	X 7	Nobel Research Park	28	3.49	0.098	Yes	250-1701
Kearny Mesa							
	N 1-6	Montgomery Field	276	544	6.76	No***	234-1725
	N 7	Serra Mesa Library	25	9.2	0.36	Yes	234-1725
	N 8	General Dynamics	21	4.74	0.40	Yes	234-1725
	U 15	Magnatron	1	1	0.34	No***	242-1725
	U 15	Sander	33	30.6	0.44	No***	242-1725
	U 19	Cubic	29	13.5	0.45	No	242-1725
Mission Trails Regional Park							
	Q 2	Mission Trails Regional Park	15	5760	0.24	Yes	242-1737

Area	Revised Bauder ID	Site*	Number of Basins	Site Acreage	Basin Acreage	Conserved	Lambert Coordinate Map
Urban San Diego							
	S 4	Kelton	3	29	0.022	Yes	194-1737
Otay Lakes							
	K 3, 5, 10, 13	Otay Lakes	87	632	2.89	No***	162-1785
	R 1	Proctor Valley	19	157	0.25	No***	178-1785
Otay Mesa							
	J 2 S	Otay Mesa Road Helix	13	1	0.21	Yes	146-1761
	J 2 S, J 2 W	Otay Mesa Road Pardee	31	38.42	0.31	No	146-1761
	J 2 W	Otay Mesa Road Recon	20	2.5	0.45	Yes	146-1761
	J 2 W	J 2 W	59	40	0.68	No	146-1761
	J 2 N/W/S	Recon Cal Terraces	271	155	2.89	Yes	146-1761
	J 2 W; J 31	Hidden Trails	42	76.52	0.13	No	146-1761
	J 3	J 3	5	42	0.087	Yes	146-1761
	J 4	J 4	11	15	0.094	No	146-1761
	J 4-5	Robinhood Ridge	83	16	0.56	Yes	146-1761
	J 11 E	J 11 E	2	40.53	0.63	No	138-1761
	J 11 W	J 11 W	5	40.53	0.49	No	138-1761
	J 12	J 12	5	163.56	0.28	No	138-1761
	J 13 E	J 13 E	8	163.56	0.059	No	138-1761
	J 13 N	J 13 N	41	40	0.28	No	138-1761
	J 13 S	J 13 S	44	108	0.62	No	138-1761
	J 14	J 14	58	105	0.60	No	138-1761
	J 14	905	7	38	0.069	Partial	138-1761
	J 14	Recon South	64	17.7	1.4	Yes	138-1761
	J 15	Arnie's Point	29	150	0.65	Yes	138-1761
	J 16-18	J 16-18	13	99	0.40	Yes	138-1761
	J 16-18	Wruck Canyon	6	9.3	0.016	Yes	138-1761
	J 21	J 21	7	49	0.21	No	138-1773
	J 27	J 27	10	6.4	0.23	No	138-1773
	J 28 E	J 28 E	5	20	0.16	No	138-1773
	J 29-30	J 29-30	76	664	0.98	No	146-1773
	J 32	West Otay A + B	44	9	0.34	Yes	138-1761
	J 33	Sweetwater High School	8	50	0.065	Yes	138-1761
	J 34	J 34	14	246	0.15	No	138-1761
	J 35	Brown Field	2	74	0.010	No	146-1773
Marron Valley							
	MM 1	Marron Valley	14	2644	0.18	Yes	Marron Valley

* Sites are defined according to location, ownership, and related project, if any (see page 15.)

**Recently approved for conservation; fee dedication/easement process in progress.

*** Denotes site in public ownership which does not meet the conservation criteria (see page 19.)

All sites are shown on maps included in Appendix C. The maps follow the City 800-scale engineering format (Lambert coordinate system) used by Beauchamp (1979) and Bauder (1986) to aid in the comparison of these products. Infrared aerial photographs have been overlain with the original Bauder complex outlines and the basins mapped as part of this inventory. Sites are labeled with Bauder or revised Bauder (show in italics) identification numbers.

Fairy shrimp were observed in a total of 643 vernal pools: *Branchinecta* spp. were identified in 628 basins, *B. sandiegoensis* were identified in 408 basins, *B. lindahli* in 20 basins, and *S. woottonii* in 134 basins. Fairy shimp presence/absence is listed by site in Appendix D.

Juvenile and/or metamorph amphibians were noted in 326 basins. Thirty-four vernal pools contained *B. boreas*, 91 contained *H. regilla*, and 89 contained *S. hammondii*.

Rare, threatened, and endangered plants were found at 1,142 vernal pools. *E. aristulatum* was observed at 804 basins, *P. abramsii* was observed at 372 basins, *P. nudiscula* was observed at 376 basins, *N. fossalis* was observed at 99 basins, *M. minimus* was observed at 51 basins, and *O. californica* was observed at 58. Refer to Appendix G for results by site.

Percent cover estimates of the rare, threatened, and endangered plants were used to approximate the total basin area covered by each species. Table 2 shows the mean, maximum, and minimum percent cover for each species, as well as the estimated total basin coverage in square feet. Note that the numbers for Table 3 and site specific cover estimates were calculated using cover class categories. Federally threatened and endangered species are shown in bold.

Table 2 – Area Percent Cover Sensitive Vernal Pool Species

Species	Basins	Mean	Maximum	Minimum	Area Covered (sq. ft)
E. aristulatum	804	19.5%	95%	<1%	98,497
M. minimus	51	1%	20%	<1%	261
N. fossalis	99	2.4%	16%	<1%	1,516
O. californica	58	3.8%	38%	<1%	2,677
P. abramsii	373	6.2%	70%	<1%	36,225
P. nudiscula	376	18.5%	82%	<1%	31,833

The low values associated with *M. minimus*, *N. fossalis*, and *O. californica* are in part a function of plant physiognomy. Slender and/or diminutive species such as these will yield low cover estimates even in areas of relatively high population density.

The percentage of vernal pools occurring in the Multi-Habitat Planning Area (MHPA) was calculated to better understand current and future conservation issues. The MHPA was designated under the MSCP as prime habitat, and provides the framework for extensive City acquisition. This area of restricted development is considered crucial to the preservation of sensitive species within the MSCP. A total of 1,496 basins (59%), covering 1,169,371 square feet (26.8 acres), are located within the MHPA. Of these, 1,005 are considered conserved. Outside the MHPA, 1,020 basins (41%) cover 512,612 square feet (11.8 acres); 364 of these basins are considered

conserved. Please see Table 3 for the allocation of sensitive species within these categories.

Table 3 – Distribution of vernal pools relative to the MHPA

	Inside MHPA		Outside MHPA	
	Conserved	Not Conserved*	Conserved	Not Conserved
Number of Basins	1005	491	364	656
Basin (ft²)	649,488	519,883	176,177	336,435
Basins containing				
E. aristulatum	580	87	106	31
M. minimus	5	2	44	0
N. fossalis	79	3	16	1
O. californica	52	0	5	1
P. abramsii	168	126	43	36
P. nudiscula	319	2	55	0
Branchinecta spp.	289	52	125	133
B. sandiegoensis	236	15	107	21
B. lindahli	18	0	1	0
S. woottonii	94	3	11	3
Total fairy shrimp	294	53	130	133
Percent Cover (ft²)**				
E. aristulatum	84,784	2,446	9,680	1,214
M. minimus	16	149	154	0
N. fossalis	1,406	152	141	17
O. californica	2,206	0	328	330
P. abramsii	12,022	17,768	4,527	1,714
P. nudiscula	27,910	107	3,520	0

* Sites in public ownership that do not meet conservation criteria (see page 10) are considered "Not Conserved." Refer to Table 1 for list of sites.
**Percent cover estimates in this table were calculated using in-field cover estimates.

Results of the comprehensive plant surveys have been divided into vernal pool indicator species, facultative wetland plants, and upland vegetation. These data are included at Appendices D, E and F, respectively.

3.2 *Results by site*

The inventory results have been organized geographically, from north to south, by site. Revised Bauder identification numbers (noted in parentheses), location and conservation status of the site, as well as number and size of vernal pools, are included in the following descriptions. Vernal pools are natural unless noted as "enhanced," "restored," or "created." Enhancement refers to improvement of existing, functional vernal pools (i.e., introduction of fairy shrimp). Restoration describes efforts to reestablish the ecosystem values of vernal pools that have ceased to function. Creation efforts establish new vernal pool basins in areas where historic vernal pools have been destroyed. Survey findings are compared with results from Bauder (1986) when applicable. Cover percentage estimates in this section were calculated using the

following classes: <1%, 1-5%, 5-10%, 10-25%, 25-50%, 50-75%, 75%+. Tables of vernal pool indicator plant and fairy shrimp occurrence and representative photographs of the sites have been included in this section; species presence is indicated in Tables 4 through 63 by a dot ("•"). Facultative wetland species are listed by site in Appendix E and upland vegetation is listed by site in Appendix F.

3.2.1 Del Mar Mesa

Five vernal pool sites are found in the Del Mar Mesa area: Li Collins, Greystone Torrey Highlands, Rhodes, Del Mar Mesa, and Shaw Texas.

3.2.1.a Li Collins (H 40), near the intersection of Carmel Valley Road and Camino del Sur, is a 0.3 acre (13,361 square foot) parcel conserved and fenced as part of a Torrey Highlands Subarea residential development. Li Collins is owned and managed by the Environmental Trust; this site was grazed historically and was not included in Bauder's report (1986). The two vernal pools on-site cover 1,659 square feet and do not support rare, threatened, or endangered plant or animal species. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 4. Li Collins is located on map 290-1725 in Appendix C.

Table 4
Li Collins
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Li Collins
Vernal pool 2 looking southwest

3.2.1.b Greystone Torrey Highlands (H 39) is a 3.5 acre mitigation site bordering Camino del Sur and Highway 56. This conserved site is fenced and privately owned. Nineteen vernal pools, containing 29,824 square feet of basin area, were created in 2001. *E. aristulatum* was noted in three vernal pools and covered an estimated 188 square feet of pool basin. *P. abramsii* was noted in five vernal pools and covered an estimated basin area of 51 square feet. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 5. Fairy shrimp (*Branchinecta* spp.) were not observed on-site. Western spadefoot toad (*S. hammondii*) and Pacific treefrog (*H. regilla*) juveniles were noted in a total of seven basins. For a map of this site, please refer to 282-1713 in Appendix C.

Table 5
Greystone Torrey Highlands
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	

Table 5, con't Greystone Torrey Highlands Presence of Vernal Pool Indicator Species			
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Greystone Torrey Highlands
Vernal pool 2 looking north

3.2.1.c The Rhodes vernal pool site (H 18-23) covers 102 acres near the southern terminus of Carmel Mountain Road, contiguous to the Del Mar Mesa open space and vernal pool preserves. The vernal pools on these multiple privately owned parcels were recently approved for conservation and the conservation easement process is in progress. Historical activity on the site includes agriculture and off-road vehicles. One hundred fifty-two vernal pools and road ruts cover 32,841 square feet. Two federally endangered plant species are found on-site: *E. aristulatum* was noted in six vernal pools and covered an estimated 268 square feet of basin while *P. abramsii*, noted in seven vernal pools, covered an estimated 80 square feet of basin. These species, as well as *M. minimus* were noted on-site in 1986 (Bauder, 1986). Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 6. *Branchinecta* spp. were observed in 73 basins, *H. regilla* were observed in 50 basins, *B. boreas* were observed in 22 basins, and *S. hammondii* were observed in 2 basins. Rhodes is located on map 282-1713 in Appendix C.

Table 6 Rhodes Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Rhodes
Vernal pool 47 looking west



Rhodes
Vernal pool 66 looking south

3.2.1.d The Del Mar Mesa habitat acquisiton (H series, H 1-15), completed in 2002, protected one of the largest remaining extents of natural vernal pools in the City of San Diego.[*] Three hundred forty-four basins, covering 239,647 square feet, occur on 779 acres of publicly owned land. Prior to preservation, this area was impacted by off-road vehicles and portions of the site have been fenced to limit access. Located north of Peñasquitos Canyon, Del Mar Mesa vernal pools support robust populations of *E. aristulatum* and *P. abramsii*. *E. aristulatum* was observed in 186 basins, covering a total of 19,342 square feet; *P. abramsii* was observed in 63 basins, and covered a total of 2,490 square feet. *E. aristulatum*, *P. abramsii*, and *M. minimus* were present during Bauder's surveys in 1986. Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 7. Unidentified fairy shrimp (*Branchinecta* spp.) were observed in 62 basins, while *B. sandiegonensis* were observed in 53 basins. City and USGS staff noted *S. hammondii* in 16 basins, *H. regilla* in 10 basins, *B. boreas* in 1 basin, and unidentified tadpoles in 8 basins. Del Mar Mesa is located on map 282-1713 in Appendix C.

[*] A small number of basins were enhanced by Dr. Paul Zedler in the early 1980s.

Table 7 Del Mar Mesa Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Del Mar Mesa
Vernal pool 21 looking east



Del Mar Mesa
Vernal pool 49 looking north



Del Mar Mesa
Vernal pool 30 looking east



Del Mar Mesa
Vernal pool 50 looking north



Del Mar Mesa
Vernal pool 126 looking south

3.2.1.e Shaw Texas (H 17) is located west of the Del Mar Mesa acquisiton area adjacent to the Meadows Del Mar Golf Club. This privately owned site covers approximately 200 acres of historic agricultural land and the vernal pools in this area have recently been approved for conservation. The conservation easement process is currently in progress. Twenty-six basins, including several road ruts, cover 10,063

square feet. No sensitive plant species were observed on-site; however, *Branchinecta* spp. were found in nearly half (10) of the basins. This site was not surveyed for amphibians. Bauder (1986) noted that these pools had been destroyed by agriculture. Vernal pool indicators observed at this site are listed in Table 8. Shaw Texas is split between maps 274-1701 and 274-1713 in Appendix C.

Table 8
Shaw Texas
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Shaw Texas
Road ruts 8, 9, and 25 (near to far) looking northwest

3.2.2 Carmel Mountain

Thirty vernal pools were inventoried at Carmel Mountain (H 31-32, H 38), a 300-acre open space area owned by the City of San Diego. Prior to preservation, this site was impacted by off-road vehicles. Located south of Highway 56 near Ocean Air Drive, the basins cover 13,900 square feet and do not support populations of rare, threatened, or endangered plant species. Bauder (1986) reports *E. aristulatum* and *M. minimus* at H 31-33, but only one extant basin is near the area mapped in that report. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 9. Eight vernal pools contain *Branchinecta* spp., including two basins in which San Diego fairy shrimp were identified. Two amphibian species were observed on-site: *H. regilla* in 6 basins and *S. hammondii* in 10 basins. For a map of this site, please refer to 274-1701 in Appendix C.

Table 9
Carmel Mountain
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	

Table 9, con't Carmel Mountain Presence of Vernal Pool Indicator Species			
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Carmel Mountain
Vernal pool 12 looking east



Carmel Mountain
Road rut 26 looking north

3.2.3 Mira Mesa

Eleven sites occur on Mira Mesa, remnants of the extensive vernal pool complexes that historically covered the mesa: Mesa Norte, Tierra Alta, Lopez Ridge, Crescent Heights, Fieldstone, Winterwood, Mira Mesa Market Center, Maddox, Parkdale Carroll Canyon, Carroll Canyon Preserve and Arjons.

3.2.3.a Mesa Norte (B 11) is a mitigation site in northwestern Mira Mesa on Prairie Wood Drive. Forty-five vernal pools, totalling 25,298 square feet, were created or restored on this 5-acre site in 1998. Prior to restoration, this site was utilized as a BMX track; however, this privately owned site is now conserved and fenced. *E. aristulatum* covered approximately 186 square feet in 10 basins and *P. abramsii* covered approximately 296 square feet in 13 basins. *B. sandiegonensis* were observed in 25 vernal pools. *H. regilla* were observed in 14 vernal pools and unidenitifed tadpoles in 12 vernal pools. The Bauder report (1986) found *E. aristulatum*, *M. minimus*, and *P. abramsii* at B 11-13. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 10. Mesa Norte is located on map 274-1713 in Appendix C.

Table 10
Mesa Norte
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	

Table 10, con't Mesa Norte Presence of Vernal Pool Indicator Species			
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Mesa Norte
Vernal pool 5 looking south

3.2.3.b A single vernal pool is preserved at the Tierra Alta site (B 5-6), located north of Lopez Ridge Park. The 0.1-acre parcel is owned and maintained by the adjacent homeowner's association. No sensitive species were observed within the 241 square feet of vernal pool basin. Bauder (1986) noted *M. minimus* and *P. abramsii* at nearby B 5-6, but the Tierra Alta pool does not appear to have been included in previous surveys. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 11. This site is located on map 274-1713 in Appendix C.

Table 11 Tierra Alta Presence of Vernal Pool Indicator Species			
Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	•
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	

3.2.3.c The Lopez Ridge vernal pool preserve (B 5-8) is a 5.6-acre parcel bounded by Los Peñasquitos Canyon Preserve to the north and Calle Cristobal to the south. An additional vernal pool on a nearby 6.8-acre parcel is also included. The mitigation site is owned by the City of San Diego and includes 13 vernal pool basins covering 20,868 square feet. Lopez Ridge was the site of unauthorized impacts and subsequent restoration, including fencing. All of the basins support *P. abramsii* (covering a total of 395 square feet) while a single individual of *E. aristulatum* was noted on-site. *M. minimus* and *P. abramsii* were detected at this site in 1986 (Bauder, 1986). Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 12. *B. sandiegonensis* were observed in two basins; this site was not surveyed for amphibians. Lopez Ridge is located on map 274-1713 in Appendix C.

Table 12 Lopez Ridge Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidate	•	*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	

Table 12, con't Lopez Ridge Presence of Vernal Pool Indicator Species			
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Lopez Ridge
Vernal pool 3 looking northeast

3.2.3.d Crescent Heights (B 5-8) borders Peñasquitos Canyon at the intersection of Camino Santa Fe and Calle Cristobal. Seven vernal pools with a total area of 1,837 square feet occur on this 36-acre parcel; the site is privately owned and is not conserved at this time. No rare, threatened, or endangered plant or animal species were observed on-site, and the area was not surveyed for amphibians. *M. minimus* and *P. abramsii* were noted at this series in 1986 (Bauder, 1986). Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 13. Crescent Heights is located on map 274-1713 in Appendix C.

Table 13 Crescent Heights Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita	•	***Pogogyne nudiuscula***	
Malvella leprosa	•	*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Crescent Heights
Vernal pool 7 looking south

3.2.3.e Nine vernal pools, totaling 13,790 square feet, occur on the 4.3-acre Fieldstone site (C 17-18). This privately owned site, accessed via Sunny Meadow Street in northwestern Mira Mesa, is fenced and conserved. *P. abramsii*, estimated to cover

4,754 square feet, was observed at eight of the nine vernal pools; *P. abramsii* was also observed on-site during the Bauder survey (1986). Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 14. No fairy shrimp or amphibians were observed at this site. Fieldstone is located on map 266-1713 in Appendix C.

Table 14
Fieldstone
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Fieldstone
Vernal pool 6 looking west

3.2.3.f The Winterwood site (C 10-16) is located off of Parkdale Avenue adjacent to Challenger Middle School. Historic activity in this area includes unauthorized grading and the site is currently fenced on two sides. Sixty-one vernal pools were inventoried on-site. The 20-acre parcel is owned by the City of San Diego and twelve acres of the site are conserved. Forty-six basins (75%) were mapped within the conserved area. Vernal pool basins cover a total of 35,428 square feet, and support populations of *E. aristulatum* and *P. abramsii*. *E. aristulatum* was observed in seven vernal pools and covers 71 square feet; *P. abramsii* was observed in 27 vernal pools and covers 1,128 square feet. Field records from the Bauder report (1986) note *E. aristulatum* and *P. abramsii* at C 9-16. Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 15. Fairy shrimp (*B. sandiegonensis*) were observed in two basins, while amphibians were not noted at this site. For a map of this site, please refer to 266-1713 in Appendix C.

Table 15
Winterwood
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	

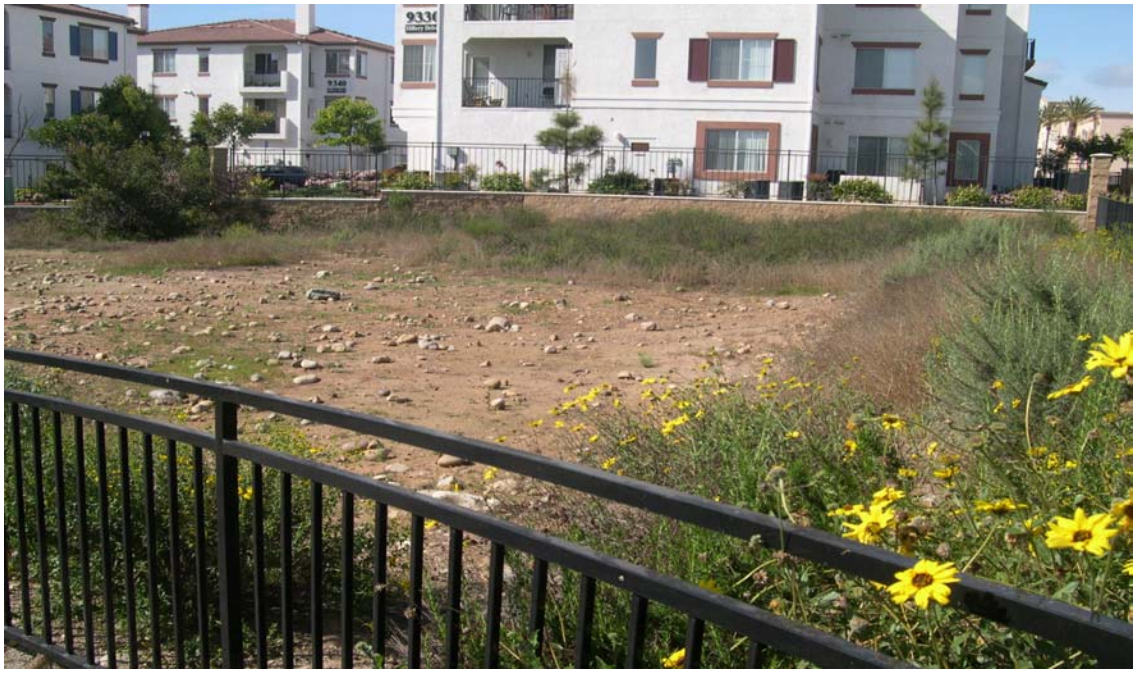
Table 15, con't Winterwood Presence of Vernal Pool Indicator Species			
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.	•	*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Winterwood
Vernal pool 12 looking west

3.2.3.g The only remaining vernal pool of the C 27 series is preserved at the Mira Mesa Market Center site. A small portion of the 17-acre parcel has been fenced to decrease impacts to the basin, which is located on the grounds of a multi-family residential development west of Interstate 15. However, trash has been observed at this restored site. The enhanced basin (2,483 square feet) and the watershed of the vernal pool are conserved. *P. abramsii* was observed in the basin, and covered an estimated 12 square feet. Field surveys conducted during for Bauder report (1986) did not detect any sensitive species at C 27. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 16. *B. sandiegonensis* were present, but no amphibians were observed at this location. For a map of this site, please refer to 266-1725 in Appendix C.

Table 16 Mira Mesa Market Center Presence of Vernal Pool Indicator Species			
Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidate	•	*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Mira Mesa Market Center
Vernal pool 1 looking northwest

3.2.3.h* Maddox (C 28) is a 13-acre site owned by the San Diego Unified School

*Maddox site discussion edited 9/10/04 per conversation with USFWS.

District. The 82 vernal pools on-site, covering 42,116 square feet, are not conserved. No sensitive plant species were observed on this site, which is south of Mira Mesa Boulevard along Parkdale Avenue. *Branchinecta* spp. were noted in one basin, *B. sandiegonensis* were noted in two basins, and *S. hammondii* were noted in a single basin. Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 17. For a map of this site, please refer to 266-1713 in Appendix C.

Table 17
Maddox
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.	•	*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Maddox
Maddox complex looking west



Maddox
Vernal pool 2 looking south

3.2.3.i Parkdale Carroll Canyon (D 5-8) consists of four vernal pools (899 square feet) on the unconserved portion of the adjacent Carroll Canyon vernal pool preserve. The site, located at the southern terminus of Parkdale Avenue, is owned and managed by the City of San Diego and no sensitive species were observed on-site. Vernal pool

indicator species and fairy shrimp present at this site are listed in Table 18. Parkdale Carroll Canyon is located on map 266-1713 in Appendix C.

Table 18
Parkdale Carroll Canyon
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	

3.2.3.j One hundred nineteen vernal pools occur at the 19-acre Carroll Canyon Preserve site (D 5-8). The basin area of these vernal pools totals 51,712 square feet. This mitigation site is located along the edge of Carroll Canyon and is owned by the City of San Diego. Basins within the Carroll Canyon Vernal Pool Preserve are conserved. This area is fenced but trash has been noted at the site. *E. aristulatum* covers a total of 2,550 square feet in 65 basins, *N. fossalis* covers a total of 9 square feet in one basin, and *P. abramsii* covers a total of 361 square feet in 42 basins. Bauder (1986) noted *E. aristulatum*, *P. abramsii*, and *M. minimus* and recorded 34 basins. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 19. *Branchinecta* spp. were observed in five vernal pools; and seven basins contained amphibians: *H. regilla* in four basins and *S. hammondii* in two basins. Carroll Canyon is located on map 266-1713 in Appendix C.

Table 19
Carroll Canyon Preserve
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	

Table 19, con't Carroll Canyon Preserve Presence of Vernal Pool Indicator Species			
Elatine californica		*Phalaris* spp.	•
Epilobium pygmaeum		*Pilularia Americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	
Isoetes orcuttii	•	*Plantago elongate*	•
Isoetes spp.	•	*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Carroll Canyon (Photo by Scott McMillan, 2001)
Vernal pool 74 looking west



Carroll Canyon (Photo by Scott McMillan, 2001)
Vernal pool 5 looking northwest



Carroll Canyon (Photo by Scott McMillan, 2001)
Vernal pool 6

3.2.3.k The Arjons site (I 1) is located south of Carroll Canyon along Arjons Drive; the 8.7-acre parcel is privately owned, fenced, and conserved. This area was the site of unauthorized grading in 1999. Thirty-four vernal pools were mapped on-site, with a total basin area of 31,908 square feet. The site supports populations of *E. aristulatum* and *P. abramsii*: *E. aristulatum* covered at total of 617 square feet at 15 basins and *P.*

abramsii covered a total of 3,569 square feet at 22 basins. These species were also observed by Bauder in 1986. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 20. Nine vernal pools contained fairy shrimp; *B. sandiegonensis* were conclusively identified in one of these basins. *B. boreas* were observed in two basins and *H. regilla* were observed in three basins. For a map of this site, please refer to 258-1713 in Appendix C.

Table 20
Arjons
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Arjons
Vernal pool 13 looking southeast

3.2.4 Nobel Drive

The area along the eastern end of Nobel Drive includes five vernal pool sites: Pueblo Lands, Bob Baker, Bob Baker 2, Nobel Research Park, and Nobel Drive.
3.2.4.a The Pueblo Lands vernal pool site (I 12) is located on a 10.3-acre parcel owned by the City of San Diego that is not conserved at this time. Three road ruts totalling 737 square feet occur on the site, which is located east of I-805 along Eastgate Mall Road. No sensitive plant species were observed on-site; however, *B. sandiegonensis* were found in each of the three basins. This site was not discussed in Bauder's 1986 report. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 21. The area was not surveyed for amphibians. For a map of this site, please refer to 258-1701 in Appendix C.

Table 21
Pueblo Lands
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	

Table 21, con't Pueblo Lands Presence of Vernal Pool Indicator Species			
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Pueblo Lands
Vernal pool 1 looking north

3.2.4.b Bob Baker (I 6 B) is a privately owned site that is not considered conserved; however, this site was the subject of a previous USFWS Section 7 consultation. Impacts due to trash were noted at this unfenced site. Eight vernal pools are found on a 0.5-acre plot that bisects two large, developed parcels. These vernal pools comprise 3,351 square feet of basin area immediately north of Miramar Road. *P. abramsii* was observed in seven basins and covered an area of 76 square feet. Bauder observed *P. abramsii* on-site in 1986. Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 22. *Branchinecta* spp. were observed in three vernal pools, and *H. regilla* were noted in a single basin. For a map of this site, see 258-1713 in Appendix C.

Table 22 Bob Baker/Bob Baker 2 Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	•
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Bob Baker
Vernal pool 2 looking west

3.2.4.c Bob Baker 2 (I 6 C) is located to the north of Miramar Road immediately west of Miramar Mall Road. Although the 0.95-acre site is fenced, impacts due to trash were noted. This privately owned site contains 15 vernal pools situated along the

southern edge of two, 2-acre parcels and is not conserved at this time; the basins cover a total of 10,404 square feet. *E. aristulatum* was observed in two vernal pools and covered 41 square feet, and *P. abramsii* was observed in 11 basins and covered 606 square feet. Both species were observed by Bauder in 1986. Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 22. *Branchinecta* spp. were observed in six basins; the site was not surveyed for amphibians. Bob Baker 2 is located on map 258-1713 in Appendix C.



Bob Baker 2
Vernal pool 5 looking north



Bob Baker 2
Vernal pool 10 looking north

3.2.4.d Twenty-eight vernal pools make up the Nobel Research Park site (X 7), located north of Nobel Drive immediately west of I-805. The basins, covering a total of 4,250 square feet, are clustered along the eastern edge of a privately owned, fenced, 28-acre parcel and are conserved. No rare, threatened, or endangered plant species were observed on-site. This site is not discussed in Bauder's report (1986). Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 23. *B. sandiegonensis* were identified in nine vernal pools, and *S. hammondii* were identified in two basins. For a map of this site, please refer to 250-1701 in Appendix C.

Table 23
Nobel Research Park
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	

Table 23, con't			
Nobel Research Park			
Presence of Vernal Pool Indicator Species			
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Nobel Research Park
Vernal pool 24 looking north



Nobel Research Park
Vernal pool 18 looking west



Nobel Research Park
Vernal pool 25 looking south

3.2.4.e The Nobel Drive site (X 5) is located directly south of Nobel Research Park across Nobel Drive. Fifty-five acres (56%) of the 94-acre, City-owned site are conserved; the seven vernal pool basins (0.085 acres of total basin area) on-site occur completely within the conserved area and are individually fenced. *N. fossalis* was

present on-site and covered approximately 11 square feet in a single basin. No sensitive species were observed at this site during the Zedler, et al., survey (1979), and the site was not visited by Bauder (1986). Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 24. *B. sandiegonensis* were noted in six basins and *S. hammondii* were noted in one basin. For a map of this site, refer to 250-1701 in Appendix C.

Table 24
Nobel Drive
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Nobel Drive
Vernal pool 4 looking west



Nobel Drive
Vernal pool 5 looking north

3.2.5 Kearny Mesa

The Kearny Mesa area includes the following vernal pool sites: Cubic, Miramar, Sander, Magnatron, General Dynamics, Montgomery Field, and Serra Mesa Library.

3.2.5.a Cubic (U 19) is a 28-basin site located at the convergence of Highways 52 and 163. The 13.5-acre parcel is privately owned and is not conserved at this time. Directly adjacent to Cubic is a 3-acre, military-owned parcel that also contains vernal pools; however, this parcel was not surveyed due to access issues. Two endangered plant species were observed on-site: *E. aristulatum* was found in two basins and covered a total area of 35 square feet, and *P. abramsii* was found in one large basin and covered a total area of three square feet. This site was not discussed by Bauder (1986). Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 25. *Branchinecta* spp. were also observed in six vernal pool basins. Amphibians were not noted on-site. For a map of this site, refer to 242-1725 in Appendix C.

Table 25
Cubic
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Cubic
Vernal pools 2 and 3 looking south

3.2.5.b Vernal pools located on MCAS Miramar (EE, FF, GA, GG, HH, RR) are not currently included in this inventory. However, the agency responsible for managing these resources is in the process of collecting data to be incorporated into this inventory.

3.2.5.c The Magnatron site (U 15) is comprised of a single, 14,719 square foot basin. No sensitive plant or animal species have been observed on the 1-acre parcel; the site is owned by the City of San Diego but is not conserved at this time. Bauder (1986) observed *E. aristulatum*, *M. minimus*, and *P. abramsii* at the U series, but complex-level information is not given for this site. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 26. For a map of this site, refer to 242-1725 in Appendix C.

Table 26
Magnatron
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris sp.*	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia sp.*	
Isoetes howellii		*Plagiobothrys acanthocarpus*	

Table 26 , con't Magnatron Presence of Vernal Pool Indicator Species			
Isoetes orcuttii		*Plantago elongata*	
Isoetes sp.		*Plantago sp.*	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Magnatron
Vernal pool 1 looking west

3.2.5.d Located along Highway 52 east of Convoy Street, 33 vernal pool basins cover 19,264 square feet of the 30.6-acre, City-owned Sander site (U 15). These vernal pools are not considered conserved; however, this site was the subject of a previous USFWS Section 7 consultation regarding the transfer of land from the Navy to the City. *P. abramsii* covered 652 square feet in a single large basin. Bauder (1986) observed *E. aristulatum*, *M. minimus*, and *P. abramsii* at the U series, but complex-level information is not given for this site. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 27. Two basins supported *B. sandiegonensis*, and *S. hammondii* were observed in one basin. For a map of this site, refer to 242-1725 in Appendix C.

Table 27 Sander Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Sander
Vernal pool 12 looking north



Sander
Vernal pool 29 looking south

3.2.5.e General Dynamics (N 8) is a conserved mitigation site located north of Balboa Avenue along Ruffin Road. The 4.74-acre parcel is fenced. Twenty-one vernal pools covering a total area of 17,215 square feet support populations of the following sensitive plant species: *E. aristulatum* was observed in two vernal pools and covers approximately 92 square feet, while *P. abramsii* was observed in 20 basins and covers approximately 2,222 square feet. This site was not surveyed for the Bauder report (1986). Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 28. San Diego fairy shrimp (*B. sandiegonensis*) were identified in six vernal pools on-site; *H. regilla* were also noted in a single basin. For a map of this site, refer to 234-1725 in Appendix C.

Table 28			
General Dynamics			
Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•

Table 28, con't General Dynamics Presence of Vernal Pool Indicator Species			
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



General Dynamics
Vernal pool 3 looking west



General Dynamics
Vernal pool 3 looking south



General Dynamics
Vernal pool 21 looking east

3.2.5.f Montgomery Field (N 1-4, N 5-6) includes many of the highest quality vernal pools in the City of San Diego. Two hundred seventy-six basins occur among the Mima topography on 544 acres owned by the City of San Diego. Over 6.7 acres of vernal pool basin area make this site the largest in the City. Located on the grounds of Montgomery Field airport north of Aero Drive, the majority of this site is restricted

from development by navigational easements. Vernal pools on-site also benefit from fencing surrounding the airstrip. However, the site is not considered conserved because it fails to meet the criteria designated by this inventory. *P. abramsii* was found in 131 basins on-site, covering an area of 19,523 square feet. This is consistent with results from Bauder (1986) which found abundant *P. abramsii* in "a large proportion of the estimated 138 [vernal] pools." Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 29. Fairy shrimp were observed in 19 vernal pools, and *B. sandiegonensis* were conclusively identified in 11 of those basins. Amphibians were noted in 66 basins: *B. boreas* in 30 basins, *H. regilla* in 11 basins, and *S. hammondii* in 25 basins. For a map of this site, refer to 234-1725 in Appendix C.

Table 29
Montgomery Field
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata	•	*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	•
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	•
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Montgomery Field
Vernal pool 151 looking west



Montgomery Field
Vernal pool 205 looking east



Montgomery Field
Vernal pool 67 looking northeast



Montgomery Field
Vernal pool 126 looking north

3.2.5.g The Serra Mesa Library (N 7) site is located directly south of Montgomery Field across Aero Drive. The 25 vernal pools at this site cover 15,822 square feet of the 9.2-acre parcel. The land is owned by the City of San Diego and is not conserved at this time; however, current development plans for a library would protect and conserve the basins on-site. Historically, this site has been subject to off-road vehicle usage. No

sensitive plant or animal species were observed in 2003; vernal pool indicator species and fairy shrimp noted on-site are listed in Table 30. This area was not surveyed by Bauder (1986). For a map of this site, refer to 234-1725 in Appendix C.

Table 30
Serra Mesa
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Serra Mesa
Vernal pool 9 looking east



Serra Mesa
Vernal pools 15, 14, 13, and 11 (clockwise) looking south

3.2.6 Mission Trails Regional Park

3.2.6.a Fifteen vernal pools, covering a total of 10,505 square feet, were mapped at Mission Trails Regional Park (Q 2). These vernal pools occur in four locations but are not designated as separate sites. Mission Trails Regional Park encompasses 5,760 acres in eastern San Diego, bordered by Highway 52 on the north and Santee on the east.

This area is owned and managed by the City of San Diego Department of Parks and Recreation and is conserved as open space. Sensitive vernal pool obligate plant species were not observed on-site. These vernal pools were not classified by Bauder (1986). Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 31. Six basins support *B. sandiegonensis*; and *B. boreas* were observed in one basin, *H. regilla* in two basins, and *S. hammondii* in two basins. For a map of this site, refer to 242-1737 in Appendix C.

Table 31
Mission Trails Regional Park
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Mission Trails Regional Park
Vernal pool 1 looking north



Mission Trails Regional Park
Vernal pool 7 looking south



Mission Trails Regional Park
Vernal pool 5 looking north



Mission Trails Regional Park
Vernal pool 13 looking north

3.2.6.b An additional site in this area, Murphy Canyon (G 1), will not be included in the inventory. The site is located on lands owned by the U.S. Navy; however, military personnel were unwilling to grant access to City staff for survey purposes. Bauder (1986) recorded *M. minimus* and *P. abramsii* at G 1-2.

3.2.7 Urban San Diego

Two vernal pool sites occur within the urban San Diego area: Kelton and Chollas Lake.

3.2.7.a Kelton (S 4) is a 29-acre parcel owned by the City of San Diego located southeast of the intersection of Euclid and Highway 94. Three vernal pool basins cover a total of 962.5 square feet. No sensitive species were observed, and BMX activity is known to occur on-site. This site was not included in Bauder's report (1986). Vernal pool indicators noted at this site are listed in Table 32. For a map of this site, refer to 194-1737 in Appendix C.

Table 32
Kelton
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii	•	*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Kelton
Vernal pool 3 looking north

3.2.7.b A second site occurs in the vicinity of Chollas Lake. This 13-acre site, which historically supported *B. sandiegonensis* (personal comm. Greg Mason, Helix Environmental), was not included in Bauder's inventory (1986). The current inventory was unable to cover this area because it is owned by the U.S. Navy, and repeated attempts by the City to gain access were denied.

3.2.8 Otay Lakes

Two vernal pool sites are located in the Otay Lakes area: the 19 basins of Proctor Valley and the larger Otay Lakes, which includes 87 basins.

3.2.8.a The Proctor Valley (R 1) site is located along Proctor Valley Road between Indian Springs and eastern Chula Vista. This site has been grazed and off-road vehicle activity occurs on-site. Eighteen basins were mapped on a City-owned parcel of approximately 157 acres and a single basin was mapped on an adjacent privately owned parcel. None of these vernal pools are conserved at this time. No sensitive plant species were observed at this site; however, Bauder (1986) observed *M. minimus* at two basins. *Branchinecta* spp. were noted in eight vernal pools. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 33. This area was not surveyed for amphibians. For a map of this site, refer to 178-1785 in Appendix C.

Table 33
Proctor Valley
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	

Table 33, con't Proctor Valley Presence of Vernal Pool Indicator Species			
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Proctor Valley
Vernal pool 1 looking southeast

3.2.8.b Otay Lakes includes series 3, 5, 10, and 13 of the "K" complex. Adjacent to the east side of Lower Otay Reservoir, these 87 vernal pools cover 125,779 square feet on two City-owned parcels totalling 632 acres. These basins are not conserved at this time and this site has been impacted by grazing. Two plant species covered by the MSCP were noted on-site: *E. aristulatum* was observed at 47 basins with a total cover of 1,645 square feet and *N. fossalis* was observed in two basins with a total cover of 24

square feet. Bauder (1986) noted these species at K 3-5. Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 34. Fairy shrimp (*Branchinecta* spp.) were observed in six basins, but were not identified by species. The area was not surveyed for amphibians. For a map of this site, refer to 162-1785 in Appendix C.

Table 34
Otay Lakes
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Otay Lakes (Photo by Scott McMillan, 2001)
Vernal pool 71 looking south



Otay Lakes (Photo by Scott McMillan, 2001)
Vernal pool 12 looking north

3.2.9 Otay Mesa

Along the Mexican border, Otay Mesa is the southernmost extent of vernal pools under U. S. jurisdiction. Within the City of San Diego, 979 basins are distributed from Otay Ranch to Mexico, Chula Vista to Otay Mountain. These vernal pools have been divided into 29 sites in the "J" complex, series 2, 4, 5, 11, 12, 13, 14, 15, 16, 17,

18, 21, 27, 28, 29, 30, 31, 32, 33, 34 and 35. This area has been heavily impacted by off-road vehicles: ORV activity is known to occur historically or in the present at all sites discussed below. Sites have been grouped for discussion purposes when deemed appropriate.

3.2.9.a Robinhood Ridge (J 4-5) is accessible from Avenida de las Vistas north of Otay Mesa Road. Historic activities at Robinhood Ridge include off-road vehicle impacts and subsequent creation of vernal pools. This conserved site is privately owned, covers 16 acres and contains 83 vernal pools. These basins cover 24,362 square feet and provide habitat for *B. sandiegonensis*, identified in 41 basins, and *S. woottonii*, identified in six basins. *H. regilla* were observed in 14 vernal pools, *S. hammondii* were observed in three vernal pools, and unidentified tadpoles were observed in 18 vernal pools. *E. aristulatum* covered a total of 5,225 square feet in 46 basins. *M. minimus* was observed in 18 basins, and covered approximately 75 square feet. Four basins supported *N. fossalis*, which covered 13 square feet. *P. nudiscula* covered a total of 182 square feet in 19 basins. *E. aristulatum*, *M. minimus*, and *N. fossalis* were noted by Bauder (1986) at J 5. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 35. For a map of this site, refer to 146-1761 in Appendix C.

Table 35
Robinhood Ridge
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	•
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum	•	*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	•
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



Robinhood Ridge
Vernal pool 59 looking south



Robinhood Ridge
Vernal pool 62 looking north

3.2.9.b J 4 is located on a privately owned, 15-acre parcel adjacent to Robinhood Ridge. Of the 11 basins (4,075 total area) mapped on-site, *Branchinecta* spp. were noted in five. No rare, threatened or endangered plant species were observed; vernal pool indicator species and fairy shrimp noted at this site are listed in Table 36. This site

occurs completely outside of the original Bauder classification polygons (1986). This site was not surveyed for amphibians. For a map of this site, refer to 146-1761 in Appendix C.

Table 36 J 4 Presence of Vernal Pool Indicator Species			
Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 4
Vernal pool 1 looking southwest



J 4
Vernal pool 4 looking east

3.2.9.c Forty-two vernal pools, totalling 5,753 square feet in basin area, were mapped on two parcels at the Hidden Trails (J 2 W, J 31) site. The vernal pools are located at the southern end of a privately owned, 76-acre site north of Otay Mesa Road and adjacent to Hidden Trails Road, which is not conserved at this time. No sensitive plant species were observed; vernal pool indicators noted at the site are listed in Table 37. This site occurs completely outside the original Bauder classification polygons (1986). Fairy shrimp (*Branchinecta* spp.) were observed in seven basins, and amphibians were not noted on-site. For a map of this site, refer to 146-1761 in Appendix C.

Table 37
Hidden Trails
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•

Table 37, con't			
Hidden Trails			
Presence of Vernal Pool Indicator Species			
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	

3.2.9.d J 2 W is located northwest of the intersection of Otay Mesa Road and Ocean View Hills Parkway. Two parcels covering approximately 40 acres contain 59 vernal pools, with a total of 29,632 square feet in basin area. The site is privately owned and is not conserved at this time. *E. aristulatum* was noted at a single basin with an estimated cover of 16 square feet. *E. aristulatum* and *N. fossalis* were observed by Bauder (1986). Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 38. Fairy shrimp were noted in a total of seven basins: *Branchinecta* spp. were present in 13 basins while *B. sandiegonensis* were identified in three basins, and *S. woottoni* in three basins. *H. regilla* were observed in three vernal pools; *S. hammondii* were present in two vernal pool basins. For a map of this site, refer to 146-1761 in Appendix C.

Table 38 J 2 W Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



J 2 W
Vernal pool 14 looking north



J 2 W
Vernal pool 20 looking north

3.2.9.e Five vernal pools were mapped at the J 3 site, located at the convergence of Otay Mesa Road and Highway 905. These basins cover 3,811 square feet on two parcels totalling approximately 42 acres. The area is privately owned and is not conserved at this time. No rare, threatened, or endangered plant species were noted on-

site; Table 39 lists vernal pool indicator species and fairy shrimp observed. Bauder (1986) noted *N. fossalis* on-site. San Diego fairy shrimp (*B. sandiegonensis*) were observed in two basins and *S. woottonii* were observed in a single basin. *H. regilla* and *S. hammondii* were also noted in one basin on-site. For a map of this site, refer to 146-1761 in Appendix C.

Table 39
J 3
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



J 3
Vernal pool 4 looking south



J 3
Vernal pool 5 looking north

3.2.9.f The Sweetwater High School site (J 33) is a 50-acre parcel located south of the intersection of Otay Mesa Road and Airway Road. Eight created vernal pools, covering 2,844 square feet, are under the jurisdiction of the Sweetwater Union High School District and are conserved. *E. aristulatum* covered approximately 15 square feet in two

basins; *M. minimus* was observed in five basins and covered 11 square feet; three basins support *N. fossalis*, with a total cover of seven square feet; and five basins provide habitat for *P. nudiscula*, which covers an estimated nine square feet. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 40. *B. sandiegonensis* were present in every basin and *S. woottonii* were observed in three basins. Amphibians were noted in six vernal pools: *S. hammondii* in three basins and unidentified tadpoles in three basins. For a map of this site, refer to 138-1761 in Appendix C.

Table 40
Sweetwater High School
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	•
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



Sweetwater High School
Vernal pool 5 looking east



Sweetwater High School
Vernal pool 7 looking north

3.2.9.g West Otay A + B (J 32) covers 44 vernal pools that include unnatural ruts from historic grading, recently created basins, and a few natural depressions. These basins are found on three conserved parcels owned by the Environmental Trust and a private entity, and extend across approximately nine acres of the total 177 acres. The vernal

pools are located near the San Diego Gas and Electric substation south of Otay Mesa Road. Four sensitive plant species were present on-site: *E. aristulatum* was observed in four basins with an estimated cover of 48 square feet, *M. minimus* was observed in 21 basins with an estimated cover of 63 square feet, *N. fossalis* was observed in three basins with an estimated cover of 18 square feet, and *P. nudiscula* was observed in eight basins with an estimated cover of 22 square feet. *Branchinecta* spp. were noted in one vernal pool, *B. sandiegonensis* were noted in eight vernal pools, and *S. woottoni* were noted in one vernal pool. This site was not included in the 1986 Bauder report. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 41. *H. regilla* were noted in a single basin, *S. hammondii* were noted in two basins, and unidentified juveniles were noted in two additional basins. For a map of this site, refer to 138-1761 in Appendix C.

Table 41
West Otay A + B
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	•
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	•
Branchinecta lindahli	•	***Streptocephalus woottoni***	•



West Otay A + B
Vernal pool 19 looking west



West Otay A + B
Vernal pool 38 looking east



West Otay A + B
Vernal pool 41 looking east

3.2.9.h Fourteen vernal pools were mapped at the J 34 site. The three privately owned parcels are located south of Otay Mesa Road and east of Caliente Avenue and are not conserved at this time. A total of 6,482 square feet of vernal pool basins occur on the 246-acre site. Sensitive plant and animal species were not observed; however, *S. hammondii* were present in one vernal pool and unidentified tadpoles were observed in another basin. This site was not included in Bauder (1986). Vernal pool indicator species and fairy shrimp noted on-site are listed in Table 42. For a map of this site, refer to 138-1761 in Appendix C.

Table 42
J 34
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	

Table 42, con't J 34 Presence of Vernal Pool Indicator Species			
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 34
Vernal pool 1 looking southwest

3.2.9.i Recon South (J 14) is a 17.7 acre site adjacent to Otay Mesa Road and the southern terminus of Innovative Drive. Sixty-four vernal pools, with a total area of 61,135 square feet, were created on this mitigation site; the site is privately owned and is conserved. Prior to restoration, the site was subject to off-road vehicle activity. This site supports the following sensitive species: *E. aristulatum* was noted in 48 basins (1,760 square feet of cover), *N. fossalis* was noted in four basins (seven square feet of cover), *O. californica* was noted in five basins (>1 square foot), and *P. nudiscula* was noted in 55 basins (1,505 square feet of cover). Fairy shrimp were observed in 34 basins: *B. sandiegonensis* in 30, *B. lindahli* in 1, and *S. woottonii* in 24. *H. regilla* were noted in two vernal pools and *S. hammondii* were noted in a single basin. Vernal pool indicator species and fairy shrimp noted at this site are listed in Table 43. For a map of this site, refer to 138-1761 in Appendix C.

Table 43 Recon South Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	•
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita	•	***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli	•	***Streptocephalus woottoni***	•



Recon South
Vernal pool 15 looking north

3.2.9.j The 905 basins (J 14) are located along Heritage Road near the intersection of Camino Maquiladora. Grazing occurred on-site historically. Seven basins cover a total of 2,987 square feet on the 38 acre site. Five of these vernal pools occur on two

conserved parcels, one owned by a private entity and the other by the City. No sensitive plants were observed on-site; *B. sandiegonensis* were identified in two basins. This site occurs completely outside the original Bauder classification polygons (1986). The vernal pool indicator plants present at this site are listed in Table 44. For a map of this site, refer to 138-1761 in Appendix C.

Table 44
905
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



905
Vernal pool 1 looking south



905
Vernal pool 1 looking east

3.2.9.k The J 11 East and J 11 West basins are located east of San Ysidro Boulevard just north of Mexico. Seven basins are scattered across several privately owned parcels totalling approximately 40.53 acres. These sites are not conserved at this time. Vernal pool indicator species and fairy shrimp occurring at these sites are listed in Tables 45

and 46. J 11 E is comprised of two basins that cover 27,347 square feet and do not support populations of any sensitive species. A previous survey found *O. californica* at J 11 E (Bauder, 1986). For a map of J 11 E, refer to 138-1761 in Appendix C.

Table 45
J 11 E
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa	•	*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



J 11 E
Vernal pool 1 looking north



J 11 E
Vernal pool 1 looking northwest

3.2.9.l The five vernal pools of J 11 W total 21,485 square feet of basin area and one basin supports *M. minimus*. This population was estimated to cover an area of approximately 45 square feet. No sensitive species were found during a 1986 survey (Bauder, 1986). *Branchinecta* spp. were noted in a single basin and *B. sandiegonensis* were also noted in a different basin. *H. regilla* were observed in one basin, and *S. hammondii* were noted in two basins. For a map of J 11 W, refer to 138-1761 in Appendix C.

Table 46
J 11 W
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	•
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	

Table 46, con't J 11 W Presence of Vernal Pool Indicator Species			
Marsilea vestita	•	***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



J 11 W
Vernal pool 1 looking southwest

3.2.9.m The J 12 vernal pools are located on a privately owned, 163.56-acre parcel in Spring Canyon. Original descriptions of the site included three basins, and two additional vernal pools were mapped during the 2002 inventory. These basins cover a total of 12,018 square feet and do not appear to support populations of sensitive plant or animal species. However, historical surveys found *E. aristulatum* and *O. californica* at this site (Bauder, 1986). Vernal pool indicator species and fairy shrimp observed at these sites are listed in Table 47. For a map of J 12, refer to 138-1761 in Appendix C.

Table 47 J 12 Presence of Vernal Pool Indicator Species			
Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•

Table 47, con't J 12 Presence of Vernal Pool Indicator Species			
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	•



J 12
Vernal pool 1 facing east

3.2.9.n On the mesa between Dennery Canyon and Spring Canyon, 93 vernal pool basins make up J 13 East, J 13 North, and J 13 South. While the number of basins associated with these sites have greatly increased as a result of the recent survey, sensitive plant diversity and abundance have decreased since the Bauder report (1986). These three sites are located on map 138-1761 in Appendix C. The eight J 13 E vernal pools occur on the same parcel as the J 12 vernal pools. The 2,570 square feet of basin area provide habitat for *E. aristulatum* (estimated to cover 15 square feet in a single basin) and *S. hammondii* (tapoles were observed in one vernal pool). *E. aristulatum*

also occurred on-site at the time of the Bauder survey (1986). Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 48.

Table 48
J 13 E
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 13 E
Vernal pool 1 looking south



J 13 E
Vernal pool 3 looking northeast

3.2.9.o J 13 N is comprised of 41 basins covering a total of 12,017 square feet. This site extends over five parcels for a total of nearly 40 acres and is not conserved at this time. *E. aristulatum* was observed in two basins and covered an estimated 53 square feet. *N. fossalis* was observed in a single basin and covered approximately 17 square feet. *O. californica* was also observed in a single basin and covered 248 square feet. These three species, as well as *M. minimus*, were noted during historical surveys (Bauder, 1986). San Diego fairy shrimp (*B. sandiegonensis*) were identified in three vernal pools. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 49.

Table 49
J 13 N
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	•
Deschampsia danthoniodes		***Orcuttia californica***	•
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum	•	*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	

Table 49, con't J 13 N Presence of Vernal Pool Indicator Species			
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



J 13 N
Vernal pool 2 looking northwest



J 13 N
Vernal pool 23 looking north

3.2.9.p Forty-four basins are included in J 13 S: Seven of these support *E. aristulatum* which covers approximately 393 square feet and *Branchinecta* spp. were observed in three vernal pools. In addition to these sensitive species, *M. minimus*, *N. fossalis*, and *O. californica* were also noted at J 13 S in Bauder's 1986 report. J 13 S includes seven parcels for a total of 108 acres that are not conserved at this time. *H. regilla* and *S. hammondii* were observed in a single basin. Vernal pool indicator species and fairy shrimp observed at this site are listed in Tables 50.

Table 50
J 13 S
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum	•	*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	

Table 50, con't J 13 S Presence of Vernal Pool Indicator Species			
Malvella leprosa	•	*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 13 S
Vernal pool 5 looking south



J 13 S
Vernal pool 11 looking south

3.2.9.q The J 14 vernal pools are scattered across five privately owned parcels that total over 105 acres. J 14 is not conserved at this time. The total area of the 58 basins on-site is 26,153 square feet; however, only a single basin appears to supports rare, threatened, or endangered plant species. *M. minimus*, *N. fossalis*, and *P. nudiscula* each occur in this basin with approximately 52 square feet of coverage. Bauder (1986) notes only *P. nudiscula* at this site. Vernal pool indicator species and fairy shrimp observed at J 14 are listed in Table 51. *B. sandiegonensis* were identified in four basins and *S. woottonii* were identified in three basins. Unidentified tadpoles were also observed in one vernal pool. For a map of this site, refer to 138-1761 in Appendix C.

Table 51
J 14
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	•
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum	•	*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	

Table 51, con't J 14 Presence of Vernal Pool Indicator Species			
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



J 14
Vernal pool 24 looking south

3.2.9.r Arnie's Point (J 15) is located in southern Spring Canyon directly along the U. S.—Mexican border. The proximity of this area to the border contributed to impacts from off-road vehicle activity such as Border Patrol and illegal immigrant traffic; however, the site is now protected and restored as a mitigation site. This 150-acre area is owned by the federal government and the 29 vernal pools (total basin area of 28,143 square feet) are conserved. *E. aristulatum* was noted in 16 basins and covered approximately 347 square feet; this species was also observed by Bauder in 1986. No other sensitive plants and animals were observed on-site. Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 52. For a map of this site, refer to 138-1761 in Appendix C.

Table 52 Arnie's Point Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Arnie's Point
Vernal pool 5 looking west

3.2.9.s J 16-18 and Wruck Canyon (J 16-18) are located in the Spring Canyon area of southern Otay Mesa. Both sites are conserved. J 16-18 and Wruck Canyon are located on map 138-1761 in Appendix C. The 13 vernal pools of J 16-18 are found on three

City-owned parcels that total 99 acres in area. The 17,449 square feet of basin area support *E. aristulatum* and *S. hammondii*: *E. aristulatum* covered approximately 206 square feet in four basins and *S. hammondii* were noted in three basins. *E. aristulatum* was observed in 1979, but this site was not visited as part of the 1986 survey (Bauder, 1986; Zedler, 1979). Vernal pool indicator species and fairy shrimp present at this site are listed in Table 53.



J 16-18
Vernal pool 2 looking northeast

3.2.9.t Wruck Canyon is comprised of six vernal pools located on 9.3 acres owned and managed by the Environmental Trust. In addition of off-road vehicle activity, this site has been impacted by grazing and illegal immigrant traffic. The combined basin area of these vernal pools is 684 square feet and no sensitive species were present at the site. This area was not surveyed by Bauder (1986). Vernal pool indicator species and fairy shrimp present at this site are listed in Table 53.

Table 53
J 16-18/Wruck Canyon
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum	•	*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	

Table 53, con't J 16-18/Wruck Canyon Presence of Vernal Pool Indicator Species			
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



Wruck Canyon
Vernal pool 3 looking south

3.2.9.u Seven vernal pools were mapped at the J 21 site. Located southwest of Siempre Viva Road and La Media Road, this 49-acre parcel is privately owned and is not conserved at this time. The total basin area for the vernal pools on-site is 9,275 square feet. No sensitive species were noted. Vernal pool indicator species and fairy shrimp are listed in Table 54. While *E. aristulatum*, *M. minimus*, and *P. nudiuscula* were observed in 1979, no vernal pool species were located at this site in 1986 and Bauder notes the existence of dense non-natives in the basins (Bauder, 1986). For a map of J 21, refer to 138-1773 in Appendix C.

Table 54 J 21 Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	•
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 21
Vernal pool 21 looking south

3.2.9.v J 27 is a privately owned site located northwest of the intersection of La Media Road and Airway Road. Ten vernal pools, covering a total of 10,174 square feet, were mapped on this 6.4-acre parcel that is not currently conserved. Nine basins support *E.*

aristulatum, which was estimated to cover an area of 564 square feet. No other rare, threatened, or endangered plant or animal species were observed on-site; Table 55 lists the presence of vernal pool indicator species and fairy shrimp. *E. aristulatum* was also noted in 1986, and *N. fossalis* and *P. nudiscula* were located on-site in 1979 (Bauder, 1986; Zedler, 1979). This site was not surveyed for amphibians. For a map of this site, refer to 138-1773 in Appendix C.

Table 55
J 27
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	•
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa	•	*Psilocarphus brevissimus*	
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 27
Vernal pool 2 looking west

3.2.9.w Five vernal pools covering 6,959 square feet make up the 20-acre J 28 E site. The two privately owned parcels are located near the intersection of La Media Road and Avenida de la Fuente. Neither parcel is conserved at this time. No sensitive species were observed on-site; occurrence of vernal pool indicator species and fairy shrimp is listed in Table 56. Bauder (1986) noted a single individual of *E. aristulatum*; Zedler's group (1979) located *N. fossalis*, *O. californica*, and *P. nudiuscula*. For a map of this site, refer to 138-1773 in Appendix C.

Table 56
J 28 E
Presence of Vernal Pool Indicator Species

Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	•
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	

Table 56, con't J 28 E Presence of Vernal Pool Indicator Species			
Malvella leprosa		*Psilocarphus brevissimus*	
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	



J 28 E
Vernal pool 2 looking north

3.2.9.x A total of 76 vernal pools were mapped at J 29-30. This site is located north of the intersection of Lonestar Road and La Media Road on five privately owned parcels. These 664 acres are not currently conserved and have been impacted by off-road vehicles and grazing. The basin area of these vernal pools totalled 42,053 square feet, and 42 basins (56%) supported *E. aristulatum*. The total coverage for this species was estimated to be 1,155 square feet. *P. nudiscula* covered two square feet of a single basin on-site. These species were also located in historical surveys (i.e., Bauder, 1986). Vernal pool indicator species and fairy shrimp observed at these sites are listed in Table 57. *Branchinecta* spp. were observed in a single basin, and amphibians were not noted at this site. For a map of this site, refer to 146-1773 in Appendix C.

Table 57 J 29-30 Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	

Table 57, con't J 29-30 Presence of Vernal Pool Indicator Species			
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



J 29-30
Vernal pool 32 looking south

3.2.9.y Two road ruts are located at the Brown Field site (J 35) north of Brown Field in Otay Mesa. The 74-acre site is owned by the City of San Diego and is not conserved at this time. The road ruts total 454 square feet in basin area and do not support rare, threatened, or endangered species. This area was not included in historic surveys. Vernal pool indicator species and fairy shrimp present at this site are listed in Table 58. For a map of this site, refer to 146-1773 in Appendix C.

Table 58 Brown Field Presence of Vernal Pool Indicator Species			
Callitriche marginata		*Myosurus minimus*	
Crassula aquatica		***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.		***Branchinecta sandiegonensis***	
Branchinecta lindahli		***Streptocephalus woottoni***	

3.2.9.z Otay Mesa Road Helix (J 2 S) is a one-acre mitigation site owned by the City of San Diego. The 13 vernal pools on this conserved site were created in 1998 and total 9,077 square feet in basin area. Prior to restoration, off-road vehicle activity occurred on-site. This site is located along Otay Mesa Road near the intersection of Corporate Center Drive. Each basin supported *E. aristulatum*, covering a total of 3,058 square feet, and *P. nudiscula*, with a total coverage of 151 square feet. *M. minimus* was observed in five basins, covering approximately 16 square feet, while *N. fossalis* and *O. californica* covered three and five square feet in a single basin, respectively. Prior to restoration, *E. aristulatum* and *N. fossalis* were found at this site (Bauder, 1986). Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 59. *B. sandiegonensis* and *S. woottonii* were noted in eight vernal pools, *H. regilla* were noted in ten vernal pools, *S. hammondii* were noted in four vernal pools, and unidentified tadpoles were noted in one vernal pool. For a map of this site, refer to 146-1761 in Appendix C.

Table 59 Otay Mesa Road Helix Presence of Vernal Pool Indicator Species			
Callitriche marginata	•	*Myosurus minimus*	•
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	•
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	

Table 59, con't Otay Mesa Road Helix Presence of Vernal Pool Indicator Species			
Epilobium pygmaeum	•	*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



Otay Mesa Road Helix
Vernal pool 8 looking south



Otay Mesa Road Helix
Vernal pools 10 and 6 looking north

3.2.9.aa Twenty vernal pools were created at the Otay Mesa Road Recon (J 2 W) site in 1999. Located immediately adjacent to Otay Mesa Road Helix, this conserved parcel is a City-owned site restored with grant funding from the State of California. Prior to restoration, this area was the site of off-road vehicle activity. The 2.5-acre area supports populations of four sensitive plant species in a total basin area of 19,794 square feet: *E. aristulatum* covered approximately 2,152 square feet in 20 basins (100%); *P. nudiscula* covered 1,938 square feet in 20 basins (100%); *N. fossalis* covered 41 square feet in nine basins (45%); and *O. californica* covered 74 square feet in nine basins (45%). Historically, basins in this area supported *E. aristulatum* and *N. fossalis* (Bauder, 1986). Vernal pool indicator species and fairy shrimp observed at this site are listed in Table 60. San Diego fairy shrimp (*B. sandiegonensis*) were identified in 15 vernal pools, while *S. woottonii* were identified in seven. No amphibians were noted on this site. For a map of this site, refer to 146-1761 in Appendix C.

Table 60
Otay Mesa Road Recon
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	•
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica	•	*Phalaris* spp.	
Epilobium pygmaeum	•	*Pilularia americana*	•
Eryngium aristulatum	•	*Pilularia* spp.	

Table 60, con't Otay Mesa Road Recon Presence of Vernal Pool Indicator Species			
Isoetes howellii		*Plagiobothrys acanthocarpus*	
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	•



Otay Mesa Road Recon
Vernal pool 2 looking west



Otay Mesa Road Recon
Vernal pool 18 looking west



Otay Mesa Road Recon
Vernal pool 8 looking north

3.2.9.bb Otay Mesa Road Pardee and Recon Cal Terraces are located along Otay Mesa Road off of Ocean View Hills Parkway. For a map of these sites, refer to 146-1761 in Appendix C. Otay Mesa Road Pardee (J 2 S, J 2 W) is an unconserved, 38-acre parcel immediately west of Recon Cal Terraces. As with other sites in this area, off-road

vehicle impacts have been observed. The 31 vernal pools on-site total 13,564 square feet, and support *Branchinecta* spp. in four basins, *B. sandiegonensis* in one basin, and *S. hammondii* in one basin. No sensitive plants were noted on-site; vernal pool indicator species and fairy shrimp observed at this site are listed in Table 61. Historically, *E. aristulatum* and *N. fossalis* were found on-site (Bauder, 1986).

Table 61
Otay Mesa Road Pardee
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes		***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	•
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Otay Mesa Road Pardee
Vernal pool 7 looking south



Otay Mesa Road Pardee
Vernal pool 11 looking south

3.2.9.cc Recon Cal Terraces (J 2 N, S, W) is a 155-acre site located on three privately owned parcels. Two hundred seventy-one created basins cover 126,096 square feet (2.9 acres); the entire site is conserved. Prior to restoration and fencing, this site was impacted by off-road vehicle activity. *E. aristulatum* was observed in 243 basins and

covered approximately 58,341 square feet, *N. fossalis* was observed in 69 basins and covered 1,314 square feet, *O. californica* was observed in 42 basins and covered 2,350 square feet, and *P. nudiscula* was observed in 254 basins and covered 27,972 square feet. *Branchinecta* spp. were noted in 188 vernal pools, *B. sandiegonensis* were noted in 186 vernal pools, *B. lindahli* were noted in 19 vernal pools, and *S. woottoni* were noted in 78 vernal pools. These basins were created after previous vernal pool surveys so no historic data is available for this site. The sensitive plant species observed on-site are listed in Table 62. For a map of Recon Cal Terraces, refer to 146-1761 in Appendix C.

Table 62
Recon Cal Terraces
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	•
Deschampsia danthoniodes	•	***Orcuttia californica***	•
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum	•	*Pilularia* spp.	
Isoetes howellii		*Plagiobothrys acanthocarpus*	•
Isoetes orcuttii		*Plantago elongata*	
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides	•	***Pogogyne abramsii***	
Marsilea vestita	•	***Pogogyne nudiuscula***	•
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli	•	***Streptocephalus woottoni***	•



Recon Cal Terraces
Vernal pool 271 looking north

3.2.10 Marron Valley

Marron Valley (MM 1) consists of 2,644 acres approximately 25 miles inland along the Mexican border; this area was the site of long-term historic grazing. Conserved in 1999 as part of the City of San Diego MSCP cornerstone lands, vernal pools are among the many important natural resources occurring in this area. Fourteen basins cover 7,951 square feet and support populations of fairy shrimp (*Branchinecta* spp.) in three vernal pools. *H. regilla* and *S. hammondii* were observed in one vernal pool. Sensitive vernal pool obligatory plants were not observed at the site; vernal pool indicator plants noted on-site are listed in Table 63. This site was not included in historical surveys (i.e., Bauder, 1986). For a map of this site, refer to the Marron Valley map in Appendix C.

Table 63
Marron Valley
Presence of Vernal Pool Indicator Species

Callitriche marginata	•	*Myosurus minimus*	
Crassula aquatica	•	***Navarretia fossalis***	
Deschampsia danthoniodes	•	***Orcuttia californica***	
Downingia cuspidata		*Phalaris lemmonii*	
Elatine californica		*Phalaris* spp.	
Epilobium pygmaeum		*Pilularia americana*	
Eryngium aristulatum		*Pilularia* spp.	
Isoetes howellii	•	*Plagiobothrys acanthocarpus*	•

Table 63, con't Marron Valley Presence of Vernal Pool Indicator Species			
Isoetes orcuttii		*Plantago elongata*	•
Isoetes spp.		*Plantago* spp.	
Lilaea scilloides		***Pogogyne abramsii***	
Marsilea vestita		***Pogogyne nudiuscula***	
Malvella leprosa		*Psilocarphus brevissimus*	•
Branchinecta spp.	•	***Branchinecta sandiegonensis***	•
Branchinecta lindahli		***Streptocephalus woottoni***	



Marron Valley
Vernal pool 8 looking south



Marron Valley
Vernal pool 9 looking north

3.3 B. sandiegonensis *genetic research*

A preliminary report of the *B. sandiegonensis* genetic research has been prepared by Dr. Andrew Bohonak (Appendix H). Complete results for this study will be available under separate cover in 2005.

4.0 SYNOPSIS

Within the City of San Diego, 1,369 vernal pools have been conserved by an easement, dedication in fee title, or designation as City open space (see Table 3). These represent 54% of the total known basins in the City. Of the conserved vernal pools, 861 (63%) support rare, threatened, or endangered plant species. Refer to Table 64 for specific information for each species.

Table 64 – Sensitive plant species in conserved vernal pools

Species	Number of basins	Percent of basins	Area Covered* (ft²)
E. aristulatum	686	50	94,300
M. minimus	49	4	165
N. fossalis	95	7	1,424
O. californica	51	4	2,429
P. abramsii	210	15	15,235
P. nudiscula	374	27	31,779
* Area calculations are derived from percent cover estimates.			

An additional 419 vernal pools, although not considered conserved, are located on publicly owned lands. These basins support populations of *E. aristulatum* (47 basins), *N. fossalis* (1 basins), and *P. abramsii* (131 basins).

Four hundred fifty-seven conserved vernal pools (33%) support fairy shrimp. Table 65 contains information on fairy shrimp and amphibians found in conserved vernal pools.

Table 65 – Fairy shrimp and amphibians in conserved vernal pools

	Occupied basins			
	Number	% of total	Area (ft²)	% total area
Species				
Branchinecta spp.	443	32	569,765	34
B. sandiegonensis	372	27	332,558	20
B. lindahli	20	1.5	17,441	1
S. wootonii	128	9	145,460	9
B. boreas	4	0.3	113,216	7
H. regilla	73	5	128,988	8
S. hammondii	53	4	99,336	6

These data are an important inventory of current conditions and should be compared to historic studies to detect and analyze changes in vernal pool quality, distribution, and management. Specifically, this inventory documents trends subsequent to Bauder's 1986 report. Although the general geographic extent of these studies is comparable, the scale and precision of recorded data differ significantly. The Bauder (1986) report presents data such as location, number of basins, and presence of sensitive species at the complex level. The City inventory utilized current technology to record the precise size and location of individual basins, and data such as presence and cover of sensitive species were collected at this scale.

Comparing the data from 1986 and 2003 helps to detect and understand changes in vernal pools in the City of San Diego. While the estimate for the total number of vernal pools in the City has increased due to the recent survey, it is known that an overall decrease occurred due to urbanization and, in certain cases, lack of protection. Table 66 compares the number of basins at current City-owned sites surveyed in 1979 (compilation of existing survey information by Bauder), 1986 (Bauder), and 2003 (City of San Diego).

Table 66 – Vernal pool survey results in 1979, 1986, and 2003

Number of Basins			
	1979	1986	2003
Revised Bauder ID Series			
A	8	0	0
B	50	12	66
C	212	66	153
D	154	34	123
E	30	0	0
H	218	125	573

Number of Basins			
	1979	1986	2003
Revised Bauder ID Series			
I	324	48	60
J	137	102	983
K	31	31	87
N	202	187	322
O	6	0	0
P	37	0	0
U*	—	—	63
X	35	25	35
BB	9	0	0
CC	12	0	0
DD	15	9	0
Total	**1480**	**639**	**2465**
*Numbers for City-owned sites in this complex are not available in Bauder report (1986) or field notes.			
Note: 1979 and 1986 numbers from Table 3 (Bauder, 1986); figures from 2003 include restoration/creation sites.			

Sites such as C 27 were destroyed through development while pools have been lost in the J series through border security and recreational off-road vehicle activity. Some sites, though still extant, have been degraded through many of the same factors mentioned by Bauder in 1986: edge effects, non-native invasion, pollution and hydrologic changes. These negative results have been to some degree balanced by positive trends such as targeted acquisition of vernal pool sites, large-scale restoration and creation efforts, and improved conservation planning through the MSCP. Sites such as Mesa Norte have been restored and fenced since Bauder's report, which noted damage from vehicular traffic and dumping. Additional sites, such as Del Mar Mesa, Carmel Mountain, General Dynamics, and Nobel Research Park have also been acquired and/or conserved through City mitigation requirements. Such creation, restoration, and.or conservation sites consistently show sustained or improved species presence and diversity over the past 20 years. Refer to Table 67 for information on creation, restoration, and enhancement at each site.

Table 67 – Creation, restoration, and enhancement activity by site[†]

Area	Revised Bauder ID	Site	Vernal Pool Basin Acreage				
			Total	Conserved	Created	Restored	Enhanced
Del Mar Mesa							
	H 1-15	Del Mar Mesa	5.23	5.23	0	0	0
	H 17	Shaw Texas	0.23	0	0	0	0
	H 18-23	Rhodes	0.75	0	0	0	0
	H 39	Greystone Torrey Highlands	0.68	0.68	0.68	0	0
	H 40	Li Collins	0.04	0.04	0	0	0
Carmel Mountain							
	H 38	Carmel Mountain	0.32	0.32	0	0	0

[†] Refer to page 23 for definitions of these terms.

Area	Revised Bauder ID	Site	Vernal Pool Basin Acreage				
			Total	Conserved	Created	Restored	Enhanced
Mira Mesa							
	B 5-6	Tierra Alta	0.0055	0.0055	0	0	0
	B 5-8	Lopez Ridge	0.48	0.48	0	0	0.27
	B 5-8	Sunset Pointe	0.042	0	0	0	0
	B 11	Mesa Norte	0.58	0.58	0.27	0.31	0
	C 10-16	Winterwood	0.81	0.59	0	0	0
	C 17-18	Fieldstone	0.32	0.32	0	0	0
	C 27	Mira Mesa Market Center	0.057	0.057	0	0	0.057
	C 28	Maddox	0.97	0	0	0	0
	D 5-8	Parkdale Carroll Canyon	0.021	0	0	0	0
	D 5-8	Carroll Canyon Preserve	1.19	1.19	0	0	0
	I 1	Arjons	0.73	0.73	0	0	0
Nobel Drive							
	I 6 B	Bob Baker	0.077	0	0	0	0
	I 6 C	Bob Baker 2	0.24	0	0	0	0
	I 12	Pueblo Lands	0.017	0	0	0	0
	X 5	Nobel Drive	0.085	0.085	0	0	0
	X 7	Nobel Research Park	0.098	0.098	0	0	0
Kearny Mesa							
	N 1-6	Montgomery Field	6.76	0	0	0	0
	N 7	Serra Mesa Library	0.36	0.36	0	0	0
	N 8	General Dynamics	0.4	0.4	0	0	0
	U 15	Magnatron	0.34	0	0	0	0
	U 15	Sander	0.44	0	0	0	0
	U 19	Cubic	0.45	0	0	0	0
Mission Trails Regional Park							
	Q 2	Mission Trails Regional Park	0.24	0.24	0	0	0
Urban San Diego							
	S 4	Kelton	0.022	0.022	0	0	0
Otay Lakes							
	K 3, 5, 10, 13	Otay Lakes	2.89	0	0	0	0
	R 1	Proctor Valley	0.25	0	0	0	0
Otay Mesa							
	J 2 S	Otay Mesa Road Helix	0.21	0.21	0.21	0	0
	J 2 S, J 2 W	Otay Mesa Road Pardee	0.31	0	0	0	0
	J 2 W	Otay Mesa Road Recon	0.45	0.45	0.45	0	0
	J 2 W	J 2 W	0.68	0	0	0	0
	J 2 N/W/S	Recon Cal Terraces	2.9	2.9	2.9	0	0
	J 2 W; J 31	Hidden Trails	0.13	0	0	0	0
	J 3	J 3	0.087	0.087	0	0	0
	J 4	J 4	0.09	0	0	0	0

Area	Revised Bauder ID	Site	Vernal Pool Basin Acreage				
			Total	Conserved	Created	Restored	Enhanced
	J 4-5	Robinhood Ridge	0.56	0.56	0.56	0	0
	J 11 E	J 11 E	0.63	0	0	0	0
	J 11 W	J 11 W	0.49	0	0	0	0
	J 12	J 12	0.28	0	0	0	0
	J 13 E	J 13 E	0.059	0	0	0	0
	J 13 N	J 13 N	0.28	0	0	0	0
	J 13 S	J 13 S	0.62	0	0	0	0
	J 14	J 14	0.60	0	0	0	0
	J 14	905	0.069	0.04	0	0	0
	J 14	Recon South	1.4	1.4	1.4	0	0
	J 15	Arnie's Point	0.65	0.65	0	0	0
	J 16-18	J 16-18	0.25	0.25	0	0	0
	J 16-18	Wruck Canyon	0.016	0.016	0	0	0
	J 21	J 21	0.21	0	0	0	0
	J 27	J 27	0.23	0	0	0	0
	J 28 E	J 28 E	0.16	0	0	0	0
	J 29-30	J 29-30	0.97	0	0	0	0
	J 32	West Otay A + B	0.34	0.34	0.15	0	0
	J 33	Sweetwater High School	0.065	0.065	0.065	0	0
	J 34	J 34	0.15	0	0	0	0
Marron Valley							
	MM 1	Marron Valley	0.18	0.18	0	0	0

Twenty-one new sites (766 basins) have been identified as a result of this survey (Tables 1 and 68). Ten of these sites are geographically distinct from areas mapped in the Bauder (1986) survey ("new" sites in Table 68). Six sites are contiguous to known sites in 1986 but fall outside of the complex boundaries mapped by Bauder ("contiguous" sites in Table 68). Additionally, five new sites are the result of creation efforts ("creation" sites in Table 68).

Table 68 – Complexes identified during the 2003 inventory

	Site	Revised Bauder ID	Number of Basins
New			
	Carmel Mountain	H 38	30
	General Dynamics	N 8	21
	Kelton	S 4	3
	Li Collins	H 40	2
	Maddox	C 28	82
	Marron Valley	MM 1	14
	Mission Trails Regional Park	Q 2	15
	Nobel Research Park	X 7	28
	Serra Mesa Library	N 7	25
	Wruck Canyon	J 16-18	6
Contiguous			
	905	J 14	7

	Site	Revised Bauder ID	Number of Basins
Contiguous			
	Hidden Trails	J 2 W; J 31	42
	J 2 W	J 2 W	59
	J 4	J 4	11
	J 34	J 34	14
	Tierra Alta	B 5-6	1
Creation			
	Greystone Torrey Highlands	H 39	19
	Recon Cal Terraces	J 2 N/W/S	271
	Recon South	J 14	64
	Sweetwater High School	J 33	8
	West Otay A + B	J 32	44

When comparing the datasets, it is also important to note that 43 series surveyed by Bauder were not included in the City inventory. Table 69 lists the series or complexes and why they were not relocated in 2003.

Table 69 – Previously mapped series/complexes not relocated in 2003

Bauder ID	Reason
F	Military ownership
G	Military ownership
V	Military ownership
W	Military ownership
Y	Military ownership
Z	Military ownership
AA	Military ownership
EE	Military ownership
FF	Military ownership
GA	Military ownership
GG	Military ownership
HH	Military ownership
RR	Military ownership
A 4	Military ownership
I 7	Military ownership
X 1-3	Military ownership
X 4	Military ownership
L	Outside City
M	Outside City
Q	Outside City
S	Outside City
T	Outside City
J 22	Outside City
J 23-24	Outside City
J 25	Outside City
J 26	Outside City
K 6	Outside City

Bauder ID	Reason
CC 1	Outside City
CC 5-6	Outside City
CC 7	Outside City
DD 4	Outside City
A 1	Developed
A 3	Developed
B 12-13	Developed
C 22	Developed
J 1	Developed
O 1	Developed
X 6	Developed
D 1	Gravel mining
C 23-24	Graded/inaccessible in '86
D 16	Destroyed in '86 (Bauder, 1986)
J 19	Ag/plowed in '86 (Bauder, 1986)
J 28 W	Visited—no basins located

Tables 67, 68, and 69 are indicative of the changes in vernal pool distribution within the City of San Diego. Discussion of these changes will follow the general geographic areas shown in Figure 1 and grouped in the Results. The 2003 inventory shows consistent increases in the number of vernal pools located over previous surveys.

Five hundred seventy-one vernal pools were inventoried in the Del Mar Mesa area (H series) in 2003. This is more than triple the number (125) recorded by Bauder in 1986. These numbers will remain static, within the limits of yearly rainfall variability, due to the completed conservation of vernal pools from future development in this area.

Mira Mesa includes all of series B, C, D, and I complex 1. In 1979, 154 vernal pools were located; five years later, 34 basins were surveyed. In 2003, the City inventoried 376 vernal pools in this area. The increase in this number is due in part to small restoration and creation projects such as Mesa Norte, and to the location of new sites within the area (i.e., Maddox). Several vernal pool series in this area have been lost to development since 1986 (i.e., B 12-13).

It is difficult to compare temporal changes at Nobel Drive and Montgomery Field/General Dynamics. Portions of both sites are located on military land, and several specific complexes owned by the City are not mentioned in Bauder's 1986 report (i.e., X 5). Also, several new sites were identified in this area (i.e., General Dynamics and Serra Mesa Library).

Mission Trails Regional Park, urban San Diego, and Marron Valley are made up of vernal pool groups that were not surveyed previously.

Otay Lakes showed an overall increase of 70 vernal pools from 1986 to the present. Procter Valley surveys detected one vernal pool in 1979, five in 1986, and 19 in 2003. Thirty-one vernal pools were surveyed at Otay Lakes in both 1979 and 1986, while 87 were surveyed in 2003. No restoration or creation efforts have occurred in this area.

One complex (J 1) containing two vernal pools was lost in Otay Mesa between 1986 and 2003. Although other vernal pools have been destroyed due to off-road

vehicles and grazing, J 1 is the only instance of an entire complex being lost. The recent inventory located 982 vernal pools, which is 880 more than the previous survey. A portion of this increase is due to large-scale mitigation efforts that have restored or created over 300 vernal pools in this area.

These findings form the baseline for future management decisions. The results of this survey will be utilized to prepare a management plan for all vernal pools within the City of San Diego.

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APPENDIX A
SURVEY DATES AND STAFF

Site	Date	Work done	Staff
Bob Baker	2/11/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
Del Mar Mesa	2/19/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong
Otay Lakes	2/20/2003	mapping/fs	Keli Balo, Holly Cheong, Melanie Johnson, Keith Greer
J 16-18	2/21/2003	mapping/fs	Keli Balo, Holly Cheong, Greg Mason
J13S	2/21/2003	mapping/fs	Keli Balo, Holly Cheong, Greg Mason
Nobel Drive	2/21/2003	mapping/fs	Betsy Miller, Keith Greer, Holly Cheong, Chad Kane
Nobel Research	2/21/2003	mapping/fs	Betsy Miller, Keith Greer, Holly Cheong, Chad Kane
Proctor Valley	2/21/2003	mapping/fs	Keli Balo, Holly Cheong
Sweetwater HS	2/21/2003	mapping/fs/cover estimates	Greg Mason
West Otay A+B	2/21/2003	mapping/fs/cover estimates	Greg Mason
Arjons	2/24/2003	mapping/fs	Melanie Johnson, Holly Cheong, Keli Balo
Lopez Ridge	2/24/2003	mapping/fs	Melanie Johnson, Holly Cheong, Keli Balo
Mira Mesa Marketcenter	2/24/2003	mapping/fs	Melanie Johnson, Holly Cheong, Keli Balo
J29-30	2/26/2003	mapping/fs	Betsy Miller, Keith Greer, Keli Balo
Cubic	2/27/2003	mapping/fs	Keli Balo, Betsy Miller
Magnatron	2/27/2003	mapping/fs	Keli Balo, Betsy Miller
Sander	2/27/2003	mapping/fs	Keli Balo, Betsy Miller
Serra Mesa Library	2/27/2003	mapping/fs	Keli Balo, Betsy Miller
Bowtie	2/28/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong
Del Mar Mesa	2/28/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong
Clayton	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
J13S	3/4/2003	cover estimates	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
Otay Mesa Road Pardee	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
Sander	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
St Jerome	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
Wahl Hudson	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
J11E	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
J11W	3/4/2003	mapping/fs/cover estimates	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
J12	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
RR Sesi Family	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
Wahl Hudson	3/4/2003	mapping/fs	Keli Balo, Betsy Miller, Holly Cheong, Keith Greer
Kelton	3/6/2003	mapping/fs	Holly Cheong, Keli Balo
Otay Lakes	3/6/2003	mapping/fs	Keli Balo, Holly Cheong
Marron Valley	3/7/2003	mapping/fs	Holly Cheong, Betsy Miller
Carmel Mountain	3/10/2003	mapping/fs	Holly Cheong, Keli Balo
Li Collins	3/10/2003	mapping/fs	Holly Cheong, Keli Balo

Site	Date	Work done	Staff
Mission Trails	3/11/2003	mapping/fs	Holly Cheong, Keith Greer
Carmel Mountain	3/12/2003	mapping/fs	Betsy Miller, Randy Rodriguez, Keli Balo
Shaw Texas	3/12/2003	mapping/fs	Betsy Miller, Randy Rodriguez, Keli Balo
Fieldstone	3/14/2003	mapping/fs/cover estimates	Holly Cheong, Betsy Miller
Maddox	3/14/2003	mapping/fs/cover estimates	Holly Cheong, Betsy Miller
Sunset Pointe	3/14/2003	mapping/fs	Holly Cheong, Betsy Miller
Del Mar Mesa	3/19/2003	cover estimates plants	Keli Balo, Betsy Miller
Bachman	3/20/2003	mapping/fs	Keli Balo, Greg Mason, Holly Cheong
J34	3/20/2003	mapping/fs	Keli Balo, Greg Mason, Holly Cheong
Lopez Ridge	3/20/2003	cover estimates	Melanie Johnson
Otay Mesa Road Pardee	3/20/2003	mapping/fs	Keli Balo, Greg Mason, Holly Cheong
Proctor Valley	3/20/2003	mapping/fs	Keli Balo, Holly Cheong
Arjons	3/21/2003	mapping/fs	Melanie Johnson, Holly Cheong, Keli Balo
Nobel Research	3/21/2003	mapping/fs	Melanie Johnson, Holly Cheong, Keli Balo
Sunset Pointe	3/21/2003	mapping/fs	Melanie Johnson, Holly Cheong, Keli Balo
Del Mar Mesa	3/25/2003	cover estimates plants	Keli Balo
Montgomery Field	3/26/2003	mapping/fs/cover estimates	Holly Cheong, Keli Balo, Betsy Miller, Melanie Johnson
J13E	3/27/2003	mapping/fs/cover estimates	Keli Balo, Melanie Johnson, Betsy Miller
J13N	3/27/2003	mapping/fs/cover estimates	Keli Balo, Melanie Johnson, Betsy Miller
Wruck	3/27/2003	mapping/fs	Keli Balo, Melanie Johnson, Betsy Miller
Carroll Canyon	3/28/2003	mapping/fs	Betsy Miller, Holly Cheong, Keli Balo
Bowtie	4/1/2003	cover estimates plants	Keli Balo, Betsy Miller
Mission Trails	4/2/2003	mapping/fs	Keli Balo, Betsy Miller
Montgomery Field	4/2/2003	mapping/fs/cover estimates	Keli Balo, Betsy Miller
Clayton	4/3/2003	cover estimates plants/fs	Keli Balo, Betsy Miller
J 16-18	4/3/2003	cover estimates	Keli Balo, Betsy Miller
J13S	4/3/2003	cover estimates	Keli Balo, Betsy Miller
Greystone Torrey Highlands	4/4/2003	mapping/fs/cover estimates	Keli Balo, Betsy Miller
Mesa Norte	4/4/2003	mapping/fs/cover estimates	Keli Balo, Betsy Miller
Mira Mesa Marketcenter	4/4/2003	cover estimates	Keli Balo, Betsy Miller
Nobel Drive	4/4/2003	cover estimates	Keli Balo, Betsy Miller
Marron Valley	4/7/2003	mapping/fs	Holly Cheong, Keli Balo
Clayton	4/10/2003	cover estimates plants/fs	Keli Balo, Betsy Miller
Greystone Torrey Highlands	4/10/2003	mapping/fs/cover estimates	Keli Balo, Betsy Miller
St Jerome	4/10/2003	cover estimates	Keli Balo, Betsy Miller
Wahl Hudson	4/10/2003	mapping/fs	Keli Balo, Betsy Miller

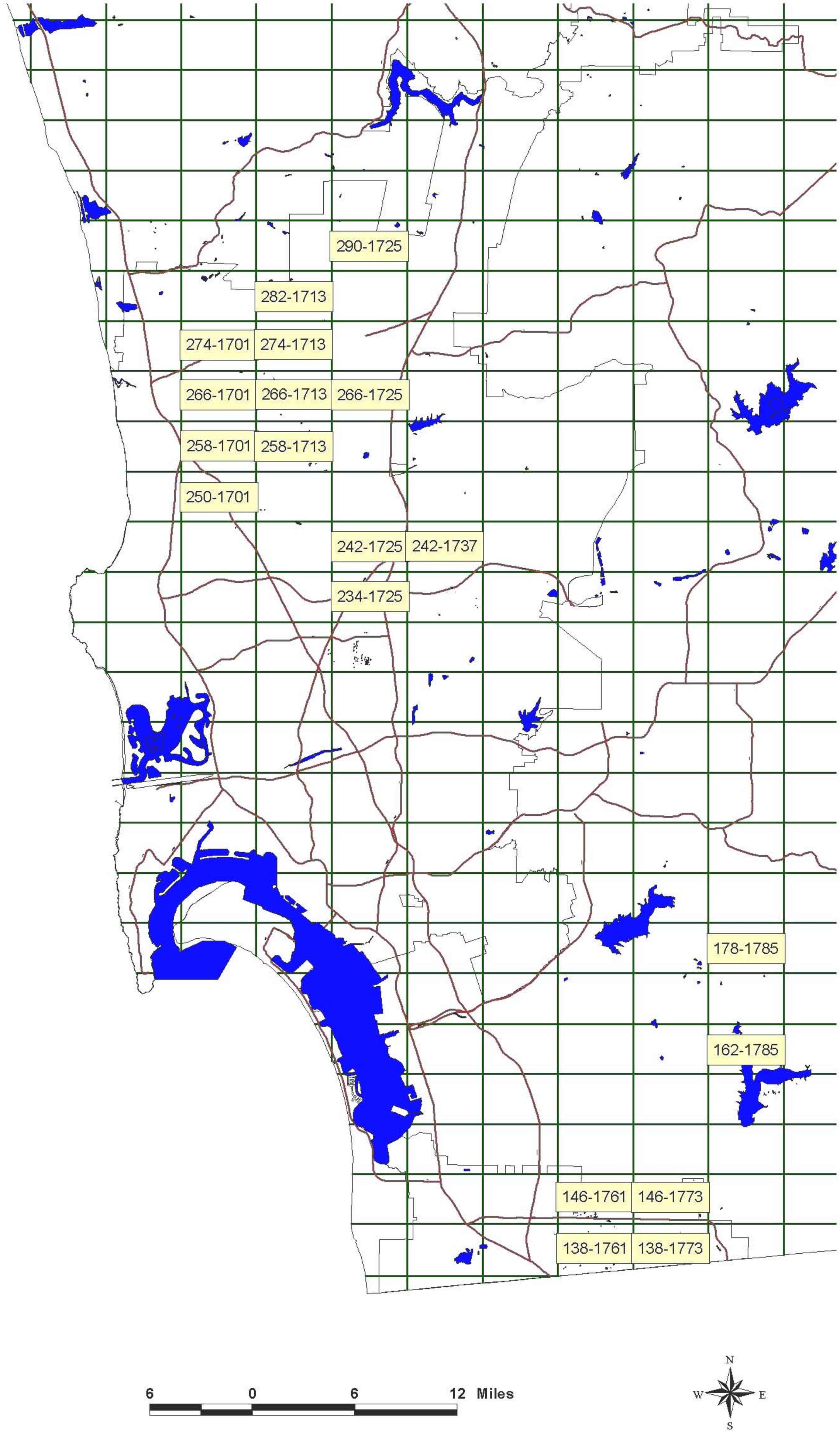
Site	Date	Work done	Staff
Bachman	4/11/2003	mapping/fs	Keli Balo, Betsy Miller
General Dynamics	4/11/2003	mapping/fs/cover estimates	Betsy Miller, Keith Greer, Keli Balo
J 16-18	4/11/2003	cover estimates	Keli Balo, Betsy Miller
J13N	4/14/2003	cover estimates	Keli Balo, Betsy Miller
Cubic	4/15/2003	cover estimates plants	Keli Balo
Sander	4/15/2003	mapping/fs/cover estimates	Keli Balo
Bob Baker	4/16/2003	cover estimates plants	Keli Balo, Betsy Miller
Lopez Ridge	4/16/2003	cover estimates	Keli Balo, Betsy Miller
Otay Mesa Recon Site	4/16/2003	mapping/fs/cover estimates	Robert MacAller
Otay Mesa Road Helix	4/16/2003	mapping/fs/cover estimates	Keli Balo, Betsy Miller
Recon Cal Terraces	4/16/2003	mapping/fs/cover estimates	Robert MacAller
Recon South	4/16/2003	mapping/fs/cover estimates	Robert MacAller
Bob Baker	4/18/2003	cover estimates plants	Keli Balo, Keith Greer
Winterwood	4/18/2003	mapping/fs/cover estimates	Keli Balo, Keith Greer
Arjons	4/23/2003	cover estimates plants	Melanie Johnson, Holly Cheong
Otay Lakes	4/24/2003	mapping/fs	Holly Cheong
Arnie's Point	4/25/2003	cover estimates plants	Melanie Johnson, Keith Greer
Carroll Canyon	4/28/2003	cover estimates plants	Betsy Miller, Holly Cheong, Randy Rodriguez
J29-30	4/30/2003	cover estimates	Holly Cheong, Melanie Johnson, Betsy Miller
Bowtie	5/19/2003	cover estimates plants	Keli Balo, Betsy Miller, Holly Cheong, Melanie Johnson
Otay Lakes	5/30/2003	cover estimates plants	Keli Balo
Del Mar Mesa	5/3/2004	mapping/cover estimates	Betsy Miller, Holly Cheong
Fieldstone	5/3/2004	cover estimates	Holly Cheong
Winterwood	5/3/2004	cover estimates	Holly Cheong
Del Mar Mesa	5/4/2004	mapping/cover estimates	Betsy Miller, Holly Cheong
Del Mar Mesa	5/6/2004	mapping/cover estimates	Betsy Miller, Holly Cheong
Arjons	5/6/2004	cover estimates	Melanie Johnson
Montgomery Field	5/6/2004	cover estimates	Melanie Johnson
General Dynamics	5/6/2004	cover estimates	Melanie Johnson
Del Mar Mesa	5/7/2004	mapping/cover estimates	Betsy Miller, Holly Cheong
J 27		mapping/fs/cover estimates	Keli Balo, Holly Cheong
J14		mapping/fs/cover estimates	Greg Mason
J21		mapping/fs	Keli Balo, Holly Cheong
J28		mapping/fs	Keli Balo, Holly Cheong
Rhodes		mapping/fs/cover estimates	Greg Mason
Robinhood Ridge		mapping/fs/cover estimates	Greg Mason

APPENDIX B
FAIRY SHRIMP PROTOCOL SURVEYS

PROTOCOL FAIRY SHRIMP SURVEYS CONDUCTED WITHIN CITY OF SAN DIEGO JURISDICTION

DATE	SITE	TYPE OF COLLECTION
9/17/2002	Winterwood	dry season
9/17/2002	Mira Mesa Marketcenter	dry season
9/20/2002	Otay Lakes	dry season
9/20/2002	J 16-18	dry season
9/20/2002	J 11E	dry season
9/20/2002	J 11W	dry season
9/20/2002	Otay Mesa Road Recon	dry season
9/23/2002	Mission Trails	dry season
9/25/2002	Montgomery Field	dry season
9/25/2002	Serra Mesa	dry season
9/25/2002	Sander	dry season
9/25/2002	General Dynamics	dry season
9/30/2002	Marron Valley	dry season
10/29/2002	Mira Mesa Marketcenter	dry season
12/12/2002	Del Mar Mesa	wet season
12/13/2002	Del Mar Mesa	wet season
12/29/2002	Mesa Norte	wet season
12/31/2003	Nobel Drive	wet season
12/31/2002	Maddox	wet season
1/3/2003	Carmel Mountain	wet season
2/21/2003	General Dynamics	wet season
2/24/2003	Lopez Ridge	wet season
2/27/2003	Sander	wet season

APPENDIX C
LAMBERT COORDINATE MAPS


290-1725
282-1713
274-1701
274-1713
266-1701
266-1713
266-1725
258-1701
258-1713
250-1701
242-1725
242-1737
234-1725
178-1785
162-1785
146-1761
146-1773
138-1761
138-1773
6 0 6 12 Miles
N
W
E
S

J 33

J 32

J 34

J 14

J 13N

J 13S

J 13E

J 16-18

J 12

J 11E

J 11W

J 15

Vernal Pools
Bauder Complex

138-1761

0 800 Feet

	146-1761	
138-1749		138-1773


J 27
J 27
J 28W
J 28E
J 19
J 21
J 20
Vernal Pools
Bauder Complex
138-1773
0
800 Feet
146-1773
138-1761
138-1785

Roads
Vernal Pools
Bauder Complex

146-1761

0 800 Feet

	154-1761	
146-1749		146-1773
	138-1761	

J 5

M 4

J 31

J 4

J 2N

J 1

M 4

M 4

J 2S

J 2W

J 14

J 14

J 3

OTAY MESA RD

J29-30

J29-30

J30

J30

J29

J31N

J29

J31N

J29

J29

J31S

J31S

J31S

J35

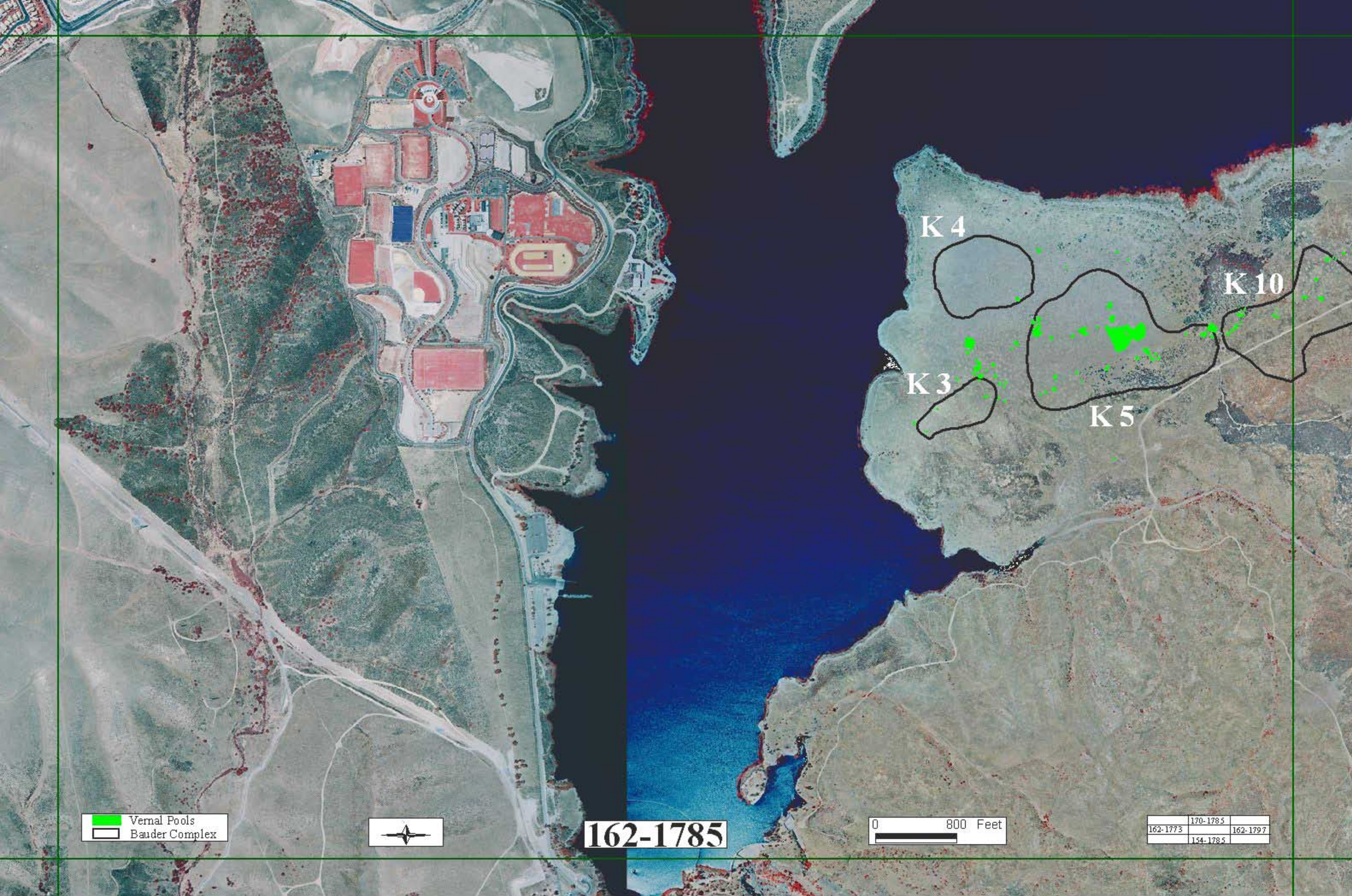
OTAY MESA

Roads
Vernal Pools
Bauder Complex

146-1773

0 800 Feet

	154-1773	
146-1761		146-1785
	138-1773	


K 4
K 10
K 3
K 5
Vernal Pools
Bauder Complex
162-1785
0 800 Feet
170-1785
162-1773
162-1797
154-1785

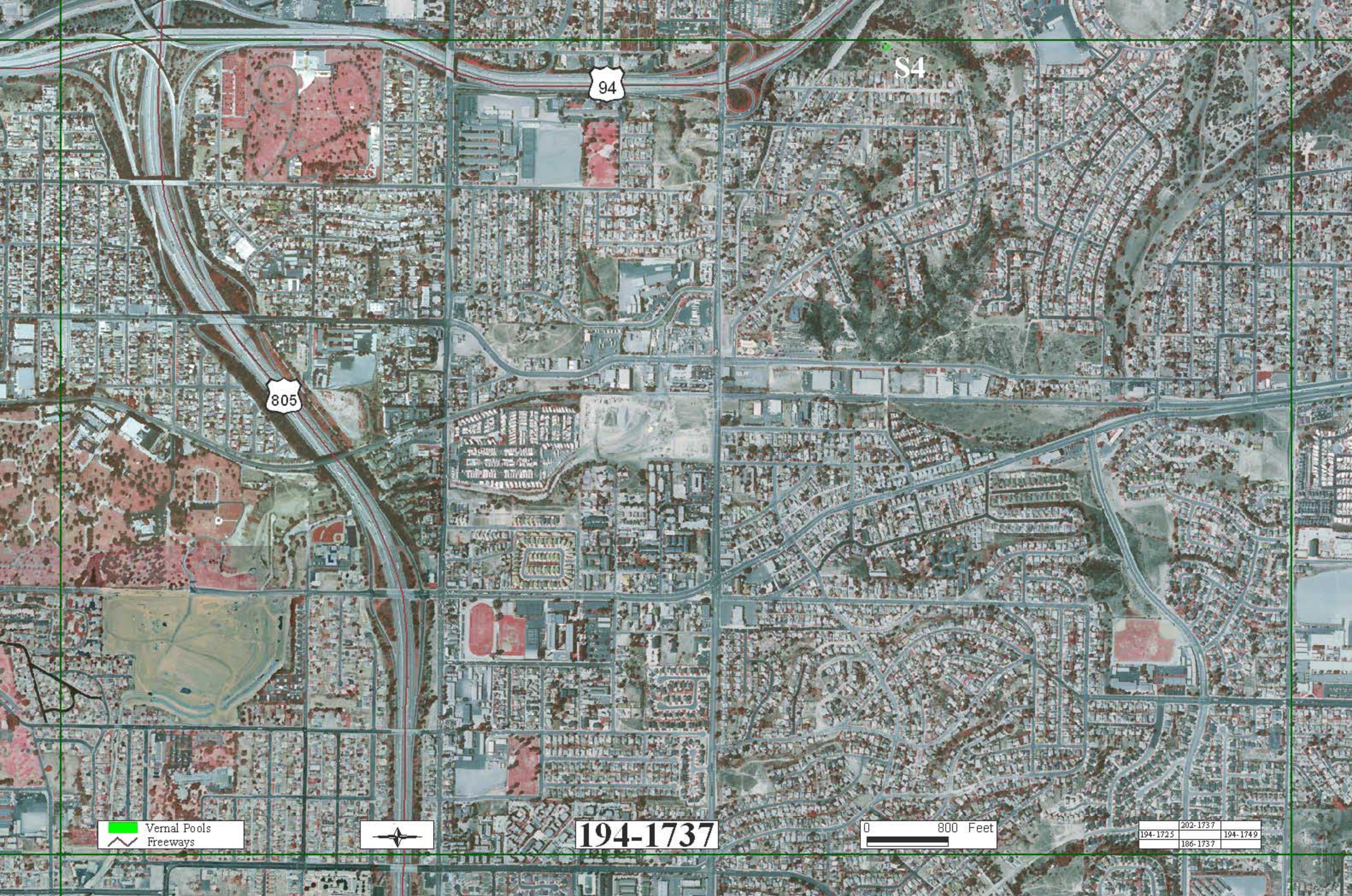
R1

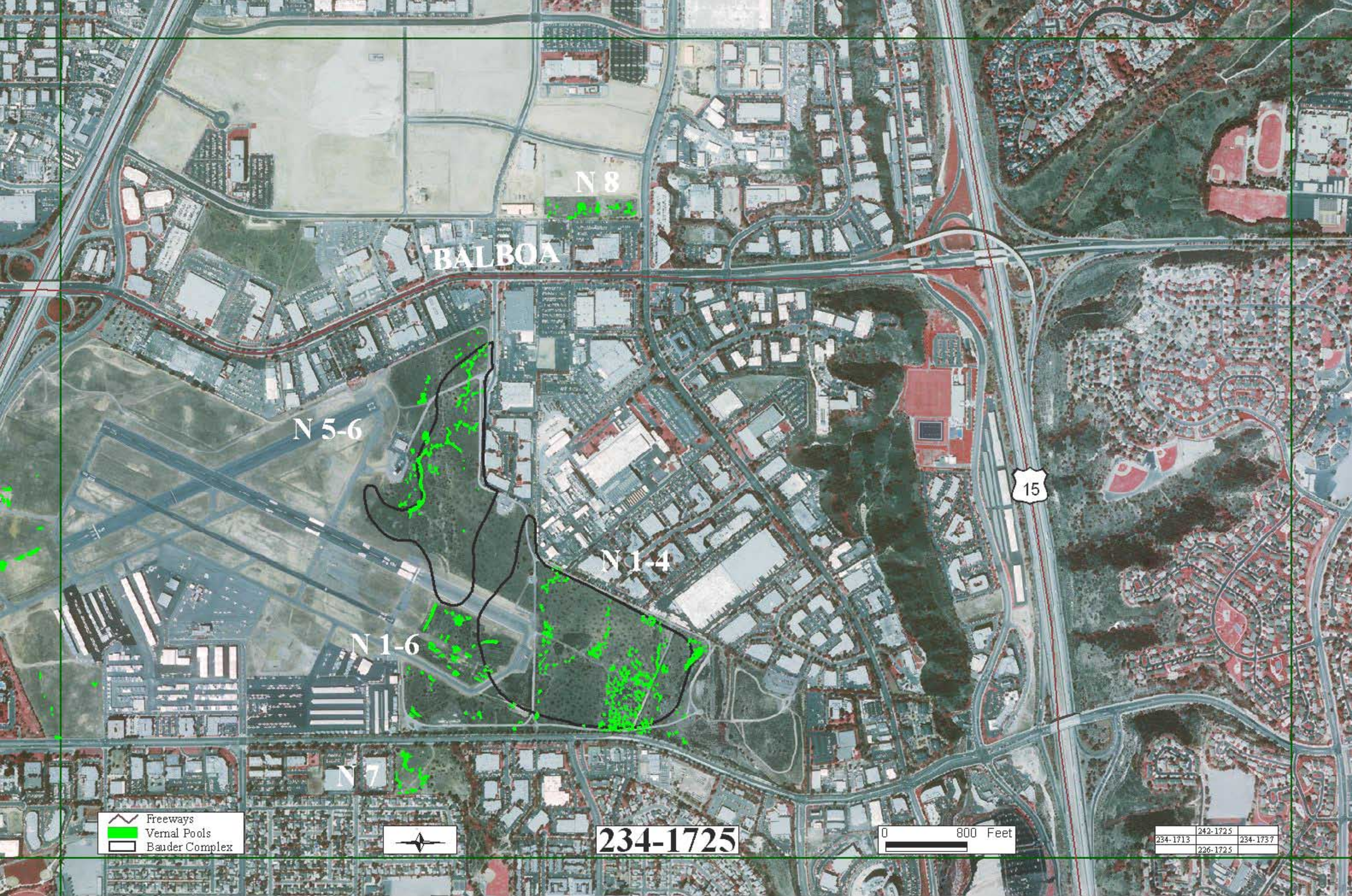
Roads
Vernal Pools
Bauder Complex

178-1785

0 800 Feet

170-1785


94
805
S4
Vernal Pools
Freeways
194-1737
0
800 Feet
202-1737
194-1725
194-1749
186-1737


N 8
BALBOA
N 5-6
N 1-4
N 1-6
N 7
15
Freeways
Vernal Pools
Bauder Complex
234-1725
0
800 Feet
242-1725
234-1713
234-1737
226-1725


F 1-27
MCAS Miramar
Not Accessible
AA 13
MCAS Miramar
Not Accessible
U 1-13
MCAS Miramar
Not Accessible
15
AA 4-7
MCAS Miramar
Not Accessible
52
MCAS Miramar
Not Accessible
F 16-17
AA 4-7
MCAS Miramar
Not Accessible
U 15
U 19
U 15
163
AA 4-7
MCAS Miramar
Not Accessible
Freeways
Vernal Pools
Bauder Complex
242-1725
0
800 Feet
250-1725
242-1713
242-1737
234-1725

AA 8
MCAS Miramar
Not Accessible

A 4
MCAS Miramar
Not Accessible

52

Q 2

Q 2

A 1

A 3

Q 2

Freeways
Vernal Pools
Bauder Complex

242-1737

0 800 Feet

	250-1737	
242-1725		242-1749
	234-1737	

X 6

X 7

X 5

NC

NC

805

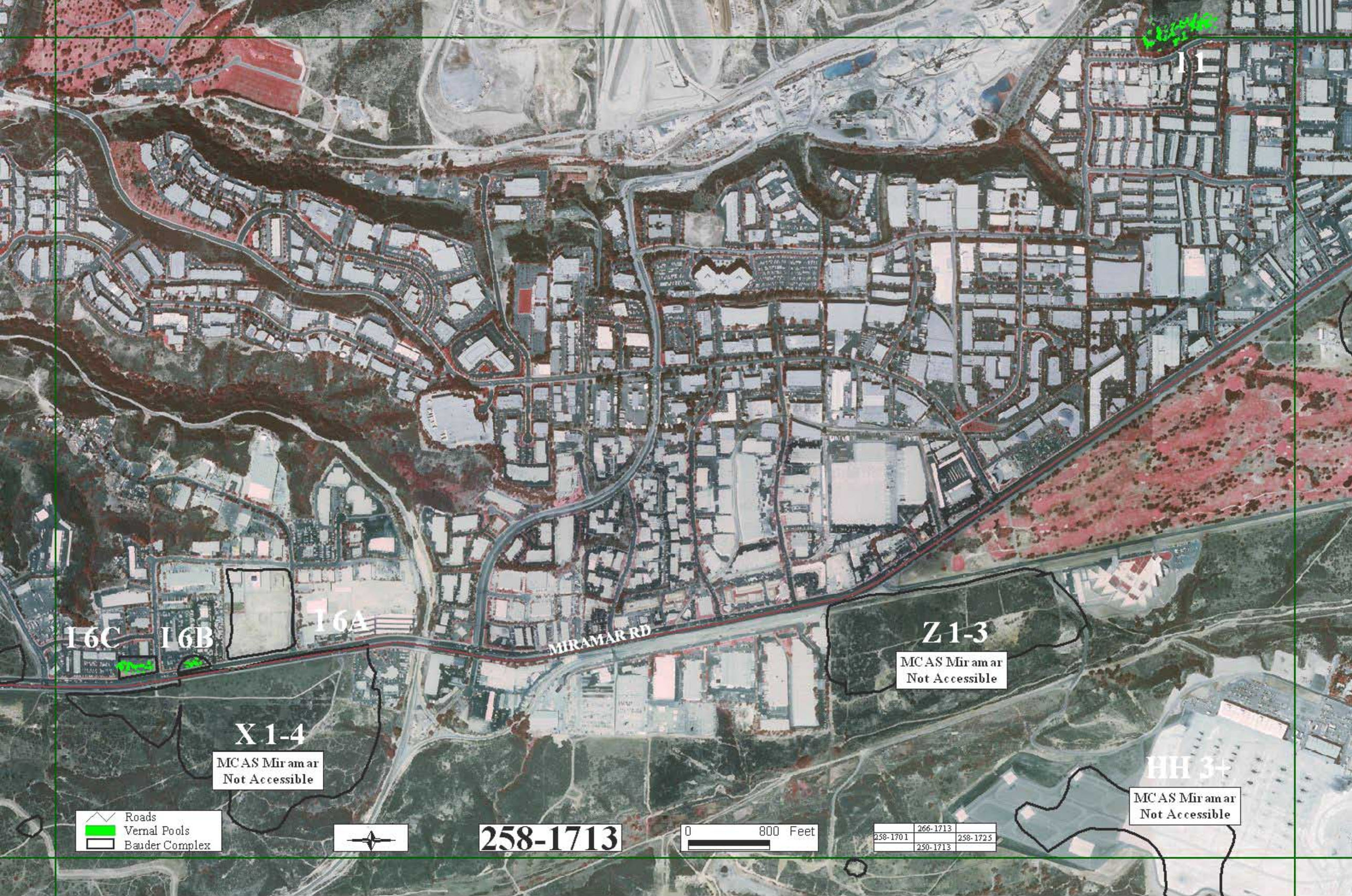
Freeways
Vernal Pools
Bauder Complex

250-1701

0 800 Feet

	258-1701	
250-1689		250-1713
	242-1701	


805
I 12
I 7
Navy
Not Accessible
Freeways
Vernal Pools
Bauder Complex
258-1701
0
800 Feet
266-1701
258-1689
258-1713
250-1701


I 1
I 6C
I 6B
I 6A
MIRAMAR RD
Z 1-3
MCAS Miramar
Not Accessible
X 1-4
MCAS Miramar
Not Accessible
HH 3+
MCAS Miramar
Not Accessible
Roads
Vernal Pools
Bauder Complex
258-1713
0 800 Feet
266-1713
258-1701
258-1725
250-1713


H 31-32
5
805
Freeways
Vernal Pools
Bauder Complex
266-1701
0 800 Feet
274-1701
266-1689
266-1713
258-1701


C 17-18
C10-16
C 28
C 24
D 1
D 5-8
Vernal Pools
Bauder Complex
266-1713
0 800 Feet
274-1713
266-1701
266-1725
258-1713

C27

15

Freeways
Vernal Pools
Bauder Complex

266-1725

0 800 Feet

	274-1725	
266-1713		266-1737
	258-1725	


H 38
H 38
H 17
H 33
Vernal Pools
Bauder Complex
274-1701
0
800 Feet
282-1701
274-1689
274-1713
266-1701


H 17
H 17
B 13
B 13
B 11
B 5-6
B 7-8
Vernal Pools
Bauder Complex
274-1713
0
800 Feet
282-1713
274-1701
274-1725
266-1713

H 39

H

H

H 1-15

Vernal Pools
Bauder Complex

282-1713

0 800 Feet

	290-1713	
282-1701		282-1725
	274-1713	

H40

Vernal Pools
Bauder Complex

290-1725

0 800 Feet

	298-1725	
290-1713		290-1737
	282-1725	

MM1

Vernal Pools
Bauder Complex

Marron Valley

0 800 Feet

APPENDIX D
VERNAL POOL INDICATORS BY SITE

Appendix D

Vernal Pool Indicators

	Bauder Complex		VP INDICATORS	*Callitriche marginata*	*Crassula aquatica*	*Deschampsia danthoniodes*	*Downingia cuspidata*	*Elatine californica*	*Epilobium pygmaeum*	***Eryngium aristulatum***	*Isoetes howellii*	*Isoetes orcuttii*	*Isoetes* spp.	*Lilaea scilloides*	*Marsilea vestita*	*Malvella leprosa*	*Myosurus minimus*	***Navarretia fossalis***	***Orcuttii californica***	*Phalaris lemmmonii*	*Phalaris* spp.	*Pilularia americana*	*Pilularia* spp.	*Plagiobothrys acanthocarpus*	*Plantago elongata*	*Plantago* spp.	***Pogogyne abramsii***	***Pogogyne nudiuscula***	*Psilocarphus brevissimus*	*Branchinecta* spp.	***B. sandiegonensis***	*B. lindahli*	***S. woottoni***
Del Mar Mesa																																
	H 1-15	Del Mar Mesa		•	•	•	•	•		•	•	•		•								•			•		•		•	•	•		
	H 17	Shaw Texas		•	•																				•					•			
	H 18-23	Rhodes		•	•	•		•		•		•		•								•		•	•		•		•	•			
	H 39	Greystone Torrey Highlands		•	•			•		•	•	•										•		•			•		•				
	H 40	Li Collins																												•				
Carmel Mountain																																
	H 38	Carmel Mountain		•	•						•			•											•				•	•	•		
Mira Mesa																																
	B 5-8	Lopez Ridge		•	•	•	•			•	•	•		•								•		•	•		•		•		•		
	B 5-8	Crescent Heights		•	•	•					•	•		•								•		•	•				•				
	B 11	Mesa Norte		•	•	•	•	•		•				•							•		•		•	•		•		•		•	
	C 10-16	Winterwood		•	•	•	•			•			•	•							•		•		•	•		•		•		•	
	C 17-18	Fieldstone		•	•	•	•				•												•		•	•		•		•			
	C 27	Mira Mesa Market Center			•		•	•			•												•					•		•		•		
	C 28	Maddox		•	•	•							•	•												•		•		•	•	•		
	D 5-8	Parkdale Carroll Canyon																												•				
	D 5-8	Carroll Canyon Preserve		•	•	•	•			•	•	•	•	•				•				•	•		•		•		•	•			
	I 1	Arjons		•	•	•	•	•		•	•	•		•							•		•		•	•		•		•	•	•	
Nobel Drive																																

Appendix D

Vernal Pool Indicators

	Bauder Complex		VP INDICATORS	*Callitriche marginata*	*Crassula aquatica*	*Deschampsia danthoniodes*	*Downingia cuspidata*	*Elatine californica*	*Epilobium pygmaeum*	***Eryngium aristulatum***	*Isoetes howellii*	*Isoetes orcuttii*	*Isoetes* spp.	*Lilaea scilloides*	*Marsilea vestita*	*Malvella leprosa*	*Myosurus minimus*	***Navarretia fossalis***	***Orcuttii californica***	*Phalaris lemmmonii*	*Phalaris* spp.	*Pilularia americana*	*Pilularia* spp.	*Plagiobothrys acanthocarpus*	*Plantago elongata*	*Plantago* spp.	***Pogogyne abramsii***	***Pogogyne nudiuscula***	*Psilocarphus brevissimus*	*Branchinecta* spp.	***B. sandiegonensis***	*B. lindahli*	***S. woottoni***
	I 6	Bob Baker/ Bob Baker 2		•	•	•	•			•		•		•							•	•		•	•		•		•	•			
	I 12	Pueblo Lands		•	•	•																			•				•		•		
	X 5	Nobel Drive		•	•	•	•							•				•		•		•		•	•				•		•		
	X 7	Nobel Research Park		•	•	•	•							•								•		•	•				•		•		
Kearny Mesa																																	
	N 1-6	Montgomery Field		•	•	•	•	•			•	•		•						•		•	•	•	•		•		•	•	•		
	N 7	Serra Mesa Library			•																			•	•				•				
	N 8	General Dynamics		•	•	•	•	•		•	•	•		•						•		•		•	•		•		•		•		
	U 15	Magnatron		•	•	•	•	•		•				•															•				
	U 15	Sander		•	•	•	•					•										•			•		•		•		•		
	U 19	Cubic		•	•	•	•	•		•				•															•	•			
Mission Trails Regional Park																																	
	Q 2	Mission Trails Regional Park		•	•									•										•	•				•		•		
Urban San Diego																																	
	S 4	Kelton		•	•							•												•	•				•				
Otay Lakes																																	
	13	Otay Lakes		•	•	•				•											•			•					•	•			
	R 1	Proctor Valley		•	•	•					•											•							•	•			
Otay Mesa																																	

Appendix D

Vernal Pool Indicators

Bauder Complex		VP INDICATORS	*Callitriche marginata*	*Crassula aquatica*	*Deschampsia danthoniodes*	*Downingia cuspidata*	*Elatine californica*	*Epilobium pygmaeum*	***Eryngium aristulatum***	*Isoetes howellii*	*Isoetes orcuttii*	*Isoetes* spp.	*Lilaea scilloides*	*Marsilea vestita*	*Malvella leprosa*	*Myosurus minimus*	***Navarretia fossalis***	***Orcuttii californica***	*Phalaris lemmmonii*	*Phalaris* spp.	*Pilularia americana*	*Pilularia* spp.	*Plagiobothrys acanthocarpus*	*Plantago elongata*	*Plantago* spp.	***Pogogyne abramsii***	***Pogogyne nudiuscula***	*Psilocarphus brevissimus*	*Branchinecta* spp.	***B. sandiegonensis***	*B. lindahli*	***S. woottoni***
J 2 S	Otay Mesa Road Helix		•	•	•		•	•	•				•			•		•			•							•	•		•		•
J 2 S	Otay Mesa Road Recon		•	•	•		•	•	•								•	•			•							•	•		•		•
J 2 W	J 2 W		•	•					•				•								•		•						•	•	•		•
J 2 S/W	Otay Mesa Road Pardee		•	•									•																•	•	•		
J 2 W/N/S	Recon Cal Terraces		•	•	•			•	•				•	•			•	•					•					•	•	•	•	•	•
J W 2; J 31	Hidden Trails																						•	•					•	•			
J 3	J 3																												•		•		•
J 4	J 4																												•	•			
J 4-5	Robinhood Ridge		•	•	•		•	•	•				•			•	•	•			•	•		•				•	•		•		•
J 11 E	J 11 E			•											•	•			•				•	•					•				
J 11 W	J 11 W		•	•	•								•	•					•				•	•					•	•	•		
J 12	J 12			•									•						•				•	•					•				
J 13 E	J 13 E																						•						•				
J 13 N	J 13 N							•	•									•	•				•	•					•		•		
J 13 S	J 13 S			•			•	•	•				•		•		•	•	•		•			•					•	•			
J 14	J 14			•	•			•					•			•	•		•								•	•		•		•
J 14	905																							•					•		•		
J 14	Recon South		•	•	•			•	•				•	•			•	•					•					•	•		•	•	•
J 15	Arnie's Point			•					•																				•				

Appendix D

Vernal Pool Indicators

	Bauder Complex		VP INDICATORS	*Callitriche marginata*	*Crassula aquatica*	*Deschampsia danthoniodes*	*Downingia cuspidata*	*Elatine californica*	*Epilobium pygmaeum*	***Eryngium aristulatum***	*Isoetes howellii*	*Isoetes orcuttii*	*Isoetes* spp.	*Lilaea scilloides*	*Marsilea vestita*	*Malvella leprosa*	*Myosurus minimus*	***Navarretia fossalis***	***Orcuttii californica***	*Phalaris lemmmonii*	*Phalaris* spp.	*Pilularia americana*	*Pilularia* spp.	*Plagiobothrys acanthocarpus*	*Plantago elongata*	*Plantago* spp.	***Pogogyne abramsii***	***Pogogyne nudiuscula***	*Psilocarphus brevissimus*	*Branchinecta* spp.	***B. sandiegonensis***	*B. lindahli*	***S. woottoni***
	J 16-18	J 16-18/ Wruck Canyon			•			•	•	•										•				•					•				
	J 21	J 21		•	•					•									•							•							
	J 27	J 27			•					•						•				•					•	•				•				
	J 28 E	J 28 E																									•						
	J 29-30	J 29-30		•	•					•				•											•					•	•			
	J 31	J 31			•					•						•									•					•				
	J 32	West Otay A + B		•	•	•		•									•	•				•			•	•			•	•	•	•		•
	J 33	Sweetwater High School		•	•	•		•		•				•			•	•		•		•			•	•			•	•		•		•
	J 34	J 34		•										•											•					•				
	J 35	Brown Field																													•				
Marron Valley																																			
	MM 1	Marron Valley		•	•	•					•														•	•				•	•			

APPENDIX E
FACULTATIVE WETLAND SPECIES BY SITE

Appendix E

Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Agrostis avenacea*	*Agrostis microphylla*	*Agrostis tandilensis*	*Ambrosia psilostachya*	*Anagallis arvensis*	*Arundo donax*	*Atriplex semibaccata*	*Baccharis salicifolia*	*Briza* spp.	*Brodiaea jolonensis*	*Brodiaea orcuttii*	*Brodiaea* spp.	*Calandrinia ciliata*	*Calandrinia maritima*	*Calandrinia* spp.	*Camissonia* spp.	*Centunculus minimus*	*Centunculus* spp.	*Chenopodium ambrosioides*	*Claytonia perfoliata*	*Cotula australis*	*Cotula coronopifolia*	*Crassula erecta --> Cyperus erythrohizos*	*Cressa truxillensis*	*Cyperus* spp.	*Distichlis spicata*	*Eleocharis acicularis*	*Eleocharis macrostachya*
Del Mar Mesa																															
	H 1-15	Del Mar Mesa												•						•	•			•	•	•					•
	H 17	Shaw Texas																							•						
	H 39	Greystone Torrey Highlands											•												•						•
	H 40	Li Collins																													
Carmel Mountain																															
	H 38	Carmel Mountain													•										•	•			•		•
Mira Mesa																															
	B 5-8	Lopez Ridge		•	•	•								•										•	•						•
	B 5-8	Crescent Heights		•	•	•								•										•	•						•
	B 5-8	Tierra Alta																								•					
	B 11	Mesa Norte		•				•						•											•			•			•
	C 10-16	Winterwood						•						•										•	•						•
	C 17-18	Fieldstone												•																	
	C 27	Mira Mesa Market Center												•											•						•
	C 28	Maddox		•																					•						
	D 5-8	Carroll Canyon							•					•	•						•										•
	D 5-8	Parkdale Carroll Canyon							•					•	•						•										•
	I 1	Arjons												•						•											•
Nobel Drive																															

Appendix E

Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Agrostis avenacea*	*Agrostis microphylla*	*Agrostis tandilensis*	*Ambrosia psilostachya*	*Anagallis arvensis*	*Arundo donax*	*Atriplex semibaccata*	*Baccharis salicifolia*	*Briza* spp.	*Brodiaea jolonensis*	*Brodiaea orcuttii*	*Brodiaea* spp.	*Calandrinia ciliata*	*Calandrinia maritima*	*Calandrinia* spp.	*Camissonia* spp.	*Centunculus minimus*	*Centunculus* spp.	*Chenopodium ambrosioides*	*Claytonia perfoliata*	*Cotula australis*	*Cotula coronopifolia*	*Crassula erecta --> Cyperus erythrohizos*	*Cressa truxillensis*	*Cyperus* spp.	*Distichlis spicata*	*Eleocharis acicularis*	*Eleocharis macrostachya*
	I 6	Bob Baker/ Bob Baker 2																							•						•
	I 12	Pueblo Lands																			•										•
	X 5	Nobel Drive												•							•				•						•
	X 7	Nobel Research Park																													•
Kearny Mesa																															
	N 1-6	Montgomery Field						•									•														•
	N 7	Serra Mesa Library																													
	N 8	General Dynamics		•										•						•											•
	U 15	Magnatron																													•
	U 15	Sander												•							•										•
	U 19	Cubic												•																	•
Mission Trails Regional Park																															
	Q 2	Mission Trails Regional Park					•																									•
Urban San Diego																															
	S 4	Kelton						•													•										
Otay Lakes																															
	K 3, 5, 10, 13	Otay Lakes						•					•		•			•								•		•				•

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Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Agrostis avenacea*	*Agrostis microphylla*	*Agrostis tandilensis*	*Ambrosia psilostachya*	*Anagallis arvensis*	*Arundo donax*	*Atriplex semibaccata*	*Baccharis salicifolia*	*Briza* spp.	*Brodiaea jolonensis*	*Brodiaea orcuttii*	*Brodiaea* spp.	*Calandrinia ciliata*	*Calandrinia maritima*	*Calandrinia* spp.	*Camissonia* spp.	*Centunculus minimus*	*Centunculus* spp.	*Chenopodium ambrosioides*	*Claytonia perfoliata*	*Cotula australis*	*Cotula coronopifolia*	*Crassula erecta --> Cyperus erythrohizos*	*Cressa truxillensis*	*Cyperus* spp.	*Distichlis spicata*	*Eleocharis acicularis*	*Eleocharis macrostachya*
	R 1	Proctor Valley						•					•	•																	•
Otay Mesa																															
	J 2 S	Otay Mesa Road Helix						•																				•			•
	J 2 W	J 2 W																													•
	J 2 W/N/S	Recon Cal Terraces																		•											•
	J W 2; J 31	Hidden Trails																													•
	J 3	J 3						•																							
	J 4	J 4																													
	J 4-5	Robinhood Ridge						•		•																					•
	J 11 E	J 11 E									•					•										•					
	J 11 W	J 11 W									•											•		•	•						•
	J 12	J 12					•																	•	•	•					•
	J 13 E	J 13 E																						•							
	J 13 N	J 13 N																													•
	J 13 S	J 13 S											•																		•
	J 14	J 14																													•
	J 14	905						•																							
	J 14	Recon South																		•											•
	J 15	Arnie's Point																													•
	J 16-18	J 16-18		•				•																						•	•

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Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Agrostis avenacea*	*Agrostis microphylla*	*Agrostis tandilensis*	*Ambrosia psilostachya*	*Anagallis arvensis*	*Arundo donax*	*Atriplex semibaccata*	*Baccharis salicifolia*	*Briza* spp.	*Brodiaea jolonensis*	*Brodiaea orcuttii*	*Brodiaea* spp.	*Calandrinia ciliata*	*Calandrinia maritima*	*Calandrinia* spp.	*Camissonia* spp.	*Centunculus minimus*	*Centunculus* spp.	*Chenopodium ambrosioides*	*Claytonia perfoliata*	*Cotula australis*	*Cotula coronopifolia*	*Crassula erecta --> Cyperus erythrohizos*	*Cressa truxillensis*	*Cyperus* spp.	*Distichlis spicata*	*Eleocharis acicularis*	*Eleocharis macrostachya*
	J 21	J 21						•								•								•	•					•
	J 27	J 27								•	•																	•	•	•
	J 28 E	J 28 E								•																		•		•
	J 29-30	J 29-30								•						•											•				•
	J 31	J 31																•									•				•
	J 32	West Otay A + B		•				•																							•
	J 33	Sweetwater High School		•				•																							•
	J 34	J 34																													•
Marron Valley																															
	MM 1										•		•						•						•				•		•

Appendix E

Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Eleocharis* spp.	*Foeniculum vulgare*	*Galium aparine*	*Gastridium ventricosum*	*Grindelia camporum*	*Helianthemum scoparium*	*Heliotropium curassavicum*	*Juncus bufonius*	*Juncus dubius*	*Juncus mexicanus*	*Leptochloa uninervia*	*Lolium multiflorium*	*Lythrum hyssopifolium*	*Marrubium vulgare*	*Melilotus indica*	*Muhlenbergia rigens*	*Nicotiana glauca*	*Ophioglossum californicum*	*Phalaris minor*	*Picris echioides*	*Pityrogramma triangularis* --> *Rubus parviflorus*	*Polypogon monspeliensis*	*Psilocarphus tenellus*	*Rumex crispus*	*Rumex pulcher*	*Salix gooddingii*	*Sambucus mexicana*	*Scirpus* spp.
Del Mar Mesa																														
	H 1-15	Del Mar Mesa									•				•	•					•				•	•	•			•	
	H 17	Shaw Texas									•		•			•									•	•	•				
	H 39	Greystone Torrey Highlands									•				•	•									•		•				
	H 40	Li Collins									•				•	•											•				
Carmel Mountain																														
	H 38	Carmel Mountain							•		•					•								•						•	
Mira Mesa																														
	B 5-8	Lopez Ridge					•				•					•					•				•	•				•	
	B 5-8	Crescent Heights					•				•					•					•				•	•				•	
	B 5-8	Tierra Alta					•						•													•					
	B 11	Mesa Norte					•				•				•	•									•		•				
	C 10-16	Winterwood									•					•										•	•				
	C 17-18	Fieldstone							•		•					•									•		•				
	C 27	Mira Mesa Market Center									•														•						
	C 28	Maddox									•				•	•											•			•	
	D 5-8	Carroll Canyon									•	•				•							•		•		•			•	
	D 5-8	Parkdale Carroll Canyon									•	•				•							•		•		•			•	
	I 1	Arjons									•					•									•						
Nobel Drive																														

Appendix E

Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Eleocharis* spp.	*Foeniculum vulgare*	*Galium aparine*	*Gastridium ventricosum*	*Grindelia camporum*	*Helianthemum scoparium*	*Heliotropium curassavicum*	*Juncus bufonius*	*Juncus dubius*	*Juncus mexicanus*	*Leptochloa uninervia*	*Lolium multiflorium*	*Lythrum hyssopifolium*	*Marrubium vulgare*	*Melilotus indica*	*Muhlenbergia rigens*	*Nicotiana glauca*	*Ophioglossum californicum*	*Phalaris minor*	*Picris echioides*	*Pityrogramma triangularis* --> *Rubus parviflorus*	*Polypogon monspeliensis*	*Psilocarphus tenellus*	*Rumex crispus*	*Rumex pulcher*	*Salix gooddingii*	*Sambucus mexicana*	*Scirpus* spp.
	I 6	Bob Baker/ Bob Baker 2									•					•								•	•						
	I 12	Pueblo Lands									•				•	•									•		•				
	X 5	Nobel Drive					•				•					•									•	•					
	X 7	Nobel Research Park					•				•				•										•	•					
Kearny Mesa																														
	N 1-6	Montgomery Field									•					•									•	•	•				
	N 7	Serra Mesa Library									•					•											•				
	N 8	General Dynamics									•					•				•					•		•				
	U 15	Magnatron										•				•									•						
	U 15	Sander									•					•									•						
	U 19	Cubic										•				•									•						
Mission Trails Regional Park																														
	Q 2	Mission Trails Regional Park			•						•					•									•		•				
Urban San Diego																														
	S 4	Kelton							•		•					•	•						•			•					
Otay Lakes																														
	K 3, 5, 10, 13	Otay Lakes									•					•										•					

Appendix E

Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Eleocharis* spp.	*Foeniculum vulgare*	*Galium aparine*	*Gastridium ventricosum*	*Grindelia camporum*	*Helianthemum scoparium*	*Heliotropium curassavicum*	*Juncus bufonius*	*Juncus dubius*	*Juncus mexicanus*	*Leptochloa uninervia*	*Lolium multiflorium*	*Lythrum hyssopifolium*	*Marrubium vulgare*	*Melilotus indica*	*Muhlenbergia rigens*	*Nicotiana glauca*	*Ophioglossum californicum*	*Phalaris minor*	*Picris echioides*	*Pityrogramma triangularis* --> *Rubus parviflorus*	*Polypogon monspeliensis*	*Psilocarphus tenellus*	*Rumex crispus*	*Rumex pulcher*	*Salix gooddingii*	*Sambucus mexicana*	*Scirpus* spp.
	R 1	Proctor Valley					•				•				•	•									•		•			
Otay Mesa																														
	J 2 S	Otay Mesa Road Helix									•				•	•						•			•						
	J 2 W	J 2 W									•				•	•											•				
	J 2 W/N/S	Recon Cal Terraces									•					•															
	J W 2; J 31	Hidden Trails									•																				
	J 3	J 3														•									•						
	J 4	J 4									•					•									•	•					
	J 4-5	Robinhood Ridge					•				•				•	•						•			•						
	J 11 E	J 11 E								•	•		•		•	•	•			•							•		•		
	J 11 W	J 11 W								•	•				•				•								•		•		
	J 12	J 12				•					•				•		•								•		•				
	J 13 E	J 13 E									•				•												•				
	J 13 N	J 13 N													•	•															
	J 13 S	J 13 S													•	•									•		•	•			
	J 14	J 14									•				•							•			•		•				
	J 14	905														•															
	J 14	Recon South									•					•															
	J 15	Arnie's Point									•					•															
	J 16-18	J 16-18													•	•									•						

Appendix E

Facultative Wetland Species

	Bauder Complex		**WETLAND SPECIES**	*Eleocharis* spp.	*Foeniculum vulgare*	*Galium aparine*	*Gastridium ventricosum*	*Grindelia camporum*	*Helianthemum scoparium*	*Heliotropium curassavicum*	*Juncus bufonius*	*Juncus dubius*	*Juncus mexicanus*	*Leptochloa uninervia*	*Lolium multiflorium*	*Lythrum hyssopifolium*	*Marrubium vulgare*	*Melilotus indica*	*Muhlenbergia rigens*	*Nicotiana glauca*	*Ophioglossum californicum*	*Phalaris minor*	*Picris echioides*	*Pityrogramma triangularis* --> *Rubus parviflorus*	*Polypogon monspeliensis*	*Psilocarphus tenellus*	*Rumex crispus*	*Rumex pulcher*	*Salix gooddingii*	*Sambucus mexicana*	*Scirpus* spp.
	J 21	J 21		•						•	•					•									•		•				
	J 27	J 27			•						•			•	•	•							•		•		•				•
	J 28 E	J 28 E													•									•		•					
	J 29-30	J 29-30						•			•				•											•					
	J 31	J 31													•																
	J 32	West Otay A + B									•					•								•							
	J 33	Sweetwater High School					•				•				•	•								•							
	J 34	J 34														•										•					
Marron Valley																															
	MM 1							•			•				•	•		•													

Appendix E

Facultative Wetland Species

	Bauder Complex		**WETLAND SPECIES**	*Sisyrinchium bellum*	*Solanum* spp.	*Tamarix* spp.	*Trifolium* spp.	*Typha* spp.	*Veronica peregrina*
Del Mar Mesa									
	H 1-15	Del Mar Mesa		•	•		•		
	H 17	Shaw Texas							
	H 39	Greystone Torrey Highlands						•	
	H 40	Li Collins						•	
Carmel Mountain									
	H 38	Carmel Mountain							
Mira Mesa									
	B 5-8	Lopez Ridge							
	B 5-8	Crescent Heights							
	B 5-8	Tierra Alta							
	B 11	Mesa Norte							
	C 10-16	Winterwood							
	C 17-18	Fieldstone							
	C 27	Mira Mesa Market Center							
	C 28	Maddox							
	D 5-8	Carroll Canyon		•					•
	D 5-8	Parkdale Carroll Canyon		•					•
	I 1	Arjons							
Nobel Drive									

Appendix E

Facultative Wetland Species

	Bauder Complex		WETLAND SPECIES	*Sisyrinchium bellum*	*Solanum* spp.	*Tamarix* spp.	*Trifolium* spp.	*Typha* spp.	*Veronica peregrina*
	I 6	Bob Baker/ Bob Baker 2							
	I 12	Pueblo Lands							
	X 5	Nobel Drive							
	X 7	Nobel Research Park							
Kearny Mesa									
	N 1-6	Montgomery Field							
	N 7	Serra Mesa Library							
	N 8	General Dynamics					•		
	U 15	Magnatron							
	U 15	Sander							
	U 19	Cubic							
Mission Trails Regional Park									
	Q 2	Mission Trails Regional Park							
Urban San Diego									
	S 4	Kelton		•					
Otay Lakes									
	K 3, 5, 10, 13	Otay Lakes			•		•		

Appendix E

Facultative Wetland Species

	Bauder Complex		**WETLAND SPECIES**	*Sisyrinchium bellum*	*Solanum* spp.	*Tamarix* spp.	*Trifolium* spp.	*Typha* spp.	*Veronica peregrina*
	R 1	Proctor Valley							•
Otay Mesa									
	J 2 S	Otay Mesa Road Helix							
	J 2 W	J 2 W							
	J 2 W/N/S	Recon Cal Terraces							
	J W 2; J 31	Hidden Trails							
	J 3	J 3							
	J 4	J 4							
	J 4-5	Robinhood Ridge							
	J 11 E	J 11 E				•			
	J 11 W	J 11 W				•			
	J 12	J 12							
	J 13 E	J 13 E							
	J 13 N	J 13 N							
	J 13 S	J 13 S							
	J 14	J 14							
	J 14	905							
	J 14	Recon South							
	J 15	Arnie's Point							
	J 16-18	J 16-18							

Appendix E

Facultative Wetland Species

	Bauder Complex		**WETLAND SPECIES**	*Sisyrinchium bellum*	*Solanum* spp.	*Tamarix* spp.	*Trifolium* spp.	*Typha* spp.	*Veronica peregrina*
	J 21	J 21							
	J 27	J 27					•		
	J 28 E	J 28 E					•		
	J 29-30	J 29-30							
	J 31	J 31							
	J 32	West Otay A + B							
	J 33	Sweetwater High School							
	J 34	J 34							
Marron Valley									
	MM 1								

APPENDIX F
UPLAND SPECIES BY SITE

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Acacia* spp.	*Adenostoma fasciculatum*	*Adolphia californica*	*Allium praecox*	*Allium* spp.	*Ambrosia chenopodifolia*	*Amsinckia menziesii* var. *intermedia*	*Antirrhinum nuttallianum*	*Apiastrum angustifolium*	*Artemisia californica*	*Astragalus trichopodus*	*Avena barbata*	*Avena fatua*	*Baccharis pilularis*	*Baccharis sarothroides*	*Bloomeria crocea*	*Brassica nigra*	*Brassica* spp.	*Bromus diandrus*	*Bromus hordeaceus*	*Bromus madritensis* ssp. *rubens*	*Bromus mollis*	*Bromus* spp.	*Calochortus splendens*	*Calystegia macrostegia*	*Castilleja exserta*	*Ceanothus tomentosus*	*Centaurea melitensis*	*Centaurium venustum*	*Cerastium glomeratum*	*Chaenactis* spp.	*Chamaesyce* spp.
Del Mar Mesa																																		
	H 1-15	Del Mar Mesa			•					•			•		•	•				•		•		•				•		•				
	H 17	Shaw Texas																					•											
	H 18-23	Rhodes			•	•				•						•							•		•			•		•				
	H 39	Greystone Torrey Highlands																																	
	H 40	Li Collins																																	
Carmel Mountain																																		
	H 38	Carmel Mountain			•					•			•											•						•				
Mira Mesa																																		
	B 5-8	Lopez Ridge			•			•					•			•							•	•				•	•		•			
	B 5-8	Crescent Heights			•			•					•			•							•	•				•	•		•			
	B 5-8	Tierra Alta			•		•				•				•	•								•	•					•	•		•		
	B 11	Mesa Norte													•	•						•	•	•	•	•					•	•			
	C 10-16	Winterwood			•								•							•														
	C 17-18	Fieldstone			•								•			•								•		•				•	•			
	C 27	Mira Mesa Market Center																																	
	C 28	Maddox														•		•					•	•		•		•						
	D 5-8	Carroll Canyon			•			•				•						•		•								•	•		•	•			•
	D 5-8	Parkdale Carroll Canyon			•			•				•						•		•								•	•		•	•			•
	I 1	Arjons			•																														

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Acacia* spp.	*Adenostoma fasciculatum*	*Adolphia californica*	*Allium praecox*	*Allium* spp.	*Ambrosia chenopodifolia*	*Amsinckia menziesii* var. *intermedia*	*Antirrhinum nuttallianum*	*Apiastrum angustifolium*	*Artemisia californica*	*Astragalus trichopodus*	*Avena barbata*	*Avena fatua*	*Baccharis pilularis*	*Baccharis sarothroides*	*Bloomeria crocea*	*Brassica nigra*	*Brassica* spp.	*Bromus diandrus*	*Bromus hordeaceus*	*Bromus madritensis* ssp. *rubens*	*Bromus mollis*	*Bromus* spp.	*Calochortus splendens*	*Calystegia macrostegia*	*Castilleja exserta*	*Ceanothus tomentosus*	*Centaurea melitensis*	*Centaurium venustum*	*Cerastium glomeratum*	*Chaenactis* spp.	*Chamaesyce* spp.
Nobel Drive																																		
	I 6	Bob Baker/ Bob Baker 2			•		•																											
	I 12	Pueblo Lands								•			•			•				•				•										
	X 5	Nobel Drive			•								•									•	•	•										
	X 7	Nobel Research Park			•						•												•			•				•				
Kearny Mesa																																		
	N 1-6	Montgomery Field			•		•				•	•	•		•	•		•		•							•	•		•				
	N 7	Serra Mesa Library																																
	N 8	General Dynamics																																
	U 15	Magnatron																																
	U 15	Sander			•													•									•			•				
	U 19	Cubic																																
Mission Trails Regional Park																																		
	Q 2	Mission Trails Regional Park											•		•	•						•		•				•			•				
Urban San Diego																																		
	S 4	Kelton										•	•	•				•										•			•				
Otay Lakes																																		

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Acacia* spp.	*Adenostoma fasciculatum*	*Adolphia californica*	*Allium praecox*	*Allium* spp.	*Ambrosia chenopodifolia*	*Amsinckia menziesii* var. *intermedia*	*Antirrhinum nuttallianum*	*Apiastrum angustifolium*	*Artemisia californica*	*Astragalus trichopodus*	*Avena barbata*	*Avena fatua*	*Baccharis pilularis*	*Baccharis sarothroides*	*Bloomeria crocea*	*Brassica nigra*	*Brassica* spp.	*Bromus diandrus*	*Bromus hordeaceus*	*Bromus madritensis* ssp. *rubens*	*Bromus mollis*	*Bromus* spp.	*Calochortus splendens*	*Calystegia macrostegia*	*Castilleja exserta*	*Ceanothus tomentosus*	*Centaurea melitensis*	*Centaurium venustum*	*Cerastium glomeratum*	*Chaenactis* spp.	*Chamaesyce* spp.
	K 3, 5, 10, 13	Otay Lakes			•		•							•						•				•	•	•			•		•				
	R 1	Proctor Valley														•								•	•				•		•				
Otay Mesa																																		
	J 2 S	Otay Mesa Road Helix														•											•			•					
	J 2 W	J 2 W												•		•	•																	
	J 2 W; J 31	Hidden Trails														•	•				•						•								
	J 3	J 3																													•			
	J 4	J 4																																
	J 4-5	Robinhood Ridge												•		•				•							•			•	•	•			
	J 11 E	J 11 E							•	•				•	•	•	•			•	•	•	•							•					
	J 11 W	J 11 W					•			•				•				•			•	•						•						•	
	J 12	J 12												•			•			•										•					
	J 13 E	J 13 E						•		•				•		•	•			•	•					•									
	J 13 N	J 13 N																						•		•									
	J 13 S	J 13 S																																	
	J 14	J 14																																	
	J 16-18	J 16-18			•				•			•	•							•				•							•				
	J 21	J 21																•		•															
	J 27	J 27													•	•				•		•		•											
	J 28 E	J 28 E													•	•																			

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Acacia* spp.	*Adenostoma fasciculatum*	*Adolphia californica*	*Allium praecox*	*Allium* spp.	*Ambrosia chenopodifolia*	*Amsinckia menziesii* var. *intermedia*	*Antirrhinum nuttallianum*	*Apiastrum angustifolium*	*Artemisia californica*	*Astragalus trichopodus*	*Avena barbata*	*Avena fatua*	*Baccharis pilularis*	*Baccharis sarothroides*	*Bloomeria crocea*	*Brassica nigra*	*Brassica* spp.	*Bromus diandrus*	*Bromus hordeaceus*	*Bromus madritensis* ssp. *rubens*	*Bromus mollis*	*Bromus* spp.	*Calochortus splendens*	*Calystegia macrostegia*	*Castilleja exserta*	*Ceanothus tomentosus*	*Centaurea melitensis*	*Centaurium venustum*	*Cerastium glomeratum*	*Chaenactis* spp.	*Chamaesyce* spp.
	J 29-30	J 29-30		•			•	•					•		•	•				•								•						
	J 31	J 31											•		•	•																		
	J 33	Sweetwater High School													•					•						•								
	J 34	J 34																																
Marron Valley																																		
	MM 1	Marron Valley								•			•									•	•	•			•	•	•			•			

Revised Bauder identification numbers are shown in bold.

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Chamomilla suaveolens*	*Chenopodium murale*	*Chlorogalum parviflorum*	*Chlorogalum pomeridianum*	*Chlorogalum* spp.	*Chrysanthemum coronarium*	*Cistus* spp.	*Cirsium vulgare*	*Clematis pauciflora*	*Comarostaphylis diversifolia*	*Cneoridium dumosum*	*Crassula comata*	*Crassula* spp.	*Croton californicus*	*Cryptantha intermedia*	*Cryptantha* spp.	*Cuscuta californica*	*Cuscuta* spp.	*Cynara cardunculus*	*Cynodon dactylon*	*Daucus carota*	*Daucus pusillus*	*Deinandra conjugens*	*Deinandra fasciculata*	*Descurainia pinnata*	*Dichelostemma capitata*	*Dichondra occidentalis*	*Dodecatheon clevelandii*	*Dudleya variegata*	*Encelia californica*	*Ephedra californica*	*Eremocarpus setigerus*
Del Mar Mesa																																		
	H 1-15	Del Mar Mesa				•							•	•	•				•							•		•						
	H 17	Shaw Texas																																
	H 18-23	Rhodes				•							•		•											•		•	•					
	H 39	Greystone Torrey Highlands																																
	H 40	Li Collins																								•								
Carmel Mountain																																		
	H 38	Carmel Mountain				•				•					•					•					•		•		•				•		
Mira Mesa																																		
	B 5-8	Lopez Ridge				•									•					•	•	•				•		•		•		•		
	B 5-8	Crescent Heights				•									•					•	•	•				•		•		•				
	B 5-8	Tierra Alta			•	•			•				•	•		•		•										•						
	B 11	Mesa Norte		•																						•								•
	C 10-16	Winterwood													•					•			•			•		•				•		
	C 17-18	Fieldstone				•									•											•		•				•		
	C 27	Mira Mesa Market Center																								•								
	C 28	Maddox															•									•								
	D 5-8	Carroll Canyon				•								•	•					•	•					•								
	D 5-8	Parkdale Carroll Canyon				•								•	•					•	•					•								
	I 1	Arjons																								•								

Appendix F

Upland Species

Bauder Complex		UPLAND SPECIES	*Chamomilla suaveolens*	*Chenopodium murale*	*Chlorogalum parviflorum*	*Chlorogalum pomeridianum*	*Chlorogalum* spp.	*Chrysanthemum coronarium*	*Cistus* spp.	*Cirsium vulgare*	*Clematis pauciflora*	*Comarostaphylis diversifolia*	*Cneoridium dumosum*	*Crassula comnata*	*Crassula* spp.	*Croton californicus*	*Cryptantha intermedia*	*Cryptantha* spp.	*Cuscuta californica*	*Cuscuta* spp.	*Cynara cardunculus*	*Cynodon dactylon*	*Daucus carota*	*Daucus pusillus*	*Deinandra conjugens*	*Deinandra fasciculata*	*Descurainia pinnata*	*Dichelostemma capitata*	*Dichondra occidentalis*	*Dodecatheon clevelandii*	*Dudleya variegata*	*Encelia californica*	*Ephedra californica*	*Eremocarpus setigerus*
Nobel Drive																																	
	I 6	Bob Baker/ Bob Baker 2			•									•											•		•						
	I 12	Pueblo Lands	•											•											•								•
	X 5	Nobel Drive											•	•											•		•						•
	X 7	Nobel Research Park												•											•			•					•
Kearny Mesa																																	
	N 1-6	Montgomery Field																					•				•						
	N 7	Serra Mesa Library																							•								
	N 8	General Dynamics																							•								
	U 15	Magnatron																							•								
	U 15	Sander												•				•							•								
	U 19	Cubic																							•								
Mission Trails Regional Park																																	
	Q 2	Mission Trails Regional Park	•		•									•				•							•		•						
Urban San Diego																																	
	S 4	Kelton		•				•						•				•							•		•						•
Otay Lakes																																	

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Upland Species

	Bauder Complex		UPLAND SPECIES	*Chamomilla suaveolens*	*Chenopodium murale*	*Chlorogalum parviflorum*	*Chlorogalum pomeridianum*	*Chlorogalum* spp.	*Chrysanthemum coronarium*	*Cistus* spp.	*Cirsium vulgare*	*Clematis pauciflora*	*Comarostaphylis diversifolia*	*Cneoridium dumosum*	*Crassula comnata*	*Crassula* spp.	*Croton californicus*	*Cryptantha intermedia*	*Cryptantha* spp.	*Cuscuta californica*	*Cuscuta* spp.	*Cynara cardunculus*	*Cynodon dactylon*	*Daucus carota*	*Daucus pusillus*	*Deinandra conjugens*	*Deinandra fasciculata*	*Descurainia pinnata*	*Dichelostemma capitata*	*Dichondra occidentalis*	*Dodecatheon clevelandii*	*Dudleya variegata*	*Encelia californica*	*Ephedra californica*	*Eremocarpus setigerus*
	K 3, 5, 10, 13	Otay Lakes				•	•								•					•	•						•		•			•			•
	R 1	Proctor Valley													•												•								•
Otay Mesa																																		
	J 2 S	Otay Mesa Road Helix																									•	•							
	J 2 W	J 2 W		•					•						•												•	•							•
	J 2 W; J 31	Hidden Trails																																	
	J 3	J 3																																	
	J 4	J 4																																	
	J 4-5	Robinhood Ridge		•					•		•																•	•					•			•
	J 11 E	J 11 E		•	•			•							•					•								•	•	•	•			•		
	J 11 W	J 11 W		•					•						•														•		•			•		
	J 12	J 12		•					•																				•		•			•		
	J 13 E	J 13 E		•		•									•						•								•		•					
	J 13 N	J 13 N																											•							
	J 13 S	J 13 S																																		•
	J 14	J 14																											•							
	J 16-18	J 16-18				•									•						•				•				•		•			•		
	J 21	J 21		•	•				•							•				•								•	•	•					
	J 27	J 27				•									•					•	•							•						•		
	J 28 E	J 28 E													•					•								•							

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Chamomilla suaveolens*	*Chenopodium murale*	*Chlorogalum parviflorum*	*Chlorogalum pomeridianum*	*Chlorogalum* spp.	*Chrysanthemum coronarium*	*Cistus* spp.	*Cirsium vulgare*	*Clematis pauciflora*	*Comarostaphylis diversifolia*	*Cneoridium dumosum*	*Crassula comata*	*Crassula* spp.	*Croton californicus*	*Cryptantha intermedia*	*Cryptantha* spp.	*Cuscuta californica*	*Cuscuta* spp.	*Cynara cardunculus*	*Cynodon dactylon*	*Daucus carota*	*Daucus pusillus*	*Deinandra conjugens*	*Deinandra fasciculata*	*Descurainia pinnata*	*Dichelostemma capitata*	*Dichondra occidentalis*	*Dodecatheon clevelandii*	*Dudleya variegata*	*Encelia californica*	*Ephedra californica*	*Eremocarpus setigerus*
	J 29-30	J 29-30				•						•			•				•								•		•		•			
	J 31	J 31				•									•																			
	J 33	Sweetwater High School		•											•											•	•							
	J 34	J 34																																
Marron Valley																																		
	MM 1	Marron Valley													•		•	•									•	•	•				•	•

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Eriogonum fasciculatum*	*Eriophyllum confertiflorum*	*Erodium botrys*	*Erodium cicutarium*	*Erodium moschatum*	*Erodium* spp.	*Eschscholzia californica*	*Euphorbia misera*	*Eucalyptus* spp.	*Ferocactus viridescens*	*Filago californica*	*Filago* spp.	*Geranium carolinianum*	*Gnaphalium californicum*	*Gutierrezia californica*	*Hedypnois cretica*	*Herniaria hirsuta* ssp. *cinerea*	*Hirschfeldia incana*	*Holocarpha virgata*	*Hordeum* spp.	*Hordeum jubatum*	*Hypochoeris glabra*	*Isocoma arborea*	*Isocoma menziesii*	*Isocoma* spp.	*Isomeris arborea*	*Jepsonia malvifolia*	*Jepsonia* spp.	*Lamarckia aurea*	*Lasthenia californica*	*Layia platyglossa*	*Lepidium lasiocarpum* var. *lasiocarpum*
Del Mar Mesa																																			
	H 1-15	Del Mar Mesa					•	•	•						•										•							•	•		
	H 17	Shaw Texas				•			•														•		•										
	H 18-23	Rhodes													•										•										
	H 39	Greystone Torrey Highlands																																	
	H 40	Li Collins																																	
Carmel Mountain																																			
	H 38	Carmel Mountain		•				•	•						•										•								•		
Mira Mesa																																			
	B 5-8	Lopez Ridge		•					•					•			•							•		•							•		•
	B 5-8	Crescent Heights		•					•					•			•							•		•							•		•
	B 5-8	Tierra Alta		•	•	•							•		•				•							•							•		
	B 11	Mesa Norte				•	•		•					•						•				•	•		•							•		
	C 10-16	Winterwood		•					•	•																									
	C 17-18	Fieldstone							•					•			•								•	•									
	C 27	Mira Mesa Market Center																																	
	C 28	Maddox							•					•												•							•		
	D 5-8	Carroll Canyon				•			•	•				•												•									•
	D 5-8	Parkdale Carroll Canyon				•			•	•				•												•									•
	I 1	Arjons																																	

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Eriogonum fasciculatum*	*Eriophyllum confertiflorum*	*Erodium botrys*	*Erodium cicutarium*	*Erodium moschatum*	*Erodium* spp.	*Eschscholzia californica*	*Euphorbia misera*	*Eucalyptus* spp.	*Ferocactus viridescens*	*Filago californica*	*Filago* spp.	*Geranium carolinianum*	*Gnaphalium californicum*	*Gutierrezia californica*	*Hedypnois cretica*	*Herniaria hirsuta* ssp. *cinerea*	*Hirschfeldia incana*	*Holocarpha virgata*	*Hordeum* spp.	*Hordeum jubatum*	*Hypochoeris glabra*	*Isocoma arborea*	*Isocoma menziesii*	*Isocoma* spp.	*Isomeris arborea*	*Jepsonia malvifolia*	*Jepsonia* spp.	*Lamarckia aurea*	*Lasthenia californica*	*Layia platyglossa*	*Lepidium lasiocarpum* var. *lasiocarpum*
Nobel Drive																																			
	I 6	Bob Baker/ Bob Baker 2		•			•													•															
	I 12	Pueblo Lands		•					•						•								•		•	•									
	X 5	Nobel Drive		•		•	•	•						•						•			•			•		•							
	X 7	Nobel Research Park		•	•																		•				•							•	
Kearny Mesa																																			
	N 1-6	Montgomery Field		•																				•	•										
	N 7	Serra Mesa Library																																	
	N 8	General Dynamics																																	
	U 15	Magnatron																																	
	U 15	Sander		•					•			•			•									•											
	U 19	Cubic																																	
Mission Trails Regional Park																																			
	Q 2	Mission Trails Regional Park		•					•				•	•										•	•						•		•		
Urban San Diego																																			
	S 4	Kelton		•	•				•						•		•		•			•			•									
Otay Lakes																																			

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Eriogonum fasciculatum*	*Eriophyllum confertiflorum*	*Erodium botrys*	*Erodium cicutarium*	*Erodium moschatum*	*Erodium* spp.	*Eschscholzia californica*	*Euphorbia misera*	*Eucalyptus* spp.	*Ferocactus viridescens*	*Filago californica*	*Filago* spp.	*Geranium carolinianum*	*Gnaphalium californicum*	*Gutierrezia californica*	*Hedypnois cretica*	*Herniaria hirsuta* ssp. *cinerea*	*Hirschfeldia incana*	*Holocarpha virgata*	*Hordeum* spp.	*Hordeum jubatum*	*Hypochoeris glabra*	*Isocoma arborea*	*Isocoma menziesii*	*Isocoma* spp.	*Isomeris arborea*	*Jepsonia malvifolia*	*Jepsonia* spp.	*Lamarckia aurea*	*Lasthenia californica*	*Layia platyglossa*	*Lepidium lasiocarpum* var. *lasiocarpum*
	K 3, 5, 10, 13	Otay Lakes		•			•	•		•														•	•	•		•				•		•
	R 1	Proctor Valley												•																					
Otay Mesa																																		
	J 2 S	Otay Mesa Road Helix												•										•		•							•		
	J 2 W	J 2 W												•					•					•			•							•
	J 2 W; J 31	Hidden Trails							•																									
	J 3	J 3																																
	J 4	J 4																																
	J 4-5	Robinhood Ridge		•					•				•	•			•		•				•	•		•		•				•		•
	J 11 E	J 11 E		•			•	•	•		•		•											•			•				•	•		•
	J 11 W	J 11 W						•	•													•		•		•	•	•				•		•
	J 12	J 12		•			•	•	•	•					•									•			•			•		•		•
	J 13 E	J 13 E				•			•	•				•			•								•	•	•				•		•		
	J 13 N	J 13 N				•																		•		•									
	J 13 S	J 13 S																						•		•									
	J 14	J 14																						•											
	J 16-18	J 16-18		•			•	•	•				•		•																		•		•
	J 21	J 21		•				•																	•										
	J 27	J 27		•			•	•							•				•					•		•						•		•
	J 28 E	J 28 E		•		•		•					•		•									•		•									•

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Eriogonum fasciculatum*	*Eriophyllum confertiflorum*	*Erodium botrys*	*Erodium cicutarium*	*Erodium moschatum*	*Erodium* spp.	*Eschscholzia californica*	*Euphorbia misera*	*Eucalyptus* spp.	*Ferocactus viridescens*	*Filago californica*	*Filago* spp.	*Geranium carolinianum*	*Gnaphalium californicum*	*Gutierrezia californica*	*Hedypnois cretica*	*Herniaria hirsuta* ssp. *cinerea*	*Hirschfeldia incana*	*Holocarpha virgata*	*Hordeum* spp.	*Hordeum jubatum*	*Hypochoeris glabra*	*Isocoma arborea*	*Isocoma menziesii*	*Isocoma* spp.	*Isomeris arborea*	*Jepsonia malvifolia*	*Jepsonia* spp.	*Lamarckia aurea*	*Lasthenia californica*	*Layia platyglossa*	*Lepidium lasiocarpum* var. *lasiocarpum*
	J 29-30	J 29-30		•		•	•	•	•				•		•									•		•			•			•		•
	J 31	J 31		•		•	•	•					•		•				•							•	•					•	•		•
	J 33	Sweetwater High School				•			•															•		•									•
	J 34	J 34																																	
Marron Valley																																			
	MM 1	Marron Valley																•					•					•		•			•	•	

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Lepidium nitidum*	*Lepidium* spp.	*Leymus condensatus*	*Linanthus dianthiflorus*	*Linaria canadensis*	*Lomatium dasycarpum*	*Lomatium* spp.	*Lotus scoparius*	*Lotus* spp.	*Lotus strigosus*	*Lupinus bicolor*	*Lupinus* spp.	*Lycium californicum*	*Malacothamnus fasciculatus*	*Malosma laurina*	*Malva parviflora*	*Malvella leprosa*	*Marah macrocarpus*	*Medicago polymorpha*	*Melica imperfecta*	*Melilotus* spp.	*Mesembryanthemum crystallinum*	*Mesembryanthemum nodiflorum*	*Mimulus aurantiacus*	*Mirabilis californica*	*Muilla clevelandii*	*Muilla maritima*	*Muilla* spp.	*Nassella lepida*	*Nassella pulchra*	*Navarretia hamata*	*Navarretia prolifera*
Del Mar Mesa																																		
	H 1-15	Del Mar Mesa						•			•						•	•			•														
	H 17	Shaw Texas																																
	H 18-23	Rhodes						•			•										•								•					
	H 39	Greystone Torrey Highlands																																
	H 40	Li Collins																																
Carmel Mountain																																		
	H 38	Carmel Mountain				•		•			•							•	•															•	
Mira Mesa																																		
	B 5-8	Lopez Ridge									•				•													•					•	•	
	B 5-8	Crescent Heights									•				•													•					•	•	
	B 5-8	Tierra Alta			•		•	•										•			•		•	•					•					•	
	B 11	Mesa Norte									•								•			•												•	
	C 10-16	Winterwood									•							•			•					•						•	•	•	
	C 17-18	Fieldstone									•							•			•			•									•	•	
	C 27	Mira Mesa Market Center																																		
	C 28	Maddox									•							•						•		•									
	D 5-8	Carroll Canyon						•			•							•			•			•									•	•	
	D 5-8	Parkdale Carroll Canyon						•			•							•			•			•									•	•	
	I 1	Arjons																																		

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Lepidium nitidum*	*Lepidium* spp.	*Leymus condensatus*	*Linanthus dianthiflorus*	*Linaria canadensis*	*Lomatium dasycarpum*	*Lomatium* spp.	*Lotus scoparius*	*Lotus* spp.	*Lotus strigosus*	*Lupinus bicolor*	*Lupinus* spp.	*Lycium californicum*	*Malacothamnus fasciculatus*	*Malosma laurina*	*Malva parviflora*	*Malvella leprosa*	*Marah macrocarpus*	*Medicago polymorpha*	*Melica imperfecta*	*Melilotus* spp.	*Mesembryanthemum crystallinum*	*Mesembryanthemum nodiflorum*	*Mimulus aurantiacus*	*Mirabilis californica*	*Muilla clevelandii*	*Muilla maritima*	*Muilla* spp.	*Nassella lepida*	*Nassella pulchra*	*Navarretia hamata*	*Navarretia prolifera*
Nobel Drive																																		
	I 6	Bob Baker/ Bob Baker 2									•																		•					
	I 12	Pueblo Lands									•													•		•				•			•	•	
	X 5	Nobel Drive						•			•							•			•									•				
	X 7	Nobel Research Park						•										•												•			•	
Kearny Mesa																																		
	N 1-6	Montgomery Field									•			•				•			•												•	•	
	N 7	Serra Mesa Library																																	
	N 8	General Dynamics																•																	
	U 15	Magnatron																•																	
	U 15	Sander								•										•															
	U 19	Cubic																•																	
Mission Trails Regional Park																																		
	Q 2	Mission Trails Regional Park		•							•							•															•		
Urban San Diego																																		
	S 4	Kelton									•							•								•					•	•	•	
Otay Lakes																																		

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Lepidium nitidum*	*Lepidium* spp.	*Leymus condensatus*	*Linanthus dianthiflorus*	*Linaria canadensis*	*Lomatium dasycarpum*	*Lomatium* spp.	*Lotus scoparius*	*Lotus* spp.	*Lotus strigosus*	*Lupinus bicolor*	*Lupinus* spp.	*Lycium californicum*	*Malacothamnus fasciculatus*	*Malosma laurina*	*Malva parviflora*	*Malvella leprosa*	*Marah macrocarpus*	*Medicago polymorpha*	*Melica imperfecta*	*Melilotus* spp.	*Mesembryanthemum crystallinum*	*Mesembryanthemum nodiflorum*	*Mimulus aurantiacus*	*Mirabilis californica*	*Muilla clevelandii*	*Muilla maritima*	*Muilla* spp.	*Nassella lepida*	*Nassella pulchra*	*Navarretia hamata*	*Navarretia prolifera*
	K 3, 5, 10, 13	Otay Lakes					•	•	•	•	•			•				•												•			•		
	R 1	Proctor Valley																													•			•	•	
Otay Mesa																																				
	J 2 S	Otay Mesa Road Helix																																		
	J 2 W	J 2 W									•															•									
	J 2 W; J 31	Hidden Trails																																		
	J 3	J 3																																		
	J 4	J 4																																		
	J 4-5	Robinhood Ridge																								•							•			
	J 11 E	J 11 E			•		•				•							•		•	•			•		•		•					•		
	J 11 W	J 11 W																•			•				•	•									
	J 12	J 12					•											•			•		•	•			•								
	J 13 E	J 13 E																	•							•										
	J 13 N	J 13 N																		•																
	J 13 S	J 13 S																								•										
	J 14	J 14																																		
	J 16-18	J 16-18					•														•															
	J 21	J 21																							•											
	J 27	J 27																				•				•								•		
	J 28 E	J 28 E																				•				•								•		

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Lepidium nitidum*	*Lepidium* spp.	*Leymus condensatus*	*Linanthus dianthiflorus*	*Linaria canadensis*	*Lomatium dasycarpum*	*Lomatium* spp.	*Lotus scoparius*	*Lotus* spp.	*Lotus strigosus*	*Lupinus bicolor*	*Lupinus* spp.	*Lycium californicum*	*Malacothamnus fasciculatus*	*Malosma laurina*	*Malva parviflora*	*Malvella leprosa*	*Marah macrocarpus*	*Medicago polymorpha*	*Melica imperfecta*	*Melilotus* spp.	*Mesembryanthemum crystallinum*	*Mesembryanthemum nodiflorum*	*Mimulus aurantiacus*	*Mirabilis californica*	*Muilla clevelandii*	*Muilla maritima*	*Muilla* spp.	*Nassella lepida*	*Nassella pulchra*	*Navarretia hamata*	*Navarretia prolifera*
	J 29-30	J 29-30									•					•															•		•		
	J 31	J 31																																	
	J 33	Sweetwater High School																																•	
	J 34	J 34																																	
Marron Valley																																			
	MM 1	Marron Valley										•	•	•					•								•						•		

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Nicotiana quadrivalvis*	*Opuntia littoralis*	*Opuntia prolifera*	*Osmadenia tenella*	*Phacelia* spp.	*Phoenix canariensis*	*Pholistoma raccemosum*	*Plantago erecta*	*Quercus dumosa*	*Quercus* spp.	*Raphanus sativus*	*Raphanus* spp.	*Rhamnus crocea*	*Rhus integrifolia*	*Salsola tragus*	*Salvia apiana*	*Salvia mellifera*	*Salvia munzii*	*Sanicula arguta*	*Schismus barbatus*	*Selaginella cinerascens*	*Senecio vulgaris*	*Sidalcea malvaeflora*	*Silene gallica*	*Simmondsia chinensis*	*Sisyrinchium bellum*	*Sonchus asper*	*Sonchus oleraceus*	*Spergula arvensis*	*Spergularia bocconi*	*Spergularia* spp.	*Stephanomeria virgata*
Del Mar Mesa																																			
	H 1-15	Del Mar Mesa																																	
	H 17	Shaw Texas																														•		
	H 18-23	Rhodes								•	•												•					•						
	H 39	Greystone Torrey Highlands																										•				•		
	H 40	Li Collins																																	
Carmel Mountain																																		
	H 38	Carmel Mountain						•		•	•									•				•			•								
Mira Mesa																																		
	B 5-8	Lopez Ridge								•									•		•		•			•		•	•					
	B 5-8	Crescent Heights								•									•		•		•			•		•	•					
	B 5-8	Tierra Alta								•	•					•			•							•			•					•
	B 11	Mesa Norte																								•		•		•		•	•	
	C 10-16	Winterwood			•				•		•		•			•								•			•		•	•				
	C 17-18	Fieldstone																	•					•				•		•				
	C 27	Mira Mesa Market Center																						•				•						
	C 28	Maddox																	•										•			•		
	D 5-8	Carroll Canyon			•						•																		•					
	D 5-8	Parkdale Carroll Canyon			•						•																		•					
	I 1	Arjons																						•										

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Nicotiana quadrivalvis*	*Opuntia littoralis*	*Opuntia prolifera*	*Osmadenia tenella*	*Phacelia* spp.	*Phoenix canariensis*	*Pholistoma raccemosum*	*Plantago erecta*	*Quercus dumosa*	*Quercus* spp.	*Raphanus sativus*	*Raphanus* spp.	*Rhammus crocea*	*Rhus integrifolia*	*Salsola tragus*	*Salvia apiana*	*Salvia mellifera*	*Salvia munzii*	*Sanicula arguta*	*Schismus barbatus*	*Selaginella cinerascens*	*Senecio vulgaris*	*Sidalcea malvaeflora*	*Silene gallica*	*Simmondsia chinensis*	*Sisyrinchium bellum*	*Sonchus asper*	*Sonchus oleraceus*	*Spergula arvensis*	*Spergularia bocconi*	*Spergularia* spp.	*Stephanomeria virgata*
Nobel Drive																																		
	I 6	Bob Baker/ Bob Baker 2								•	•						•			•															
	I 12	Pueblo Lands																•					•												
	X 5	Nobel Drive								•		•					•										•						•	•
	X 7	Nobel Research Park					•										•																•	
Kearny Mesa																																		
	N 1-6	Montgomery Field																		•				•			•			•	•			
	N 7	Serra Mesa Library																																
	N 8	General Dynamics																																
	U 15	Magnatron																																
	U 15	Sander								•				•		•								•			•							
	U 19	Cubic																																
Mission Trails Regional Park																																		
	Q 2	Mission Trails Regional Park			•																			•			•			•			•	
Urban San Diego																																		
	S 4	Kelton			•												•	•	•				•					•				•		•
Otay Lakes																																		

Appendix F
Upland Species

	Bauder Complex		UPLAND SPECIES	*Nicotiana quadrivalvis*	*Opuntia littoralis*	*Opuntia prolifera*	*Osmadenia tenella*	*Phacelia* spp.	*Phoenix canariensis*	*Pholistoma raccemosum*	*Plantago erecta*	*Quercus dumosa*	*Quercus* spp.	*Raphanus sativus*	*Raphanus* spp.	*Rhamnus crocea*	*Rhus integrifolia*	*Salsola tragus*	*Salvia apiana*	*Salvia mellifera*	*Salvia munzii*	*Sanicula arguta*	*Schismus barbatus*	*Selaginella cinerascens*	*Senecio vulgaris*	*Sidalcea malvaeflora*	*Silene gallica*	*Simmondsia chinensis*	*Sisyrinchium bellum*	*Sonchus asper*	*Sonchus oleraceus*	*Spergula arvensis*	*Spergularia bocconi*	*Spergularia* spp.	*Stephanomeria virgata*
	K 3, 5, 10, 13	Otay Lakes									•										•			•		•	•		•					
	R 1	Proctor Valley					•																									•		
Otay Mesa																																		
	J 2 S	Otay Mesa Road Helix																															•		
	J 2 W	J 2 W															•	•												•				
	J 2 W; J 31	Hidden Trails																																	
	J 3	J 3																•																
	J 4	J 4																																
	J 4-5	Robinhood Ridge									•							•											•		•		•		
	J 11 E	J 11 E						•		•	•						•	•	•					•				•		•			•	
	J 11 W	J 11 W						•								•	•											•					•	
	J 12	J 12								•	•																	•			•	•		
	J 13 E	J 13 E									•													•				•			•	•		
	J 13 N	J 13 N																																
	J 13 S	J 13 S																														•		
	J 14	J 14									•																							
	J 16-18	J 16-18		•		•					•						•							•				•						
	J 21	J 21																						•	•				•					
	J 27	J 27			•													•						•	•	•			•	•				
	J 28 E	J 28 E																•					•	•					•					

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Nicotiana quadrivalvis*	*Opuntia littoralis*	*Opuntia prolifera*	*Osmadenia tenella*	*Phacelia* spp.	*Phoenix canariensis*	*Pholistoma raccemosum*	*Plantago erecta*	*Quercus dumosa*	*Quercus* spp.	*Raphanus sativus*	*Raphanus* spp.	*Rhamnus crocea*	*Rhus integrifolia*	*Salsola tragus*	*Salvia apiana*	*Salvia mellifera*	*Salvia munzii*	*Sanicula arguta*	*Schismus barbatus*	*Selaginella cinerascens*	*Senecio vulgaris*	*Sidalcea malvaeflora*	*Silene gallica*	*Simmondsia chinensis*	*Sisyrinchium bellum*	*Sonchus asper*	*Sonchus oleraceus*	*Spergula arvensis*	*Spergularia bocconi*	*Spergularia* spp.	*Stephanomeria virgata*
	J 29-30	J 29-30			•	•					•						•	•						•	•	•	•		•	•	•			
	J 31	J 31				•																		•			•		•	•				
	J 33	Sweetwater High School									•																						•		
	J 34	J 34																																	
Marron Valley																																		
	MM 1	Marron Valley				•	•	•			•			•		•			•				•				•		•					•	

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Stylocline* spp.	*Uropappus lindleyi*	*Urtica urens*	*Verbena menthifolia*	*Verbena* spp.	*Viguiera laciniata*	*Viola pedunculata*	*Vulpia myuros*	*Vulpia octoflora*	*Yucca schidigera*	*Yucca* spp.	*Yucca whipplei*	*Xylococcus bicolor*	*Zigadenus fremontii*
Del Mar Mesa																	
	H 1-15	Del Mar Mesa									•	•				•	
	H 17	Shaw Texas									•						
	H 18-23	Rhodes									•	•					
	H 39	Greystone Torrey Highlands															
	H 40	Li Collins															
Carmel Mountain																	
	H 38	Carmel Mountain		•										•		•	
Mira Mesa																	
	B 5-8	Lopez Ridge		•													
	B 5-8	Crescent Heights		•													
	B 5-8	Tierra Alta											•			•	
	B 11	Mesa Norte									•						
	C 10-16	Winterwood							•				•				
	C 17-18	Fieldstone															•
	C 27	Mira Mesa Market Center															
	C 28	Maddox															
	D 5-8	Carroll Canyon									•						
	D 5-8	Parkdale Carroll Canyon									•						
	I 1	Arjons										•					

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Stylocline* spp.	*Uropappus lindleyi*	*Urtica urens*	*Verbena menthifolia*	*Verbena* spp.	*Viguiera laciniata*	*Viola pedunculata*	*Vulpia myuros*	*Vulpia octoflora*	*Yucca schidigera*	*Yucca* spp.	*Yucca whipplei*	*Xylococcus bicolor*	*Zigadenus fremontii*
Nobel Drive																	
	I 6	Bob Baker/ Bob Baker 2															
	I 12	Pueblo Lands															
	X 5	Nobel Drive								•	•						
	X 7	Nobel Research Park									•					•	
Kearny Mesa																	
	N 1-6	Montgomery Field															
	N 7	Serra Mesa Library															
	N 8	General Dynamics															
	U 15	Magnatron															
	U 15	Sander															
	U 19	Cubic															
Mission Trails Regional Park																	
	Q 2	Mission Trails Regional Park							•								
Urban San Diego																	
	S 4	Kelton		•					•				•				
Otay Lakes																	

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Stylocline* spp.	*Uropappus lindleyi*	*Urtica urens*	*Verbena menthifolia*	*Verbena* spp.	*Viguiera laciniata*	*Viola pedunculata*	*Vulpia myuros*	*Vulpia octoflora*	*Yucca schidigera*	*Yucca* spp.	*Yucca whipplei*	*Xylococcus bicolor*	*Zigadenus fremontii*
	K 3, 5, 10, 13	Otay Lakes									•						
	R 1	Proctor Valley									•						
Otay Mesa																	
	J 2 S	Otay Mesa Road Helix									•						
	J 2 W	J 2 W															
	J 2 W; J 31	Hidden Trails															
	J 3	J 3															
	J 4	J 4															
	J 4-5	Robinhood Ridge									•						
	J 11 E	J 11 E					•		•								
	J 11 W	J 11 W					•										
	J 12	J 12									•						
	J 13 E	J 13 E															•
	J 13 N	J 13 N															
	J 13 S	J 13 S															
	J 14	J 14															
	J 16-18	J 16-18							•		•						•
	J 21	J 21				•					•						
	J 27	J 27															
	J 28 E	J 28 E			•												

Appendix F

Upland Species

	Bauder Complex		UPLAND SPECIES	*Stylocline* spp.	*Uropappus lindleyi*	*Urtica urens*	*Verbena menthifolia*	*Verbena* spp.	*Viguiera laciniata*	*Viola pedunculata*	*Vulpia myuros*	*Vulpia octoflora*	*Yucca schidigera*	*Yucca* spp.	*Yucca whipplei*	*Xylococcus bicolor*	*Zigadenus fremontii*
	J 29-30	J 29-30															
	J 31	J 31															
	J 33	Sweetwater High School						•			•						
	J 34	J 34															
Marron Valley																	
	MM 1	Marron Valley					•				•				•		

APPENDIX G
SENSITIVE SPECIES BY SITE

Appendix G

Threatened/Endangered Plant Species by Site

Area	Revised Bauder ID	Site	Number of Basins	Basin Acreage	Erar Basins	Erar Sq. Feet	Nafo Basins	Nafo Sq. Feet
Otay Lakes								
	K 3, 5, 10, 13	Otay Lakes	87	2.89	47	1,645	2	24
	R 1	Proctor Valley	19	0.25	0	0	0	0
Otay Mesa								
	J 2 S	Otay Mesa Road Helix	13	0.21	13	3,058	1	3
	J 2 S, J 2 W	Otay Mesa Road Pardee	31	0.31	0	0	0	0
	J 2 W	Otay Mesa Road Recon	20	0.45	20	2,152	9	41
	J 2 W	J 2 W	59	0.68	1	16	0	0
	J 2 N/W/S	Recon Cal Terraces	271	2.89	243	58,341	69	1,314
	J 2 W; J 31	Hidden Trails	42	0.13	0	0	0	0
	J 3	J 3	5	0.087	0	0	0	0
	J 4	J 4	11	0.094	0	0	0	0
	J 4-5	Robinhood Ridge	83	0.56	46	5,225	4	13
	J 11 E	J 11 E	2	0.63	0	0	0	0
	J 11 W	J 11 W	5	0.49	0	0	0	0
	J 12	J 12	5	0.28	0	0	0	0
	J 13 E	J 13 E	8	0.059	1	15	0	0
	J 13 N	J 13 N	41	0.28	2	53	1	17
	J 13 S	J 13 S	44	0.62	7	393	0	0
	J 14	J 14	58	0.60	0	0	1	52
	J 14	905	7	0.069	0	0	0	0
	J 14	Recon South	64	1.4	48	1,760	4	7
	J 15	Arnie's Point	29	0.65	16	347	0	0
	J 16-18	J 16-18	13	0.40	4	206	0	0
	J 16-18	Wruck Canyon	6	0.016	0	0	0	0
	J 21	J 21	7	0.21	0	0	0	0
	J 27	J 27	10	0.23	9	564	0	0
	J 28 E	J 28 E	5	0.16	0	0	0	0
	J 29-30	J 29-30	76	0.98	42	1,155	0	0
	J 32	West Otay A + B	44	0.34	4	48	3	18
	J 33	Sweetwater High School	8	0.065	2	15	3	7
	J 34	J 34	14	0.15	0	0	0	0
	J 35	Brown Field	2	0.010	0	0	0	0
Marron Valley								
	MM 1	Marron Valley	14	0.18	0	0	0	0
Totals			**2,516.00**	**38.96**	**804.00**	**98,383.00**	**99.00**	**1,516.00**

Appendix G

Threatened/Endangered Plant Species by Site

Area	Revised Bauder ID	Site	Orca		Poab		Ponu	
			Basins	Sq. Feet	Basins	Sq. Feet	Basins	Sq. Feet
Del Mar Mesa								
	H 1-15	Del Mar Mesa	0	0	63	2,490	0	0
	H 17	Shaw Texas	0	0	0	0	0	0
	H 18-23	Rhodes	0	0	7	80	0	0
	H 39	Greystone Torrey Highlands	0	0	5	51	0	0
	H 40	Li Collins	0	0	0	0	0	0
Carmel Mountain								
	H 38	Carmel Mountain	0	0	0	0	0	0
Mira Mesa								
	B 5-6	Tierra Alta	0	0	0	0	0	0
	B 5-8	Lopez Ridge	0	0	13	395	0	0
	B 5-8	Crescent Heights	0	0	0	0	0	0
	B 11	Mesa Norte	0	0	13	296	0	0
	C 10-16	Winterwood	0	0	27	1,128	0	0
	C 17-18	Fieldstone	0	0	8	4,754	0	0
	C 27	Mira Mesa Market Center	0	0	1	12	0	0
	C 28	Maddox	0	0	0	0	0	0
	D 5-8	Parkdale Carroll Canyon	0	0	0	0	0	0
	D 5-8	Carroll Canyon Preserve	0	0	42	361	0	0
	I 1	Arjons	0	0	22	3,569	0	0
Nobel Drive								
	I 6 B	Bob Baker	0	0	7	76	0	0
	I 6 C	Bob Baker 2	0	0	11	606	0	0
	I 12	Pueblo Lands	0	0	0	0	0	0
	X 5	Nobel Drive	0	0	0	0	0	0
	X 7	Nobel Research Park	0	0	0	0	0	0
Kearny Mesa								
	N 1-6	Montgomery Field	0	0	131	19,523	0	0
	N 7	Serra Mesa Library	0	0	0	0	0	0
	N 8	General Dynamics	0	0	20	2,222	0	0
	U 15	Magnatron	0	0	0	0	0	0
	U 15	Sander	0	0	1	652	0	0
	U 19	Cubic	0	0	1	3	0	0
Mission Trails Regional Park								
	Q 2	Mission Trails Regional Park	0	0	0	0	0	0
Urban San Diego								
	S 4	Kelton	0	0	0	0	0	0

Appendix G

Threatened/Endangered Plant Species by Site

Area	Revised Bauder ID	Site	Number of Basins	Basin Acreage	Erar Basins	Erar Sq. Feet	Nafo Basins	Nafo Sq. Feet
Del Mar Mesa								
	H 1-15	Del Mar Mesa	344	5.5	186	19,342	0	0
	H 17	Shaw Texas	26	0.23	0	0	0	0
	H 18-23	Rhodes	152	0.75	6	268	0	0
	H 39	Greystone Torrey Highlands	19	0.68	3	188	0	0
	H 40	Li Collins	2	0.38	0	0	0	0
Carmel Mountain								
	H 38	Carmel Mountain	30	0.32	0	0	0	0
Mira Mesa								
	B 5-6	Tierra Alta	1	0.0055	0	0	0	0
	B 5-8	Lopez Ridge	13	0.48	1	>1	0	0
	B 5-8	Crescent Heights	7	0.042	0	0	0	0
	B 11	Mesa Norte	45	0.58	10	186	0	0
	C 10-16	Winterwood	61	0.81	7	71	0	0
	C 17-18	Fieldstone	9	0.32	0	0	0	0
	C 27	Mira Mesa Market Center	1	0.057	0	0	0	0
	C 28	Maddox	82	0.97	0	0	0	0
	D 5-8	Parkdale Carroll Canyon	4	0.021	0	0	0	0
	D 5-8	Carroll Canyon Preserve	119	1.19	65	2,550	1	9
	I 1	Arjons	34	0.73	15	617	0	0
Nobel Drive								
	I 6 B	Bob Baker	8	0.077	0	0	0	0
	I 6 C	Bob Baker 2	15	0.24	2	41	0	0
	I 12	Pueblo Lands	3	0.017	0	0	0	0
	X 5	Nobel Drive	7	0.085	0	0	1	11
	X 7	Nobel Research Park	28	0.098	0	0	0	0
Kearny Mesa								
	N 1-6	Montgomery Field	276	6.76	0	0	0	0
	N 7	Serra Mesa Library	25	0.36	0	0	0	0
	N 8	General Dynamics	21	0.40	2	92	0	0
	U 15	Magnatron	1	0.34	0	0	0	0
	U 15	Sander	33	0.44	0	0	0	0
	U 19	Cubic	29	0.45	2	35	0	0
Mission Trails Regional Park								
	Q 2	Mission Trails Regional Park	15	0.24	0	0	0	0
Urban San Diego								
	S 4	Kelton	3	0.022	0	0	0	0

Appendix G

Threatened/Endangered Plant Species by Site

Area	Revised Bauder ID	Site	Orca		Poab		Ponu	
			Basins	Sq. Feet	Basins	Sq. Feet	Basins	Sq. Feet
Otay Lakes								
	K 3, 5, 10, 13	Otay Lakes	0	0	0	0	0	0
	R 1	Proctor Valley	0	0	0	0	0	0
Otay Mesa								
	J 2 S	Otay Mesa Road Helix	1	5	0	0	13	151
	J 2 S, J 2 W	Otay Mesa Road Pardee	0	0	0	0	0	0
	J 2 W	Otay Mesa Road Recon	9	74	0	0	20	1,938
	J 2 W	J 2 W	0	0	0	0	0	0
	J 2 N/W/S	Recon Cal Terraces	42	2,350	0	0	254	27,972
	J 2 W; J 31	Hidden Trails	0	0	0	0	0	0
	J 3	J 3	0	0	0	0	0	0
	J 4	J 4	0	0	0	0	0	0
	J 4-5	Robinhood Ridge	0	0	0	0	19	182
	J 11 E	J 11 E	0	0	0	0	0	0
	J 11 W	J 11 W	0	0	0	0	0	0
	J 12	J 12	0	0	0	0	0	0
	J 13 E	J 13 E	0	0	0	0	0	0
	J 13 N	J 13 N	1	248	0	0	0	0
	J 13 S	J 13 S	0	0	0	0	0	0
	J 14	J 14	0	0	0	0	1	52
	J 14	905	0	0	0	0	0	0
	J 14	Recon South	5	>1	0	0	55	1,505
	J 15	Arnie's Point	0	0	0	0	0	0
	J 16-18	J 16-18	0	0	0	0	0	0
	J 16-18	Wruck Canyon	0	0	0	0	0	0
	J 21	J 21	0	0	0	0	0	0
	J 27	J 27	0	0	0	0	0	0
	J 28 E	J 28 E	0	0	0	0	0	0
	J 29-30	J 29-30	0	0	0	0	1	2
	J 32	West Otay A + B	0	0	0	0	8	22
	J 33	Sweetwater High School	0	0	0	0	5	9
	J 34	J 34	0	0	0	0	0	0
	J 35	Brown Field	0	0	0	0	0	0
Marron Valley								
	MM 1	Marron Valley	0	0	0	0	0	0
Totals			**58**	**2,677.00**	**372**	**36,218.00**	**376**	**31,833.00**

APPENDIX H
PRELIMINARY RESULTS OF FAIRY SHRIMP GENETICS STUDY

MSCP vernal pool inventory
City of San Diego (USFWS)
Conservation genetics of the endangered fairy shrimp species Branchinecta sandiegonensis

Andrew J. Bohonak, Department of Biology, San Diego State University

May 17. 2004

This is a preliminary report for the contract "*Genetic testing of the endangered fairy shrimp species* Branchinecta sandiegonensis" to A.J. Bohonak from the City of San Diego. This two year contract was set up in late 2002 and work for the project officially began January 1, 2003.

The information here supersedes that from reports submitted in November and December 2003, but should still be considered preliminary.

Motivation

Worldwide changes in land use (primarily agriculture and urbanization) have led to a global loss of temporary wetlands. In southern California, it is estimated that 95% of the vernal pools have been lost (Bauder 1998 and references therein). The threats to these naturally fragmented habitats are compounded by their inherent natural isolation at both local and regional scales. (Local metapopulations of ponds are found in areas where hydrologic conditions facilitate pool formation. Regionally, these pool complexes are separated kilometers or tens of kilometers by geologically unfavorable terrain.) Contemporary and historical connectivity between pools at these two scales is largely a matter of speculation (Bohonak & Jenkins, 2003). Because the continued loss of vernal pools may interact in complex ways with future climate change, there are many uncertainties concerning the persistence of vernal pool habitats, their associated ecosystem services and the endangered species they maintain (Pyke 2004).

Fairy shrimp (Crustacea: Branchiopoda: Anostraca) are relatively large crustacean zooplankton (> 10 mm) restricted almost entirely to temporary wetlands worldwide. Five Anostracan species are listed on the U.S. Endangered Species list, and several more are under consideration. Over 30 fairy shrimp are considered threatened or endangered worldwide. This project examined population genetic structure in the federally endangered fairy shrimp *Branchinecta sandiegonensis* in order to gain insight into contemporary and historical connectivity among pools and pool complexes, and make conservation recommendations.

To date, only allozymes have been used to study genetic structure in this species (Davies et al. 1997), and there are no DNA-level population genetic studies for any fairy shrimp. Davies et al. (1997) found significant genetic differentiation among 10 pools for *B. sandiegonensis* using allozymes, and evidence for a "temporal Wahlund effect" within pools. (The importance of overlapping generations created by the fairy shrimp cyst bank may be reflected by heterozygote deficiencies within each pond.) The goal of this study is to expand coverage to include the majority of the species range, including all pool complexes on City property. The choice of mitochondrial DNA sequence variation over allozymes for this study reflects the higher degree of precision that can be obtained with mtDNA sequencing. Also, sequence-level variation permits a wider range of analyses that can be used to unravel contemporary and historical processes such as allopatric isolation and gene flow.

Methods

Fairy shrimp were collected as adults or hatched from sediment samples by Marie A. Simovich (University of San Diego), a subcontractee and collaborator on this project. Simovich is permitted by USFWS for work on *B. sandiegonensis*, and Bohonak is listed under that permit. Individuals were collected from across southern California, identified to species according to Eriksen and Belk (1999), and stored in 95% ethanol or at -80° C until analysis. A map containing most of the collection locations is provided in Figure 1. We sampled additional ponds not specifically located on City of San Diego property, so that our results represent the dispersal biology and evolutionary history of this species across its entire range.

Protocol for amplifying a 658 bp portion of the mitochondrial gene cytochrome oxidase I (COI) was adapted from existing lab protocol for arthropods. (Bohonak has developed universal primers similar to LCO-1490 and HCO-2198 of Folmer et al. 1994). PCR products were cycle sequenced using BigDye v. 3 termination (Perkin-Elmer) and sequenced on an ABI 377 automated sequencer. Sequence alignments were conducted by eye using the program Sequencher. (Alignment is largely trivial, since COI is a protein-coding gene, and no insertions or deletions were detected.) Most individuals were cycle sequenced once in each direction.

For the final data set, evolutionary relationships among haplotypes will be determined using maximum parsimony with PAUP 4.0 (Swofford 2001), using Bayesian analysis with Mr. Bayes (Huelsenbeck and Ronquist 2004) and with network parsimony reconstruction as implemented in TCS (Clement et al. 2000). General population genetics summary statistics will be calculated using Arlequin v. 2.0 (Schneider et al. 2001). Geographic patterns will be interpreted using isolation by distance analyses (Bohonak 2002), standard phylogeography and nested clade analysis (Templeton 1998) using GeoDis (Posada et al. 2000). For this preliminary report on the preliminary data set, only a small subset of these analyses is presented.

Results

To date, DNA has been extracted from over 520 individual *B. sandiegonensis* from over 65 pools in 24 "pool complexes". (A pool complex is a local metapopulation of hydrologically linked pools). An additional 50 fairy shrimp from other species have also been extracted for use in comparative studies and as outgroups. Because data collection will be ongoing for another seven months, I present here a preliminary summary of haplotype distributions within and among pools for 223 individuals that have been sequenced to date.

Haplotype distributions

From the 223 *B. sandiegonensis* sequenced, 39 unique haplotypes ("alleles") have been found. Each of these alleles is a sequence that differs from all others by one or more base pairs. Table 1 summarizes allele distributions within and among pools, pool complexes and geographic regions. Unfortunately, there may be some confusion in nomenclature: the City's labeling scheme calls geographic regions "Complexes" and local metapopulation of hydrologically connected pools "Sites", although I prefer to call a local hydrologically linked set of pools a "complex. For clarity, Table 1 lists pools nested within complexes, nested within regions.

There are two dominant features in this data set. First, the numbers generally fall out along a diagonal, indicating that pool complexes are often fixed for unique haplotypes found nowhere else in the species. There is a high degree of endemicity apparent within local groups of hydrologically linked pools, and genetic differentiation among regions is high. This is particularly obvious in areas such as Ramona, Otay Mesa, Otay Lakes and Marron Valley, which have less influence from development and recreation than sites in Mira Mesa and Del Mar.

Second, two groups of haplotypes can be distinguished: "A" and "B". Haplotypes within group A or B differ from each other by relatively few mutational differences (<1% divergence). Divergence between A and B is much more pronounced (approximately 2.5% between pairs of alleles). This indicates that individuals from Group A and B have been isolated from one another biologically for tens of thousands or perhaps millions of years with little or no dispersal or hybridization.

Sample sizes are too small at this time to make definitive conclusions about variation within pools. However multiple alleles seem to be more prevalent in disturbed pools and those in suburban areas.

Geographic and phylogenetic analysis

A preliminary parsimony analysis was conducted with PAUP (heuristic search, 2000 random additions). Individuals from *B. lynchi, B. lindahli* and *B. coloradensis* were used as outgroups. A sample tree (1of 98 equally parsimonious trees) is presented in Figure 2.

It is clear from this analysis that:

1) *B. sandiegonensis* appears to represent a monophyletic taxon (i.e., a "good species" from an evolutionary perspective), but this can only be verified by a complete genetic and morphological analysis of the genus.
2) There is considerable genetic variation within this species.
3) There is a deep split between clades "A" and "B". Both clades are reciprocally monophyletic on all 98 maximally parsimonious trees.
4) Phylogenetic resolution with clades A and B will require additional analyses (e.g., nested clade analysis).
5) Clades A and B have unusual allopatric distributions (outlined in Figure 1), which do not correspond to any known current or past geologic features.
6) So far only 3 individual fairy shrimp violate the generalized distributions of clade A and B in Figure 1. (Note the outlying "1"s in Table 1.) Further analysis of these individuals will be undertaken to ensure that there were no contamination problems.

<u>Preliminary conclusions</u>

- The taxonomic status of *Branchinecta sandiegonensis* is uncertain, although it appears to be a "proper" monophyletic species at this time.
- There is high mtDNA divergence among hydrologically linked vernal pool "complexes".

- It is obvious that gene flow between pool complexes is limited in areas that are less impacted by development and recreation (e.g., vernal pool complexes in Ramona, Otay Mesa, Otay Lakes and Marron Valley).
- Two major clades were found; their distribution does not correspond to any obvious contemporary geographic barrier.
- Evolutionary significant units "ESUs" that should be considered for conservation include the two major clades and individuals pool complexes.
- According to some interpretations of the ESU concept, every pool complex could be considered an ESU worthy of separate consideration. This will require additional genetic analyses with other markers.

Caveats

All conclusions should be considered preliminary at this time. However, the preliminary conclusions regarding low dispersal, high genetic endemicity and ESU identification are unlikely to change with additional data. Additional sequences will help refine them quantitatively. The taxonomic status of Branchinecta coloradensis is outside the scope of this study and will have to be left for future work.

It is expected that this project will be completed by December 2004, with a final report presented in the spring of 2005. Results of this study will be disseminated to the scientific community through one or more peer-reviewed publications submitted beginning in 2004 or 2005.

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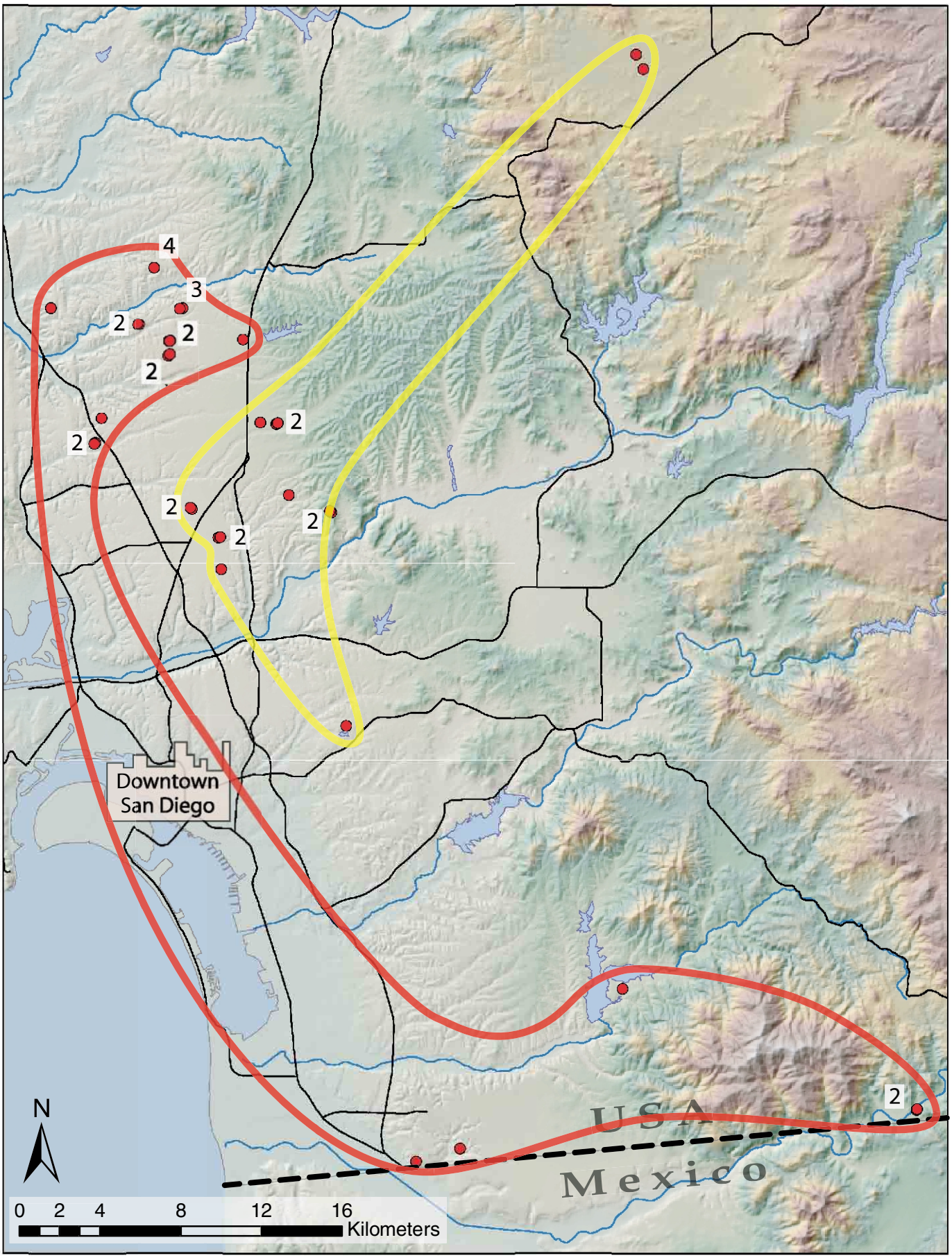
Table 1: Haplotype distributions within and among pool “complexes” (regions) and “sites” (local metapopulations of hydrologically linked pools).

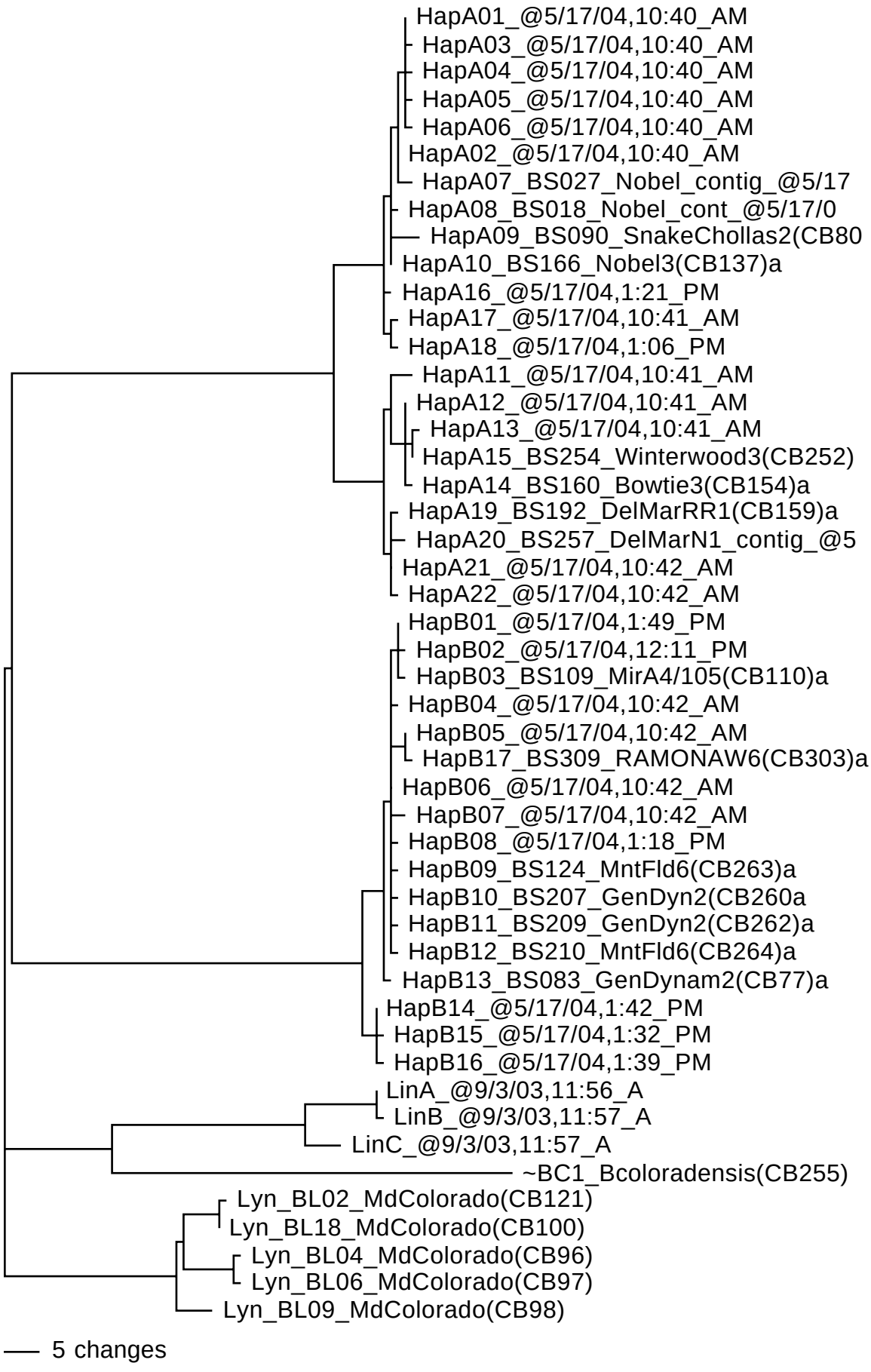
Figure 1: Geographic distribution of samples, with the primary distributions of clades A and B circled. Only 3 of 197 individuals violate these primary distributions (see Table 1). Red dots indicate ponds sampled.

Figure 2: Phylogenetic tree of preliminary data set. This is one of 98 equally parsimonious trees.

-			Haplotype																														
Region	Complex	Pond	A01	A11	A03	A02	A12	A13	A15	A06	A05	A07	A08	A10	A21	A22	A14	A04	A19	A20	A16	A09	A18	A17									
Carmel Mountain	Carmel Mountain	1	4																														
Mira Mesa	Brown	1	1	2																													
		2	3																														
		3	1	1	2																												
	Winterwood	1	2					1																									
		2		1		1	1																										
		3	1						1																								
		4					1																										
		5	2					1		2																							
	Mesa Verde	1				4																											
		2	1			3																											
		3	5																														
	Maddox	1	2																														
		2	3				1																										
		4	3																														
		7									2																						
	Cousins	1	4																														
Nobel Drive	Nobel Drive	1	1			7						1	1																				
		2				4																											
		3				2								1																			
	Eastgate	1	1												1																		
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Del Mar	Bowtie	1	1												2	1																	
		2													2	1																	
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	Del Mar Mesa East	2				1	1																										
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	Del Mar Mesa North	1													1					1												
		2	1												1																	
		3													2																	
Otay Lakes	Otay Lakes	1																			5											
Otay Mesa	Snake Cholla	2																			5	1										
	Goat Mesa	2																					5									
Marron Valley	Marron Valley	3																						5								
		5																						5								
Mission Trails	Mission Trails	1																														
		3																						1								
MFGD	Sander	1																														
		2				1																										
	Montgomery Field	6																														
	General Dynamics	1																														
		2																														
Chollas	Chollas	2																														
Miramar	A4	103.5																														
		105																														
	AA9	MC4																														
		K4																														
	AA10	MC5																														
		MC6																														
		68.3E																														
Ramona	Ramona	7																														
		17B																														
		W6																														
B.lindahli: Carmel Mountain	Carmel Mountain	1																														
		2																														
		4																														
		5																														
B.lindahli: Nobel drive	Pueblo	1																														
		2																														
B.lynchi: Mesa de Colorado	Mesa de Colorado	?																														
B.coloradensis	Mexican Cut	?																														
Grand Total			37	8	2	29	9	2	1	2	2	1	1	1	12	3	1	2	1	1	10	1	5	11								

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Kilometers
USA
Mexico


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HapA15_BS254_Winterwood3(CB252)
HapA14_BS160_Bowtie3(CB154)a
HapA19_BS192_DelMarRR1(CB159)a
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HapB10_BS207_GenDyn2(CB260a
HapB11_BS209_GenDyn2(CB262)a
HapB12_BS210_MntFld6(CB264)a
HapB13_BS083_GenDynam2(CB77)a
HapB14_@5/17/04,1:42_PM
HapB15_@5/17/04,1:32_PM
HapB16_@5/17/04,1:39_PM
LinA_@9/3/03,11:56_A
LinB_@9/3/03,11:57_A
LinC_@9/3/03,11:57_A
~BC1_Bcoloradensis(CB255)
Lyn_BL02_MdColorado(CB121)
Lyn_BL18_MdColorado(CB100)
Lyn_BL04_MdColorado(CB96)
Lyn_BL06_MdColorado(CB97)
Lyn_BL09_MdColorado(CB98)
5 changes