1927 Fifth Avenue
San Diego, CA 92101
P 619.308.9333
F 619.308.9334

2033 East Grant Road
Tucson, AZ 85719
P 520.325.9977
F 520.293.3051

2027 Preisker Lane, Ste. G
Santa Maria, CA 93454
P 619.308.9333
F 619.308.9334

www.reconenvironmental.com

RECON

An Employee-Owned Company

November 2, 2012

Mr. Glen Laube
City of Chula Vista
Planning and Building Department
276 Fourth Avenue, MS P-101
Chula Vista, CA 91910

Reference: Year 1 Annual Report for the Otay Tarplant and San Diego Thornmint Restoration and Enhancement Program (SANDAG Grant Number 5001590; RECON Number 5662)

Introduction

This first annual report provides background information and summarizes the tasks performed during the first year (June 2011 to August 2012) of the Otay tarplant (*Deinandra conjugens*) and San Diego thornmint (*Acanthomintha ilicifolia*) restoration and enhancement program in the Chula Vista Central City Preserve. Three quarterly reports have previously been prepared by RECON. The information from these reports is summarized below for tasks completed between June 13 2011 and August 31, 2012. This annual report also summarizes the results of the relevé vegetation surveys that were conducted in spring 2012 at the treatment sites, as well as the population estimates for Otay tarplant and San Diego thornmint.

The Central City Preserve is in the central portion of the city of Chula Vista, east of Interstate 805, south of State Route 54 and Bonita Road, and north of Otay Lakes Road (Figure 1; see Attachment 1 for all figures and photographs). The Central City Preserve covers approximately 1,350 acres and is subdivided further into four Preserve Management Areas (PMAs) for data management purposes and the development of the Area Specific Management Directives that were prepared in 2004 (Figure 2). Each PMA consists of a number of open space areas, referred to as subunits, which are surrounded by residential development. Each of these subunits was assigned a number to organize and distinguish each distinct survey area (Figure 3). Restoration and enhancement work was performed in PMA 1 subunits 1-1a, 1-1c, and 1-2b. The treatment areas in these three subunits are shown in Figure 3.

Otay Tarplant Status and Conservation

Otay tarplant is federally listed threatened, state listed endangered, and considered a narrow endemic species under the City of Chula Vista Multiple Species Conservation Program (MSCP) Subarea Plan (City of Chula Vista 2003; Photograph 1). It also has a California Native Plant Society (CNPS) Rare plant ranking of 1B.1 (Rare, threatened, or endangered in California and elsewhere; seriously endangered in California) (CNPS 2012). Populations of Otay tarplant are substantially declining throughout San Diego County. Extant populations are threatened by pressures from urban development, habitat disturbance, and invasion of non-native species (Photograph 2).

San Diego Thornmint Status and Conservation

San Diego thornmint is federally listed threatened, state listed endangered, and considered a narrow endemic species under the City of Chula Vista MSCP Subarea Plan (City of Chula Vista 2003; Photograph 3). It also has a CNPS Rare plant ranking of 1B.1 (Rare, threatened, or endangered in California and elsewhere; seriously endangered in California) (CNPS 2012). Populations of San Diego thornmint are substantially declining throughout San Diego County. Extant populations are threatened by pressures from urban development, habitat disturbance, and invasion of non-native species (Photograph 4), with as many as one-third of historical occurrences believed to be extirpated (CNPS 2012). San Diego thornmint is restricted to clay lens microhabitats, which limits the establishment of new populations due to the lack of such habitat remaining in San Diego (Reiser 2001).

Project Goals and Habitat Restoration Methods

- Restore native grassland and clay lens habit habitat for Otay tarplant, San Diego thornmint, and other MSCP-covered species, including variegated dudleya (*Dudleya variegata*; Photograph 5) and small-flowered morning glory (*Convolvulus simulans*; Photograph 6) in areas currently dominated by weeds.

- Increase the size of Otay tarplant and San Diego thornmint populations.

- Reduce competition with non-native weeds that are invading the native grassland habitat and degrading the rare plant habitat by controlling annual non-native grasses and perennial weed species such as fennel (*Foeniculum vulgare*) and artichoke thistle (*Cynara cardunculus*).

- Increase native grassland habitat by planting purple needlegrass (*Stipa* [=*Nassella*] *pulchra*) in areas currently dominated by non-native grasses and other weeds.

2011–12 Rainfall Summary and Ecological Effects

Between July 1, 2011 and June 30, 2012, rainfall in Chula Vista (8.41 inches) was below normal (approximately 10 inches) (Table 1). Significant fall rains began in November 2011 when nearly 3 inches of rain fell during that month. This heavier than normal rain episode was followed by below normal rainfall in December 2011 and January 2012, with less than an inch in each of those months. Well-spaced rains eventually returned in February and March, which helped continue the growth of the native vegetation in the treatment areas. The weather pattern that occurred in 2011–12, consisting of several heavy rain periods spread through the season, also triggered multiple germination events for the non-native weeds such as black mustard (*Brassica nigra*) and tocalote (*Centaurea mellitensis*). In comparison, the previous year's (June 2010–July 2011) rainfall was above normal with a total of 11.73 inches. A more detailed description of weed control efforts is given in the maintenance section below. Weed control efforts, changes observed in the native plant growth, and monitoring results were documented through photographs taken at the restoration and enhancement sites.

TABLE 1
SUMMARY OF RAINFALL DATA BY MONTH AT CHULA VISTA
JULY 1, 2011–JUNE 30, 2012

Month	Monthly Rainfall (inches)
July	0.00
August	0.00
September	0.15
October	0.34
November	2.97
December	0.84
January	0.57
February	1.23
March	1.60
April	0.71
May	0.00
June	0.00
Total Precipitation	8.41 inches

Year 1 Tasks Performed June 2011 through August 2012

Pre-Implementation Monitoring

RECON biologists delineated the restoration areas (e.g., dethatching areas) prior to site preparation activities (see Figure 3). This pre-implementation field work, conducted in the summer of 2011, included updating the mapping of Otay tarplant and San Diego thornmint locations in the restoration and enhancement areas. Permanent photo points were established at each of the restoration and enhancement areas in October 2011.

Site Preparation

Site preparation consisted of dethatching dried weeds. In the fall of 2011, RECON restoration crews used weed whips to cut dry weed thatch in Otay tarplant and San Diego thornmint habitat areas (Photographs 7–9). By October, native plants had finished their growth cycle and set seed for the season. The dehatch areas are shown on Figure 3. Cut material was raked into piles to compost on-site (Photographs 10–11). The crew peformed weed dethatching on October 3–7, 10–14, and 17–21. RECON biologists monitored the crew during dethatching efforts. While using weed whips to cut non-natives, care was taken to avoid native grasses and other species (Photograph 12). Approximately 17 acres of grassland were dethatched in three canyons, including approximately 12 acres in PMA subunit 1-2b, 2.83 acres in PMA subunit 1-1a, and 2.24.acres in PMA subunit 1-1c (see Figure 3).

Seed Collection/Redistribution

2011 Seed Collection

Prior to dethatching, RECON biologists collected Otay tarplant, San Diego thornmint, and variegated dudleya seed in July and August 2011. Seed of other grassland species such as gumplant (*Grindelia camporum*) and western blue-eyed-grass (*Sisyrinchium bellum*) was also collected for future redistribution. As a standard conservation measure, no more than 5 percent of the total Otay tarplant or San Diego thornmint seed crop was collected. The seeds were delivered to RECON Native Plants, Inc. and are being stored under cool dry conditions to maintain their viability.

In order to start new populations of San Diego thornmint, RECON biologists dispersed thornmint seed in early December 2011 at three new locations in PMA subunits 1-2b, 1-1a, and 1-1c. The

thornmint seeding areas were small experimental sites. The areas were seeded after the dethatching efforts had been completed but prior to any follow-up weed control efforts. Since follow-up weed control efforts had not yet taken place, the project biologist determined that only small areas should be seeded so that the areas could be effectively hand weeded.

After significant rains, San Diego thornmint seeding areas were monitored to determine if germination had occurred, observe the health of the plants, and determine when weeding of the seeded plots needed to be performed. During dry periods that occurred in January 2012, the newly seeded thornmint were hand watered twice to keep the soil moist between rain events.These small watering efforts were adequate enough to allow the plants to flower later in spring (Photograph 13).

2012 Seed Collection

Germination, seed development, and overall health of Otay tarplant, San Diego thornmint, and other native plant populations were monitored during the site visits to determine the correct timing for seed collection. In May and June 2012, RECON biologists collected San Diego thornmint (Photograph 14) and other associated native plant seed for future redistribution. In addition, native plant seed from western blue-eyed-grass, osmadenia (*Osmadenia tenella*), purple needlegrass, foothill needlegrass (*Stipa lepida*), variegated dudleya, and shooting star (*Dodecatheon clevelandii*) was collected. RECON biologists and crew collected Otay tarplant (Photographs 15–16) and small-flowered microseris (*Microseris douglasii* var. *platycarpha*; CNPS 4.2) seed in July 2012 .

Fence Installation

RECON biologists met with Glen Laube and other City of Chula Vista open space staff on-site on August 3, 2011 to discuss fencing locations, material, and signage. After the meeting, a map was prepared showing potential areas to be fenced, and a cost estimate was submitted to the City of Chula Vista. The project biologist placed pin-flags to delineate fence installation locations.

The RECON restoration crew installed approximately 3,528 linear feet of fencing between October and December 2011. Fencing was installed in PMA 1-1c and 1-2b to restrict public access in certain areas containing sensitive biological resources, e.g., along bicycle trails adjacent to San Diego thornmint populations (Figures 4a and 4c). Fencing materials consist of metal t-posts with three rows of non-barbed wire strung in between (Photograph 17). RECON biologists monitored the fence installation and fence integrity after installation. Minor fence damage was observed in July 2012. The fence wire had been stretched and metal clips that attached the wire to the T-posts had been cut to allow foot traffic access through the enhancement area. In August, new metal clips were installed and the wire was realigned.

Maintenance

Weed Control

Two general methods of weed treatment were conducted in the restoration and enhancement areas. In areas occupied by natural populations of San Diego thornmint, only dethatching by weed whips and thatch removal was conducted. In areas that had Otay tarplant only (with no thornmint) dethatching and spot spraying was done. In some areas where there were high concentrations of native bulbs, weed whips were used to cut non-natives around the bulbs to avoid spraying those areas.

In December 2011 and February 2012, prior to spraying, RECON biologists flagged sensitive resources, such as Otay tarplant and San Diego thornmint seedlings, variegated dudleya, and areas with large populations of native bulbs, annuals, and grasses for avoidance. In January 2012 RECON biologists checked the status of weeds within the dethatch areas to determine when to schedule the restoration crew to conduct herbicide treatment.

Transline was used to control the artichoke thistle, and Prosecutor was used to control all other weed species. RECON biologists monitored the crew during herbicide application. Both herbicides are approved for use in natural areas by the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG) and were applied by licensed applicators under the direction of RECON Field Director Ruth Vallejo. Herbicide was used when there was little to no wind present to avoid overspray that may harm native plants.

Although weeds germinated during the heavy November 2011 rain episode, the drier than normal conditions of December and January slowed their growth and made them drought stressed (Photograph 18). Based on past experience in similar spraying situations, the project biologist detemined that it would be better to delay spraying until additional rainfall occurred to induce plant growth again. This was done to allow the sprayed non-native species to actively translocate the glyphosate herbicide from leaves to stems and roots. Spraying drought-stressed weeds has led to relatively ineffective control in the past. After rains fell in late January and early February 2012, the RECON restoration crew treated weeds with herbicide in February and March (Photograph 19). The primary weed species that were controlled included black mustard, tocalote, fennel, artichoke thistle, and annual grasses such as wild oats (*Avena* spp.) and Italian rye grass (*Festuca perennis* [=*Lolium multiflorum*]) (Photographs 20–21). After the spray passes in February and March 2012, good control of non-natives was achieved (Photograph 22), but late season rains caused germination of additional weeds, particularly mustards, and the budget did not allow for additional spray passes for annual weed species (Photograph 23). Follow-up spraying of fennel and artichoke thistle occurred in early May to control small seedlings that were not visible earlier in the season.

Monitoring Methods

Sensitive Plant Population Estimates

2011 Population Baseline

During the spring and summer of 2011, prior to site preparation, baseline population estimates were performed for San Diego thornmint and Otay tarplant. These population estimates were made so that a comparison could be made before and after the initial season of weed control efforts. The 2011 population estimates were conducted by RECON biologists Anna Bennett and Megan Lahti.

In small patches (population in the hundreds), Otay tarplant and San Diego thornmint were counted individually. In large patches (population in the thousands), individuals were counted in sample sub-plots, and then population numbers were estimated based on the size of the patch and the average density within the sub-plots.

2012 Population Estimates

After the first year of dethatching and follow-up weed control, San Diego thornmint population counts were conducted in April 2012, and Otay tarplant population estimates were completed in late May 2012 (Photographs 24–25). Population counts were conducted after it was determined that the maximum number of individuals had emerged for the season and while most of the plants were still in flower. Population counts were conducted by RECON biologists Anna Bennett, JR Sundberg, and Megan Lahti using the methods described above.

Relevé Vegetation Sampling

Vegetation patch sampling was done using the relevé method. All plant species occurring in each patch were recorded, and the cover of species was estimated. A total of 22 vegetation treatment areas were sampled by RECON biologist Anna Bennett in June 2012. Study plots were located in two types of treatment areas: (1) 19 study plots were dethatched and treated with herbicide and (2) 3 study plots were dethatched only. The results of the vegetation sampling efforts are presented in the results section below.

Results

2011–12 Otay Tarplant and San Diego Thornmint Population Estimates

The results of the 2011 and 2012 population counts by PMA subunit are shown in detail in Table 2. The baseline population estimate conducted prior to implementation in 2011 showed a total of approximately 40,930 Otay tarplant, 8,542 San Diego thornmint, and 15 variegated dudleya individuals. San Diego thornmint and variegated dudleya were only observed in PMA subunit 1-2b (Rice Canyon). Otay tarplant was found in all three PMA subunits (1-1a, 1-1c and 1-2b).

TABLE 2
NUMBER OF OTAY TARPLANT, SAN DIEGO THORNMINT, AND VARIEGATED DUDLEYA INDIVIDUALS BY PRESERVE MANAGEMENT AREA SUBUNIT

Species	PMA 1-1a	PMA 1-1c	PMA 1-2b	Total
		2011		
Otay tarplant	7,107	92	33,731	40,930
San Diego thornmint	0	0	8,542	8,542
Variegated dudleya	0	0	15	15
		2012		
Otay tarplant	11,930	297	125,323	137,550
San Diego thornmint	476*	140*	32,200	32,816
Variegated dudleya	0	0	75	75

*Introduced population

In 2012 a total of 137,550 Otay tarplant, 32,816 San Diego thornmint, and 75 variegated dudleya individuals were estimated to be in the treatment areas (Photographs 26–28). Not all of the thornmint that germinated successfully flowered, as some individuals dried out prior to flowering. This is discussed below. The locations of the Otay tarplant, San Diego thornmint, and variegated dudleya populations are shown on Figures 4a through 4c. The small populations of thornmint in PMA subunits 1-1a and 1-1c were in areas seeded by the project biologists.

Year 1 Vegetation Relevé Sampling Results

A total of 25 native and 20 non-native species were recorded in PMA 1-1a; 17 native and 15 non-native species were recorded in PMA 1-1c; and 40 native and 31 non-native species were recorded in PMA 1-2b. Some representative native plant associates of Otay tarplant and San Diego thornmint are shown in Photographs 29–33. Attachment 2 lists the species observed within the restoration and enhancement areas. The results of the June 2012 relevé surveys are discussed in further detail below. Table 3 lists the results from the 19 treatment areas that were dethatched and spot sprayed with herbicide. Table 4 lists the results from the 3 dethatch only treatment areas.

TABLE 3
TREATMENT—DETHATCHED AND SPRAYED

Vegetation Type	Absolute	Relative (Vegetation only)
Average total cover (shrub & herbaceous)	41%	100%
Average native cover	15%	37%
Average non-native cover	26%	62%
Average native grass cover	5%	13%
Average bulb cover	3%	6%
Average shrub cover	3%	7%
Average bare ground	59%	0%

TABLE 4
TREATMENT—DETHATCH ONLY

Vegetation Type	Absolute	Relative (Vegetation only)
Average total cover (shrub & herbaceous)	63%	100%
Average native cover	24%	37%
Average non-native cover	39%	63%
Average native grass cover	3%	5%
Average bulb cover	3%	4%
Average shrub cover	5%	7%
Average bare ground	37%	0%

Discussion

Weed Control Results

Through the end of October 2011, a total of approximately 17.07 acres of dried weedy areas were dethatched using weed whips. All treatments areas were dethatched during the site preparation phase. Two treatments were used for weed control efforts: (1) dethatched and treated with herbicide and (2) dethatched and without herbicide (bulb concentration and thornmint areas). Through the end of March 2012, a total of approximately 14.39 acres were treated with herbicide.

In the dethatch/spray treatment areas, the absolute cover of non-natives was 26 percent compared to 39 percent in the dethatch only treatment areas. The higher cover of non-natives was expected in the dethatch only areas since follow-up spraying was not performed in those areas.

Bulb and shrub cover was similar for the two treatment types both in absolute and relative terms (see Tables 3 and 4). Absolute cover of native species was higher (24 percent) in dethatch only areas compared to dethatch and spray areas (15 percent native cover). Native cover at the treatment sites, both sprayed and not sprayed, showed high variability ranging from as low as 2.5 percent cover to as high as 35.5 percent. This may be a reflection of past disturbance and previous levels of weed invasion that had crowded out native species.

The grass specific herbicide Fusilade was not used during the first year weed control efforts, because weed cover consisted of numerous dicot weeds interspersed with non-native grasses. If Fusilade was used to treat non-native grasses in this situation, the treatment areas would have had to have been sprayed with both Fusilade to kill the non-native grasses and then sprayed again with a glyphosate-based herbicide to control the dicot weeds. This would have doubled the labor effort for spraying and would have been cost prohibitive.

Although a quantitative assessment of non-native cover was not performed prior to implementation due to limitations of budget, anecdotal observations and pre-implementation photographs indicate that non-native cover was very high, likely in the order of 75–80 percent if

not higher at some locations (Photographs 34–35). The relevé results indicate that substantial progress was made on weed control during the first year of the project. It is anticipated that annual native cover will increase as seeds are dispersed into treatment areas after the second season of weed treatment.

Germination and Seasonal Growth of Otay Tarplant and San Diego Thornmint

Otay tarplant and San Diego thornmint seedlings germinated during the heavy rainfall events in November 2011 and were visible in the field by early December 2011 (Photographs 36–37). Additional seeds of tarplant and thornmint germinated during later rain events as evidenced by visibly different age classes of the plants (Photograph 38) and extended flowering times. Otay tarplant began flowering in May and continued into August, while San Diego thornmint began flowering in late March and finished in May.

Population Estimates

After implementation of the dethatching and spraying program, there was an increase of 96,620 Otay tarplant individuals between 2011 and 2012. In PMA 1-1a, a total of 7,107 individuals were estimated in 2011, and 11,930 individuals were estimated in 2012. In PMA 1-1c, total of 92 individuals were estimated in 2011, and 297 individuals were estimated in 2012. In PMA 1-2b, a total of 33,731 individuals were estimated in 2011, and 125,323 individuals were estimated in 2012 Although Otay tarplant occupied roughly the same areas as in 2011, individuals in 2012 appeared to be smaller on average than the previous year; therefore, patches contained a higher density of individuals. These increases in population numbers from the previous growing season occurred despite below average rainfall in 2011–12.

As mentioned above, even though rainfall was below normal, there was also a large increase in the number of San Diego thornmint (23,658 individuals) between 2011 and 2012. In PMA 1-2b, a total of 8,542 individuals were estimated in PMA 1-2b in 2011, and a total of 32,200 individuals were estimated in 2012. Of the estimated 32,200 individuals up to 30 percent appeared to have dried out before successfully flowering and setting seed for an effective population size of approximately 22,540 plants in 2012. Additionally, 476 individuals were estimated in PMA 1-1a and 140 individuals in PMA 1-1c, where San Diego thornmint was seeded into clay lens habitats. A check of the dried plants after flowering and fruiting indicated that seeds were produced by at least some of the newly seeded individuals (Photograph 39).

The increase in the 2012 population of both Otay tarplant and San Diego thornmint despite below normal rainfall is probably related to increasing available sunlight for seedlings and maturing plants by removing dense thatch and reducing competition by treating non-natives with herbicide. Similar observations have been made in other Otay tarplant management projects (RECON 2006, 2009).

Wildlife and Pollinator Observations

Incidental observations of wildlife were made by RECON biologists during various maintenance and monitoring activities. Mammal species that were observed at the restoration and enhancement sites include cottontail rabbits (*Sylvilagus audubonii*) and coyotes (*Canis latrans*). Two reptile species, southern Pacific rattlesnake (*Crotalus oreganus helleri*) and two-striped gartersnake (*Thamnophis hammondii*; CDFG Species of Special Concern), were also observed. Additionally, the federally threated coastal California gnatcatcher (*Polioptila californica californica*) was detected in adjacent coastal sage scrub habitat. Invertebrates that were often seen in the grassland include California trapdoor spiders (*Bothriocyrtum californicum*), which are fossorial spiders that spin their webs in burrows in the clay soil (Photograph 40). Various potential pollinators were observed visiting Otay tarplant and associated native species, particularly gumplant, which appears to have good nectar resources based on the level of visitation (Photographs 41–45).

Future Restoration and Enhancement Tasks

Weeds will be controlled to prevent seed set in Year 2. Approximately 6,000 purple needlegrass plants are being propagated now and will be planted in winter 2012–13. Native annual seed will once again be collected and then redistributed in treatment areas that have low weed cover and little native annual cover. Vegetation sampling and population estimates will be repeated in the spring of 2013.

If you have any questions regarding the Otay tarplant and San Diego thornmint habitat restoration and enhancement program, do not hesitate to call.

Sincerely,

Mark W. Dodero

Mark Dodero
Senior Biologist

MWD:eab

Enclosures

References Cited

California Native Plant Society (CNPS)
2012 Inventory of Rare, Threatened, and Endangered Plants of California (8th Edition).

Chula Vista, City of
2003 Multiple Species Conservation Plan Subarea Plan. February.

RECON
2006 Otay Tarplant Translocation Program Year 5 Annual Report for Otay Ranch – Specific Plan Area 1, Village One South. November 29.

2009 Otay Tarplant Translocation Program Years 6–10 Final Summary Report for Otay Ranch – Specific Plan Area 1, Village One South. July 16.

Reiser, C. H.
2001 *Rare Plants of San Diego County.* Aquifir Press, Imperial Beach, CA.

Contributers to this Report

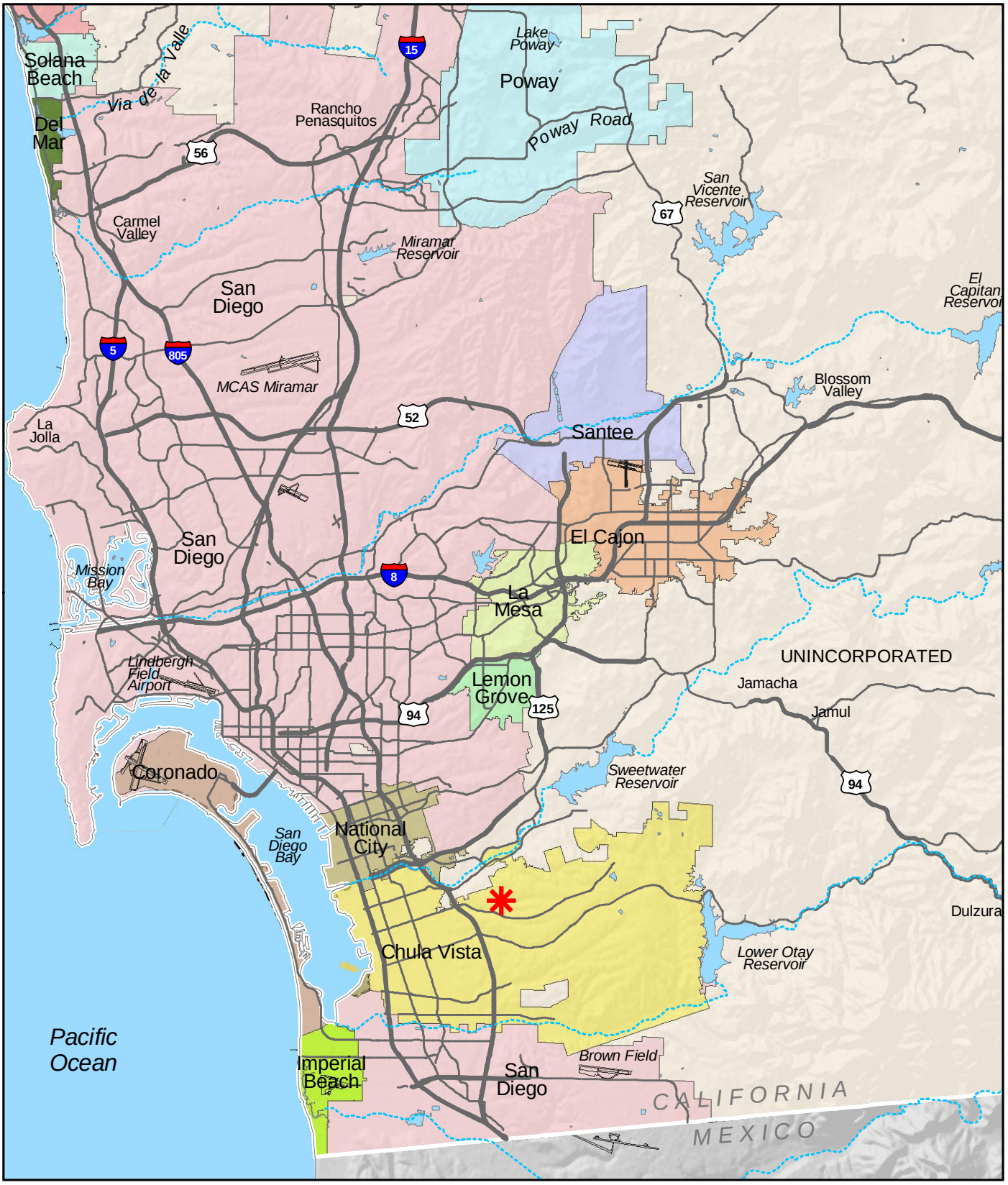
RECON biologists that conducted field surveys, analyzed data, and provided photographs included Anna Bennett, Cailin O'Meara, JR Sundberg, Mark Dodero, and Megan Lahti. Graphics and Production staff included Sean Bohac and Chris Nixon.

ATTACHMENTS

ATTACHMENT 1

Figures and Photographs

Figures



Project Location

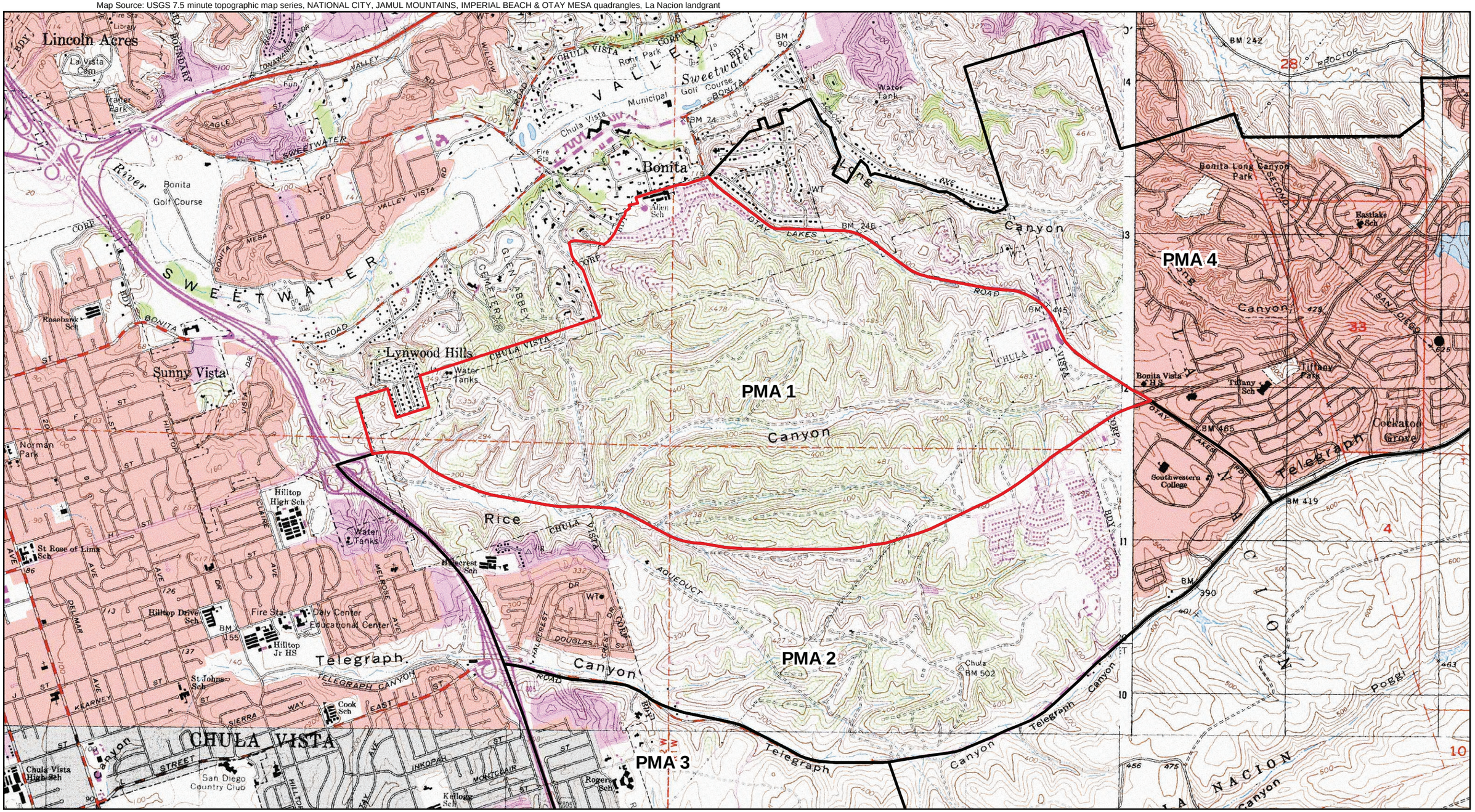
FIGURE 1

Regional Location

RECON

M:\jobs3\08-137\common_gis\fig1.mxd 06/04/08

Map Source: USGS 7.5 minute topographic map series, NATIONAL CITY, JAMUL MOUNTAINS, IMPERIAL BEACH & OTAY MESA quadrangles, La Nacion landgrant



Preserve Management Areas

PMA 1

Other PMAs

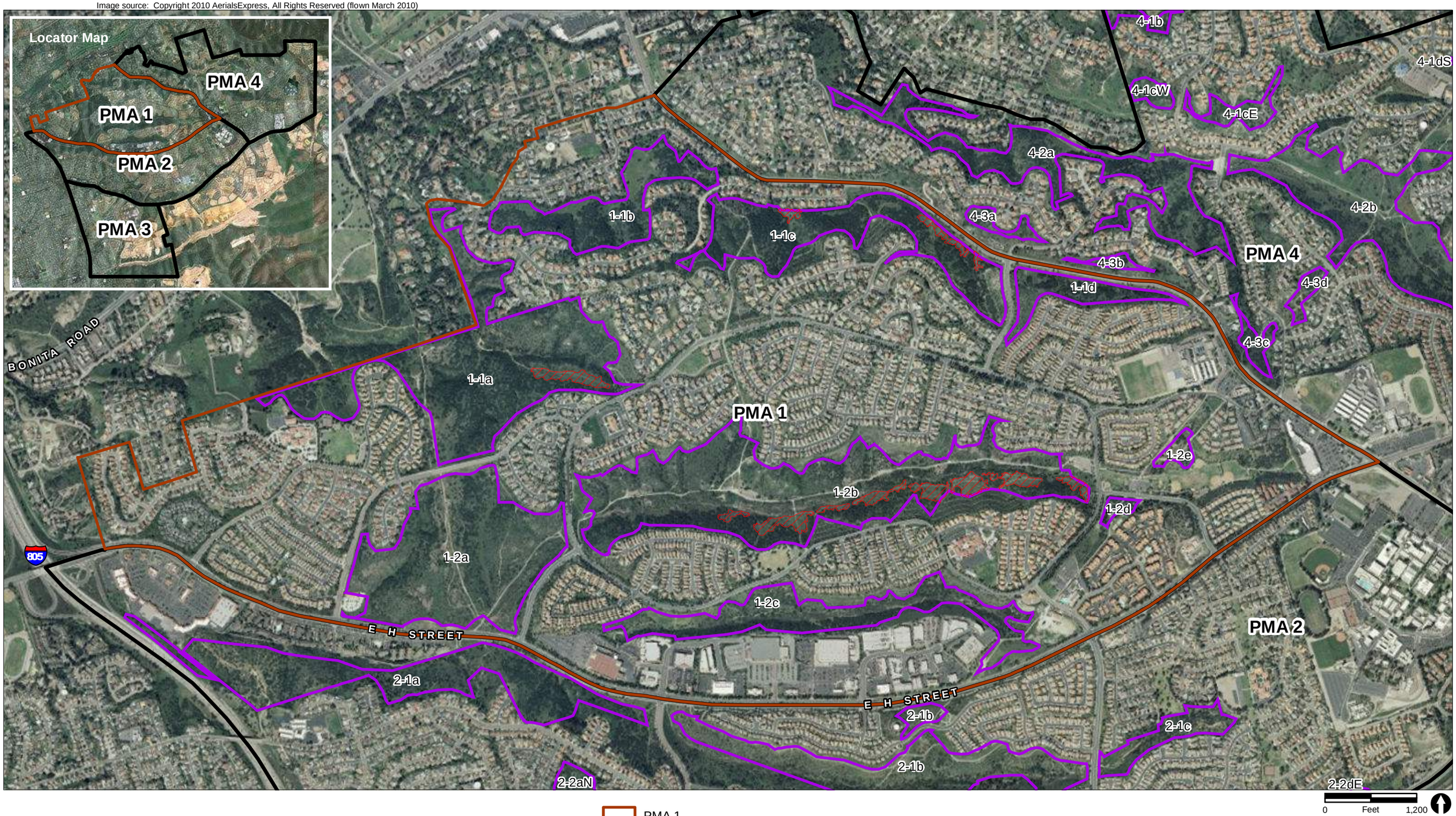
RECON

M:\jobs3\5296\common_gis\fig2_qtr.mxd 03/11/10

FIGURE 2

Project Location on USGS Map

Image source: Copyright 2010 AerialsExpress, All Rights Reserved (flown March 2010)



PMA 1

Other PMAs

PMA Subunits

Dethatching Areas

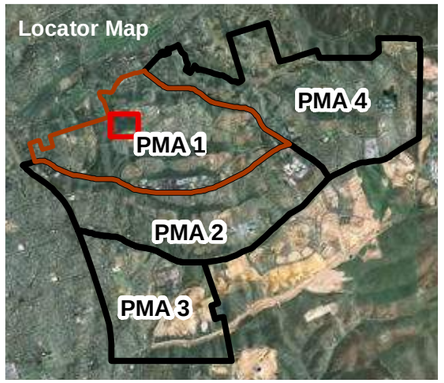
RECON

M:\JOBS3\5662\common_gis\fig3_deth.mxd 9/25/2012 sab

FIGURE 3

Preserve Management Subunits Selected for Restoration and Enhancement

Image source: Copyright 2010 AerialsExpress, All Rights Reserved (flown March 2010)



PMA Subunits

Dethatching Areas

Deinandra conjugens

Acanthomintha ilicifolia Seeding Area

0 Feet 150

FIGURE 4a

PMA 1-1a Sensitive Plant Species

RECON

M:\JOBS3\5662\common_gis\fig4a_deth.mxd 10/31/2012 sab

Image source: Copyright 2010 AerialsExpress, All Rights Reserved (flown March 2010)

PMA Subunits

Dethatching Areas

Fence

Deinandra conjugens

Acanthomintha ilicifolia Seeding Area

FIGURE 4b

RECON

M:\JOBS3\5662\common_gis\fig4b_deth.mxd 11/2/2012 fmm

PMA 1-1c Sensitive Plant Species

Image source: Copyright 2010 AerialsExpress. All Rights Reserved (flown March 2010)

PMA Subunits

Dethatching Areas

Deinandra conjugens

FIGURE 4c.1

PMA 1-2b Sensitive Plant Species

RECON

M:\JOBS3\5662\common_gis\fig4c.1_deth.mxd 10/31/2012 sab

Image source: Copyright 2010 AerialsExpress. All Rights Reserved (flown March 2010)

PMA Subunits
Dethatching Areas
Fence
Acanthomintha ilicifolia
Deinandra conjugens
Dudleya variegata
Acanthomintha ilicifolia Seeding Area

FIGURE 4c.2

PMA 1-2b Sensitive Plant Species

RECON

M:\JOBS3\5662\common_gis\fig4c.2_deth.mxd 11/2/2012 sab

Photographs

PHOTOGRAPH 1
Flowering Otay Tarplant (*Deinandra conjugens*)

PHOTOGRAPH 2
Non-native Species Can Outcompete Otay Tarplant

PHOTOGRAPH 3
Flowering San Diego Thornmint
(*Acanthomintha ilicifolia*)

RECON

PHOTOGRAPH 4
Non-native Species Can Outcompete San Diego Thornmint

PHOTOGRAPH 5
Variegated Dudleya (*Dudleya variegata*)

PHOTOGRAPH 6
Small-flowered Morning Glory (*Convolvulus simulans*)

PHOTOGRAPH 7
RECON Crews Use Weed Whips to Cut Dried Weedy Thatch

PHOTOGRAPH 8
RECON Crews Use Weed Whips to
Cut Non-native Grasses and Mustards

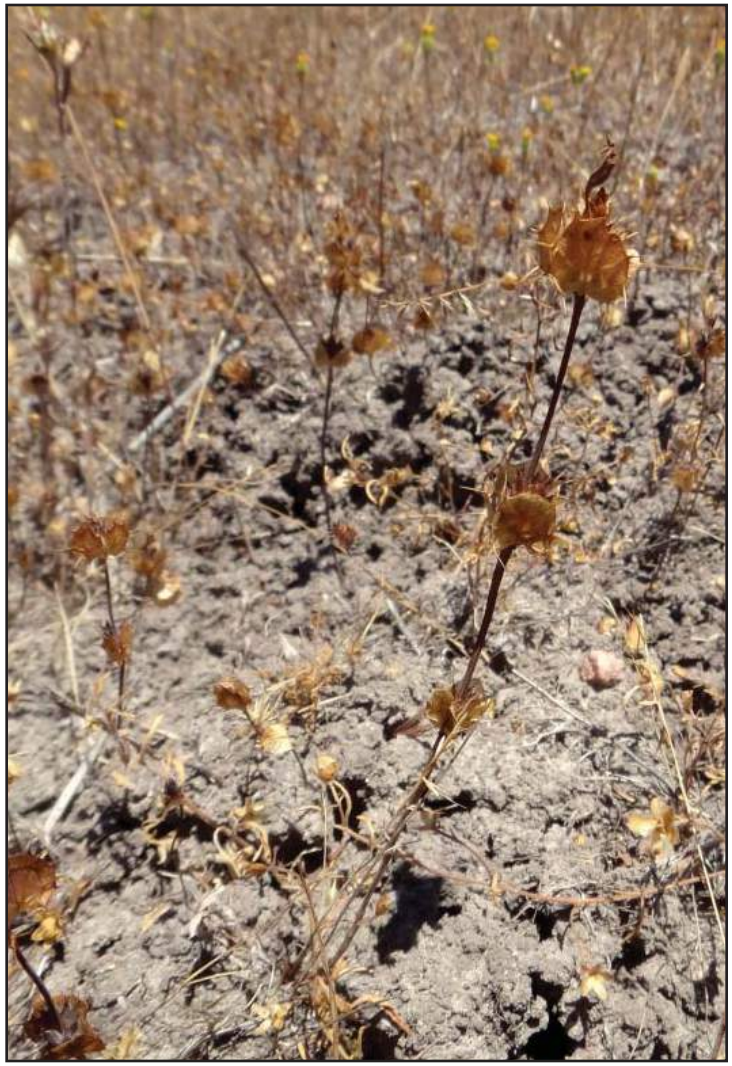
PHOTOGRAPH 9
Non-native Grasses Immediately After Cutting

PHOTOGRAPH 10
RECON Crews Raking Cut Thatch into Piles for Removal

PHOTOGRAPH 11
Cut Thatch Being Removed from Site

PHOTOGRAPH 12
Native Grasses (Purple Needlegrass [*Stipa pulchra*]) Grasses Are Avoided During Dethatching

PHOTOGRAPH 13
RECON Biologists Anna Bennett and Cailin O'Meara Watering San Diego Thornmint Seedlings



PHOTOGRAPH 14
San Diego Thornmint Fruits
Ready for Seed Collection

PHOTOGRAPH 15
Otay Tarplant Fruits Ready for Seed Collection

PHOTOGRAPH 16
Bags of Collected Otay Tarplant Fruits

PHOTOGRAPH 17
RECON Crews Installing Protective Fencing

PHOTOGRAPH 18
Non-native Grasses Appear Drought Stressed in Early January 2012

PHOTOGRAPH 19
RECON Crew Spraying Non-natives with Herbicide

PHOTOGRAPH 20
Fennel (*Foeniculum vulgare*) After Spraying

PHOTOGRAPH 21
Artichoke Thistle (*Cynara cardunculus*) After Spraying

PHOTOGRAPH 22
Initial Herbicide Treatment Provided Good Control of Weeds (Note Otay Tarplant Avoidance Area in Center Frame)

PHOTOGRAPH 23
Late Season Rains Encouraged Germination and Growth of Additional Mustards (*Brassica* spp.)

PHOTOGRAPH 24
Flowering San Diego Thornmint
During April Population Estimates

PHOTOGRAPH 25
Flowering Otay Tarplant During Late May Population Estimates

PHOTOGRAPH 26
Thousands of San Diego Thornmint Flowered at Treatment Sites

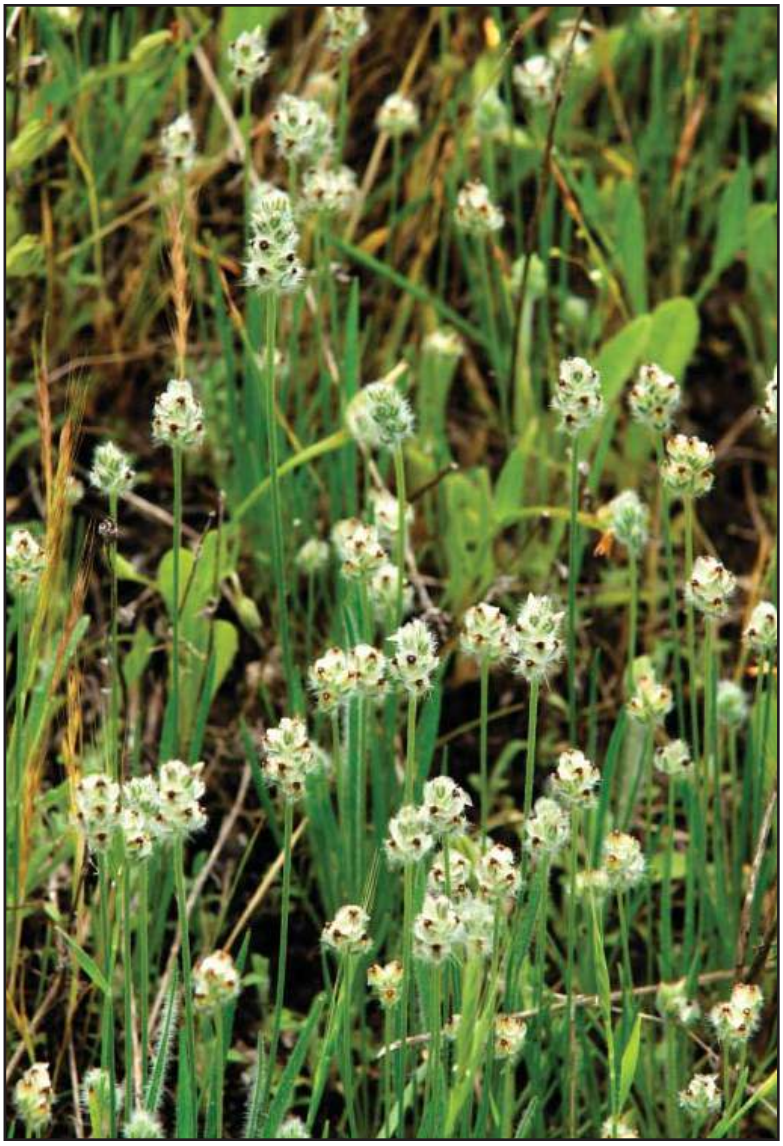
PHOTOGRAPH 27
Thousands of Otay Tarplants Flowered at Treatment Sites

PHOTOGRAPH 28
Variegated Dudleya Flowering in Rice Canyon

PHOTOGRAPH 29
Western Blue-eyed-grass (*Sisyrinchium bellum*) Is a Common Plant Associate

PHOTOGRAPH 30
Early Onion (*Allium praecox*) Often Grows Near Otay Tarplant

PHOTOGRAPH 31
Palmer's Grappling Hook (*Harpagonella palmeri*; CNPS 4.2) Grows in Clay Soils



PHOTOGRAPH 32
Dot-Seed Plantain (*Plantago erecta*) Grows with Otay Tarplant

PHOTOGRAPH 33
Gumplant (*Grindelia camporum*) Is Commonly
Found in Association with Otay Tarplant

PHOTOGRAPH 34
Treatment Site Dominated by Non-natives
Prior to Dethatching (September 2011)

PHOTOGRAPH 35
Same Treatment Site after Dethatching and
Follow-up Herbicide Spraying (January 2012)

PHOTOGRAPH 36
Otay Tarplant Seedlings Were First Visible in Early December 2011

PHOTOGRAPH 37
San Diego Thornmint Seedlings in Early December 2011

PHOTOGRAPH 38
Two Different Age Classes of San Diego
Thornmint Were Visible in Mid-February 2012

PHOTOGRAPH 39
San Diego Thornmint Seeds Produced
by Plants in Newly Created Populations

PHOTOGRAPH 40
Trap Door Spider Burrow (*Bothriocyrtum californicum*) with Potential Prey

PHOTOGRAPH 41
Native Bee Visiting Otay Tarplant

PHOTOGRAPH 42
Hoverfly Visiting Otay Tarplant

PHOTOGRAPH 43
Beetles Can Collect Pollen from Otay Tarplant Flowers

PHOTOGRAPH 44
Native Bee Visiting Gumplant

PHOTOGRAPH 45
Predatory Wasp on Gumplant

ATTACHMENT 2

ATTACHMENT 2
PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORNMINT RESTORATION AND ENHANCEMENT AREAS

Scientific Name	Common Name	Origin	Sensitivity	Preserve Management Unit
	LYCOPODS			
SELAGINELLACEAE	**SPIKE-MOSS FAMILY**			
Selaginella cinerascens A.A. Eaton	ashy spike-moss	N	CNPS 4.1	PMA 1-2b
	ANGIOSPERMS: MONOCOTS			
AGAVACEAE	**AGAVE FAMILY**			
Chlorogalum parviflorum S. Watson	smallflower soap plant	N	-	PMA 1-2b
ALLIACEAE	**ONION FAMILY**			
Allium praecox Brandegee	common wild onion	N	-	PMA 1-1a
ARECACEAE	**PALM FAMILY**			
Washingtonia robusta H. Wendl.	Washington fan palm	I	-	PMA 1-1c
IRIDACEAE	**IRIS FAMILY**			
Sisyrinchium bellum S. Watson	western blue-eyed-grass	N	-	PMA 1-1a; 1-1c; 1-2b
MELANTHIACEAE	**BUNCH FLOWER OR CAMAS FAMILY**			
Toxicoscordion [=*Zigadenus*] *fremontii* (Torr.) Rydb.	Fremont's camas	N	-	PMA 1-2b
POACEAE (GRAMINEAE)	**GRASS FAMILY**			
Agrostis pallens Trin.	dune bentgrass	N	-	PMA 1-2b
Avena barbata Link	slender wild oat	I	-	PMA 1-1a; 1-1c; 1-2b
Avena fatua L.	wild oat	I	-	PMA 1-1a; 1-2b
Brachypodium distachyon (L.) P. Beauv.	purple falsebrome	I	-	PMA 1-1c; 1-2b
Bromus hordeaceus L.	soft chess	I	-	PMA 1-1a; 1-2b
Bromus madritensis L. ssp. *rubens* (L.) Husnot	red brome	I	-	PMA 1-2b
Festuca [=*Vulpia*] *myuros* L.	rat-tail fescue	I	-	PMA 1-1a; 1-1c; 1-2b
Gastridium ventricosum (Gouan) Schinz & Thell.	nit grass	I	-	PMA 1-1a; 1-1c; 1-2b

ATTACHMENT 2
PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORNMINT RESTORATION AND ENHANCEMENT AREAS (CONT.)

Scientific Name	Common Name	Origin	Sensitivity	Preserve Management Unit
Festuca perennis (L.) Columbus & J.P. Sm. [=*Lolium multiflorum*]	rye grass	I	-	PMA 1-1a; 1-2b
Melica imperfecta Trin.	California melic	N	-	PMA 1-1c
Phalaris sp.	Canary grass	I	-	PMA 1-2b
Stipa [=*Nassella*] *lepida* (Hitchc.) Barkworth	foothill needlegrass	N	-	PMA 1-1a; 1-1c; 1-2b
Stipa [=*Nassella*] *pulchra* (Hitchc.) Barkworth	purple needlegrass	N	-	PMA 1-1a; 1-1c; 1-2b
THEMIDACEAE	**BRODIAEA FAMILY**			
Bloomeria crocea (Torr.) Coville	common goldenstar	N	-	PMA 1-1a; 1-1c; 1-2b
	ANGIOSPERMS: DICOTS			
ANACARDIACEAE	**SUMAC OR CASHEW FAMILY**			
Rhus integrifolia (Nutt.) Benth. & Hook. f. ex Rothr.	lemonadeberry	N	-	PMA 1-1a; 1-2b
APIACEAE (UMBELLIFERAE)	**CARROT FAMILY**			
Apiastrum angustifolium Nutt.	wild-celery	N	-	PMA 1-2b
Daucus pusillus Michx.	rattlesnake weed	N	-	PMA 1-1c
Foeniculum vulgare Mill.	fennel	I	-	PMA 1-1a; 1-1c; 1-2b
ASTERACEAE	**SUNFLOWER FAMILY**			
Ambrosia psilostachya DC.	western ragweed	N	-	PMA 1-2b
Artemisia californica Less.	California sagebrush	N	-	PMA 1-1a; 1-1c; 1-2b
Baccharis sarothroides A. Gray	broom baccharis	N	-	PMA 1-2b
Carduus pycnocephalus L.	Italian thistle	I	-	PMA 1-1a; 1-1c; 1-2b
Centaurea melitensis L.	tocalote, Maltese star-thistle	I	-	PMA 1-1a; 1-1c; 1-2b
Corethrogyne filaginifolia (Hook. & Arn.) Nutt.	sand-aster	N	-	PMA 1-1a; 1-1c; 1-2b
Cynara cardunculus L.	cardoon, artichoke thistle	I	-	PMA 1-2b

ATTACHMENT 2
PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORNMINT RESTORATION AND ENHANCEMENT AREAS (CONT.)

Scientific Name	Common Name	Origin	Sensitivity	Preserve Management Unit
Deinandra [=*Hemizonia*] *conjugens* (D.D. Keck) B.G. Baldwin	Otay tarplant	N	CE/FT, MSCP NE/4-1, CNPS 1B.1	PMA 1-1a; 1-2b
Encelia californica Nutt.	common encelia	N	-	PMA 1-1a
Erigeron [=*Conyza*] *canadensis* (L.) Cronquist	horseweed	N	-	PMA 1-1a
Eriophyllum confertiflorum (DC.) A. Gray var. *confertiflorum*	golden-yarrow	N	-	PMA 1-1a; 1-1c
Glebionis coronaria (L.) Spach [=*Chrysanthemum coronarium*]	garland, crown daisy	I	-	PMA 1-1a; 1-2b
Grindelia camporum Greene	gumplant	N	-	PMA 1-1; 1-1c; 1-2b
Hazardia squarrosa (Hook. & Arn.) Greene	saw-toothed goldenbush	N	-	PMA 1-1a; 1-2b
Hedypnois cretica (L.) Dum. Cours.	crete weed	I	-	PMA 1-1a; 1-2b
Helminthotheca [=*Picris*] *echioides* (L.) Holub	bristly ox-tongue	I	-	PMA 1-1c; 1-2b
Isocoma menziesii (Hook. & Arn.) G.L. Nesom var. *decumbens* (Greene) G.L. Nesom	decumbent goldenbush	N	CNPS 1B.2	PMA 1-1a; 1-1c; 1-2b
Lactuca serriola L.	prickly lettuce	I	-	PMA 1-1a; 1-2b
Logfia [=*Filago*] *gallica* (L.) Cross. & Germ.	narrow-leaf herba impia	I	-	PMA 1-2b
Microseris douglasii (DC.) Sch. Bip. var. *platycarpha* (A. Gray) B.L. Turner	small-flowered microseris	N	CNPS 4.2	PMA 1-2b
Osmadenia tenella Nutt.	osmadenia	N	-	PMA 1-1a; 1-1c; 1-2b
Pseudognaphalium biolettii Anderb.	bicolor cudweed	N	-	PMA 1-1c
Pseudognaphalium californicum (DC.) Anderb.	green everlasting	N	-	PMA 1-1a
Senecio sp. [probably undescribed taxon similar to *S. linearifolius,* currently being studied by Brant Primrose (Rebman and Simpson 2006)]	groundsel	N	-	PMA 1-2b
Silybum marianum (L.) Gaertn.	milk thistle	I	-	PMA 1-2b
Sonchus asper (L.) Hill ssp. *asper*	prickly sow thistle	I	-	PMA 1-1a; 1-1c; 1-2b
Sonchus oleraceus L.	common sow thistle	I	-	PMA 1-1a; 1-2b
BORAGINACEAE	**BORAGE FAMILY**			
Harpagonella palmeri A. Gray	Palmer's grapplinghook	N	CNPS 4.2	PMA 1-2b
BRASSICACEAE (CRUCIFERAE)	**MUSTARD FAMILY**			
Brassica nigra (L.) W.D.J. Koch	black mustard	I	-	PMA 1-1a; 1-1c; 1-2b

ATTACHMENT 2
PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORNMINT RESTORATION AND ENHANCEMENT AREAS (CONT.)

Scientific Name	Common Name	Origin	Sensitivity	Preserve Management Unit
CACTACEAE	**CACTUS FAMILY**			
Cylindropuntia [=*Opuntia*] *prolifera* (Engelm.) F.M. Knuth	coastal cholla	N	-	PMA 1-1a; 1-2b
Opuntia littoralis (Engelm.) Cockerell.	shore cactus	N	-	PMA 1-1a; 1-1c; 1-2b
Opuntia oricola Philbrick	chaparral prickly-pear	N	-	PMA 1-2b
CARYOPHYLLACEAE	**PINK FAMILY**			
Silene gallica L.	windmill pink	N	-	PMA 1-2b
CHENOPODIACEAE	**GOOSEFOOT FAMILY**			
Atriplex glauca L.	grey saltbush	I	-	PMA 1-1a
Atriplex semibaccata R. Br.	Australian saltbush	I	-	PMA 1-1a; 1-1c; 1-2b
Salsola tragus L.	Russian thistle, tumbleweed	I	-	PMA 1-1a; 1-2b
CLEOMACEAE	**SPIDERFLOWER FAMILY**			
Peritoma [=*Isomeris*] *arborea* Nutt.	bladderpod	N	-	PMA 1-1a; 1-2b
CONVOLVULACEAE	**MORNING-GLORY FAMILY**			
Convolvulus simulans L.M. Perry	small-flowered morning glory	N	CNPS 4.2	PMA 1-1a; 1-2b
Cuscuta californica Hook. & Arn.	dodder	N	-	PMA 1-1a; 1-2b
CRASSULACEAE	**STONECROP FAMILY**			
Dudleya variegata (S. Watson) Moran	variegated dudleya	N	MSCP NE/4-1, CNPS 1B.2	PMA 1-2b
EUPHORBIACEAE	**SPURGE FAMILY**			
Chamaesyce maculata (L.) Small	spotted spurge	I	-	PMA 1-2b
FABACEAE (LEGUMINOSAE)	**LEGUME FAMILY**			
Lupinus truncatus Nutt.	chaparral lupine	N	-	PMA 1-2b
Medicago polymorpha L.	California bur clover	I	-	PMA 1-2b
FAGACEAE	**OAK FAMILY**			
Quercus engelmannii Greene	Engelmann oak, mesa oak	N	CNPS 4.2	PMA 1-2b
GENTIANACEAE	**GENTIAN FAMILY**			
Zeltnera [=*Centaurium*] *venusta* (A. Gray) G. Mans.	canchalagua	N	-	PMA 1-1a; 1-1c; 1-2b

ATTACHMENT 2
PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORNMINT RESTORATION AND ENHANCEMENT AREAS (CONT.)

Scientific Name	Common Name	Origin	Sensitivity	Preserve Management Unit
GERANIACEAE	**GERANIUM FAMILY**			
Erodium botrys (Cav.) Bertol.	long-beak filaree	I	-	PMA 1-1c; 1-2b
Erodium cicutarium (L.) L'Hér. ex Aiton	red stemmed filaree	I	-	PMA 1-1a; 1-1c; 1-2b
LAMIACEAE	**MINT FAMILY**			
Acanthomintha ilicifolia (A. Gray) A. Gray	San Diego thornmint	N	CE/FT, MSCP NE/4-2, CNPS 1B.1	PMA 1-2b
Salvia apiana Jeps.	white sage	N	-	PMA 1-1c
MALVACEAE	**MALLOW FAMILY**			
Sidalcea malviflora (DC.) Gray ex Benth.	checker-bloom	N	-	PMA 1-2b
MYRSINACEAE				
Anagallis arvensis L.	scarlet pimpernel, poor-man's weatherglass	I	-	PMA 1-1a; 1-1c; 1-2b
PLANTAGINACEAE	**PLANTAIN FAMILY**			
Plantago erecta E. Morris	dot-seed plantain	N	-	PMA 1-2b
Plantago virginica L.	dwarf plantain	I	-	PMA 1-2b
POLYGONACEAE	**BUCKWHEAT FAMILY**			
Eriogonum fasciculatum Benth.	California buckwheat	N	-	PMA 1-1a; 1-1c; 1-2b
Heteromeles arbutifolia (Lindl.) M. Roem.	toyon, Christmas berry	N	-	PMA 1-2b
PRIMULACEAE	**PRIMROSE FAMILY**			
Dodecatheon clevelandii Greene ssp. *clevelandii*	shooting star, wild cyclamen	N	-	PMA 1-1a; 1-2b
SIMMONDSIACEAE	**JOJOBA FAMILY**			
Simmondsia chinensis (Link) C.K. Schneid.	jojoba, goat nut	N	-	PMA 1-1a; 1-2b
SOLANACEAE	**NIGHTSHADE FAMILY**			
Nicotiana glauca Graham	tree tobacco	I	-	PMA 1-2b

Nomenclature from:

University of California
2012 The Jepson Online Interchange. Accessed September 2012 from http://ucjeps.berkeley.edu/interchange.html.

Rebman, John P., and Michael G. Simpson
2006 Checklist of the Vascular Plants of San Diego County, 4th edition. San Diego Natural History Museum.

ATTACHMENT 2
PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORNMINT RESTORATION AND ENHANCEMENT AREAS (CONT.)

FEDERAL CANDIDATES AND LISTED SPECIES

FE = Federally listed endangered
FT = Federally listed threatened
FPT = Federally proposed (Threatened)

STATE LISTED SPECIES

CE = State listed endangered
CR = State listed rare
CT = State listed threatened
FP = CDFG fully protected species
SSC = CDFG species of special concern
WL = CDFG watch list species

CALIFORNIA NATIVE PLANT SOCIETY RARE PLANT RANKING

1A = Species presumed extinct.
1B = Species rare, threatened, or endangered in California and elsewhere. These species are eligible for state listing.
2 = Species rare, threatened, or endangered in California but more common elsewhere. These species are eligible for state listing.
3 = Species for which more information is needed. Distribution, endangerment, and/or taxonomic information is needed.
4 = A watch list of species of limited distribution. These species need to be monitored for changes in the status of their populations.
.1 = Species seriously threatened in California (over 80% of occurrences threatened; high degree and immediacy of threat)
.2 = Species fairly threatened in California (20-80% occurrences threatened; moderate degree and immediacy of threat)
.3 = Species not very threatened in California (<20% of occurrences threatened; low degree and immediacy of threat or no current threats known)
CBR = Considered but rejected
NA = Not applicable

CITY OF CHULA VISTA MSCP

NE = Narrow endemic
4-1 = Species adequately conserved (Table 4-1)
4-2 = Species with known occurrences or suitable habitat within *Chula Vista Subarea* (Table 4-2)
4-3 = Species not likely to be found in the *Chula Vista Subarea* (Table 4-3)

ORIGIN

N = Native to locality
I = Introduced species from outside locality