



San Diego Fairy Shrimp/
Vernal Pool Restoration and
Enhancement Plan for the
Castlerock Project
City of San Diego
Project No. 10046

Prepared for

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1.0 Project Summary and History

This San Diego fairy shrimp/vernal pool restoration and enhancement plan for the Castlerock site provides a description of the restoration site conditions, implementation strategy, and a five-year maintenance, monitoring, and reporting program. This restoration program is required to mitigate for the loss of habitat for the San Diego fairy shrimp (*Branchinecta sandiegonensis*) associated with the implementation of the proposed Castlerock residential development.

2.0 Project Location and Description

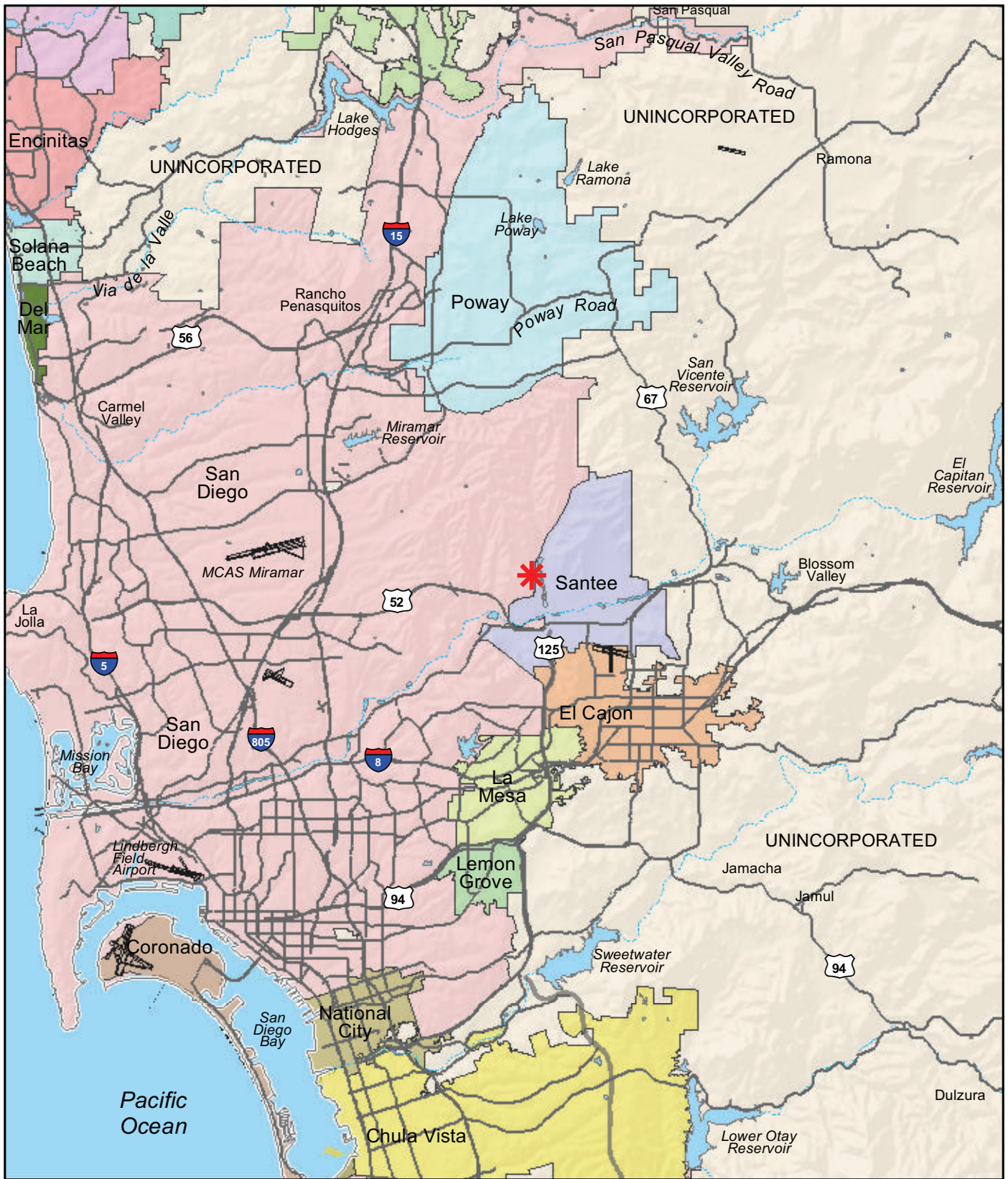
The 203.64-acre Castlerock site is located in the city of San Diego, in the East Elliott community planning area, on the north side of Mast Boulevard between Medina Drive and West Hills Parkway (Figures 1 and 2). Pardee Homes is proposing a residential development at the Castlerock site in the city of San Diego, California (see Figures 1 and 2). This report evaluates two project development scenarios (proposed project) for this site. The first scenario (Annexation Scenario) assumes that the City of San Diego approves the project, but the project is subsequently annexed into the City of Santee. For the Annexation Scenario, Pardee Homes proposes to develop approximately 108.72 out of a total of 203.64 acres of the Castlerock site for residential use (Natural Resource Consultants [NRC] 2012; Figure 3a). The Annexation Scenario would result in the construction of 283 detached single-family residences, 147 single-family detached units clustered on larger lots (referred to as green court units), approximately 4.0 acres (gross) of public parks, 0.64 acre (gross) and 0.49 acre (usable) of pocket parks, a pedestrian trail, and public streets and private driveways on an undeveloped 203.64-acre site within the East Elliott Community Plan. The remainder of the property (94.92 acres) would remain undisturbed as open space, except for small areas needed for brush management. Access to the Annexation Scenario would be provided from Mast Boulevard from the south.

The second scenario (No Annexation Scenario) assumes the project is not annexed into the City of Santee and remains within City of San Diego. For the No Annexation Scenario, Pardee Homes proposes to develop approximately 108.91 out of a total of 203.64 acres of the Castlerock site for residential use (NRC 2012; Figure 3b). Due to the additional infrastructure requirements, the No Annexation Scenario has one less detached single-family residence. The No Annexation Scenario would involve minor changes in the land uses with 282 detached single-family residences, 140 single-family detached small lot units (referred to as green court units), approximately 4.0 acres (gross) of public parks, 0.50 acre (gross) and 0.39 acre (usable) of pocket parks, a pedestrian trail, and public streets and private driveways and 94.73 acres of open space.

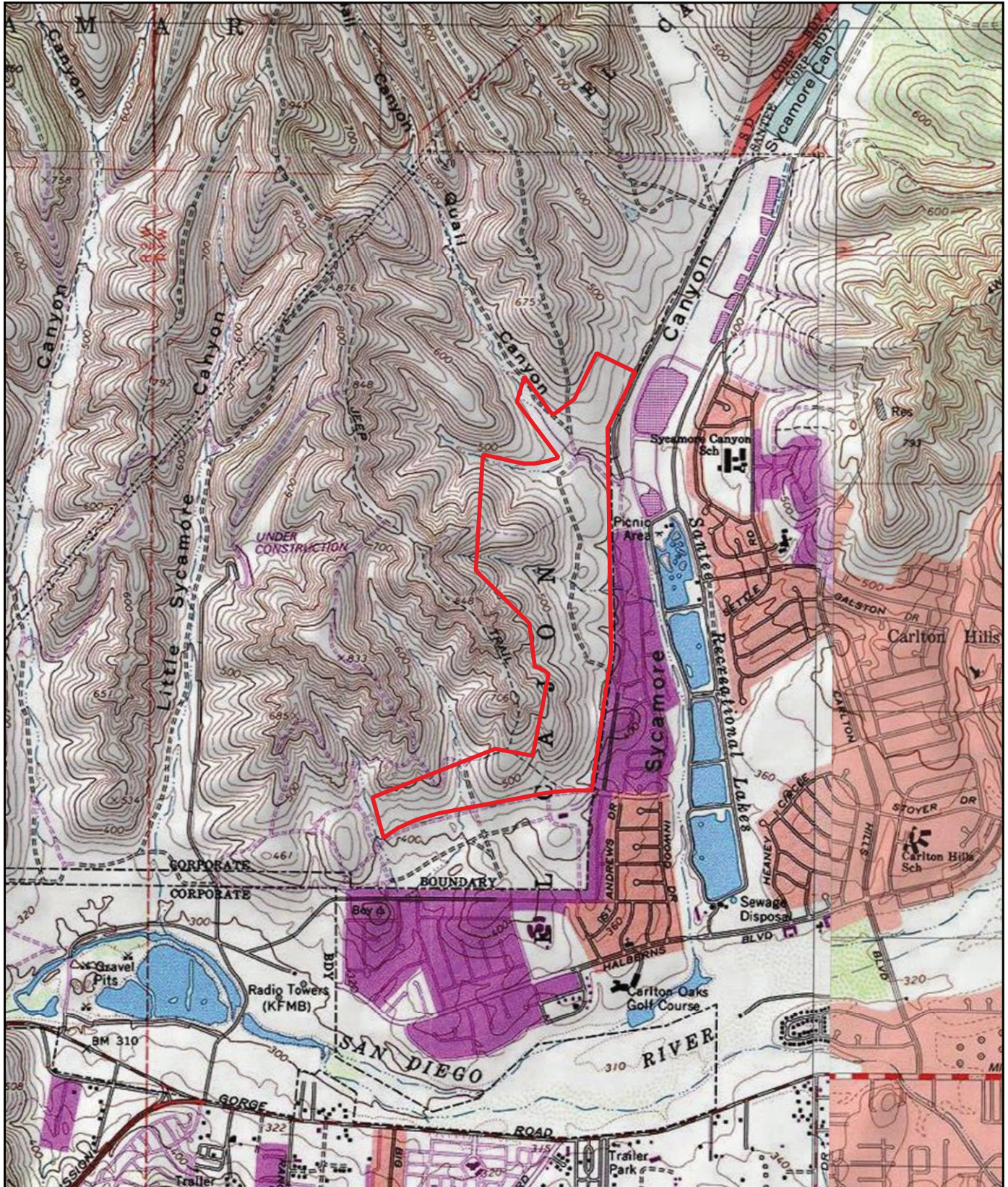
The site is primarily vegetated with annual grassland on rolling terrain of slopes and ridges, rising in elevation from east to west, and also from south to north on the associated ridges. Coastal sage scrub occupies the southwest section of the site, as well as patches in the northeastern and southern sections. Disturbed coastal sage scrub occupies a significant portion of the site as well, with the majority occurring along the western site boundary. Additional habitats present on-site include baccharis-dominated coastal sage scrub, native grassland, eucalyptus woodland, coastal and valley freshwater marsh, emergent wetland, and disturbed areas (i.e., graded areas and dirt roads) (NRC 2012). Land uses adjacent to the Castlerock site include the Santee Lakes Regional Park, single-family residences, West Hills High School, and MHPA. The maximum elevation on-site is approximately 668 feet above mean sea level (NRC 2012).

A total of 16 features have been evaluated for fairy shrimp at the Castlerock property (Glenn Lukos Associates [GLA] 2004, 2005, and 2012) (Table 1; Figures 3a and 3b). Two of the unoccupied road rut features (features 4 and 5) surveyed are located off-site. Of the remaining 14 features, six (features 1, 2, 3, 6, 15, and 16) are man-made depressions associated with dirt roadways or a bike jump. Four of these man-made features (features 1, 2, 3, and 6) are occupied by San Diego fairy shrimp and occur within the project footprint (for both the Annexation and No Annexation Scenarios). The other eight features are avoided by the project, including the five vernal pools (features 9, 10, 11, 12, and 14), two non-vernal pool features within the Vernal Pool Preserve (features 8 and 13), and the impounded emergent wetland pond (feature 7) located north of the development footprint (NRC 2012). Although the four features that would be impacted by project grading are not considered jurisdictional vernal pools by the City of San Diego, impacts to San Diego fairy shrimp habitat must be mitigated for in the form of restoration of suitable habitat at a suitable location.

The proposed project includes a 1.92-acre Vernal Pool Preserve (Preserve). The Preserve contains the five preserved vernal pools and two non-vernal pool features in a 0.45-acre enhancement area. Note that these two non-vernal pool features are not included on figures, as they are not vernal pools and they do not contain San Diego fairy shrimp. The Preserve also contains 1.47-acre Vernal Pool Restoration Area, consisting of a minimum of 0.03 acre (1,260 square feet) to be restored to vernal pool habitat and 1.43 acres of uplands to be restored to native grassland habitat.



 Project Location



 Project Boundary

FIGURE 2

Project Location on USGS Map



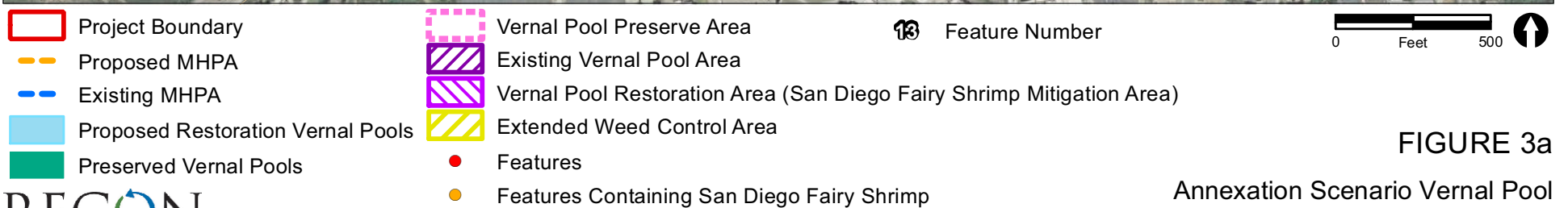
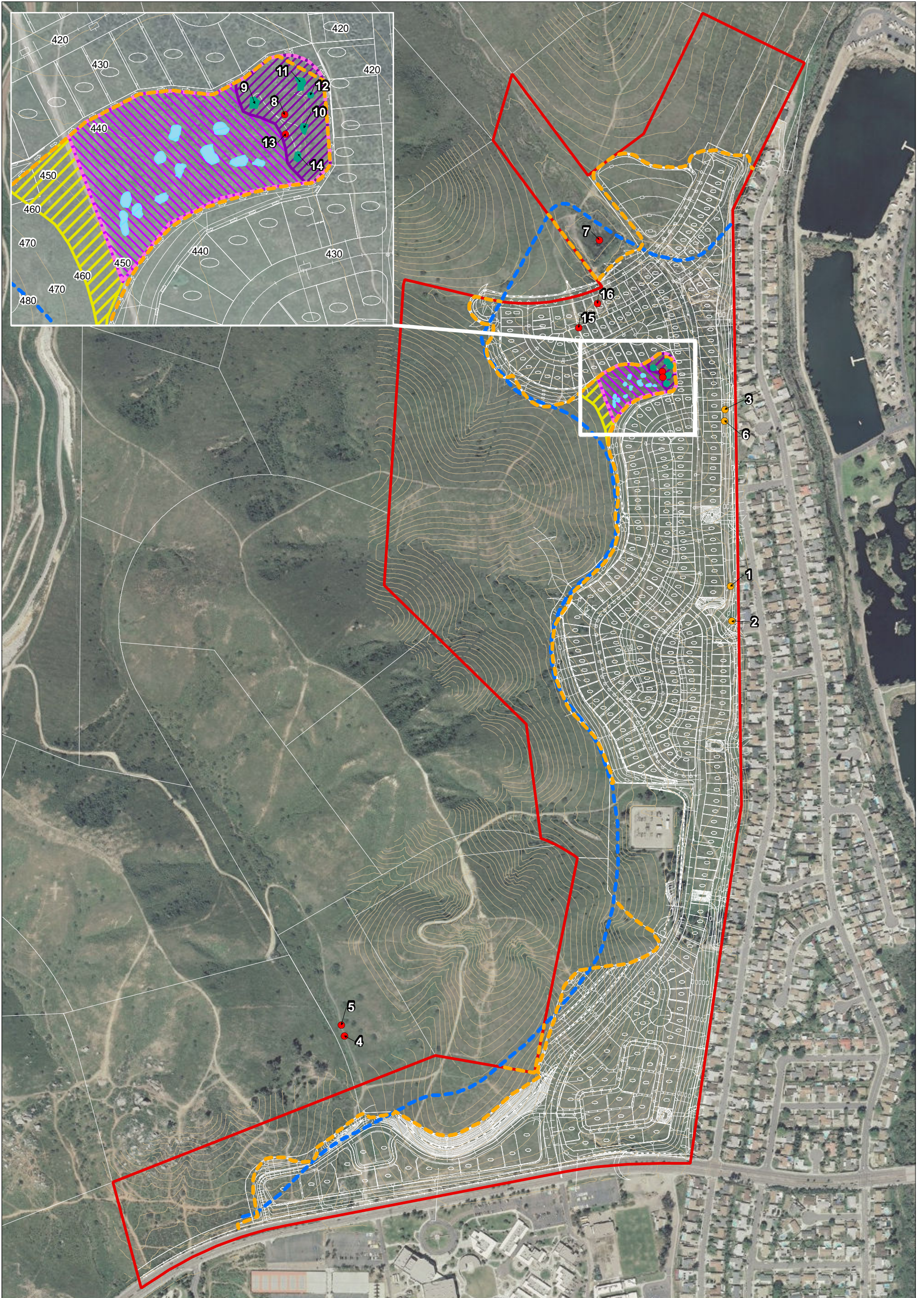
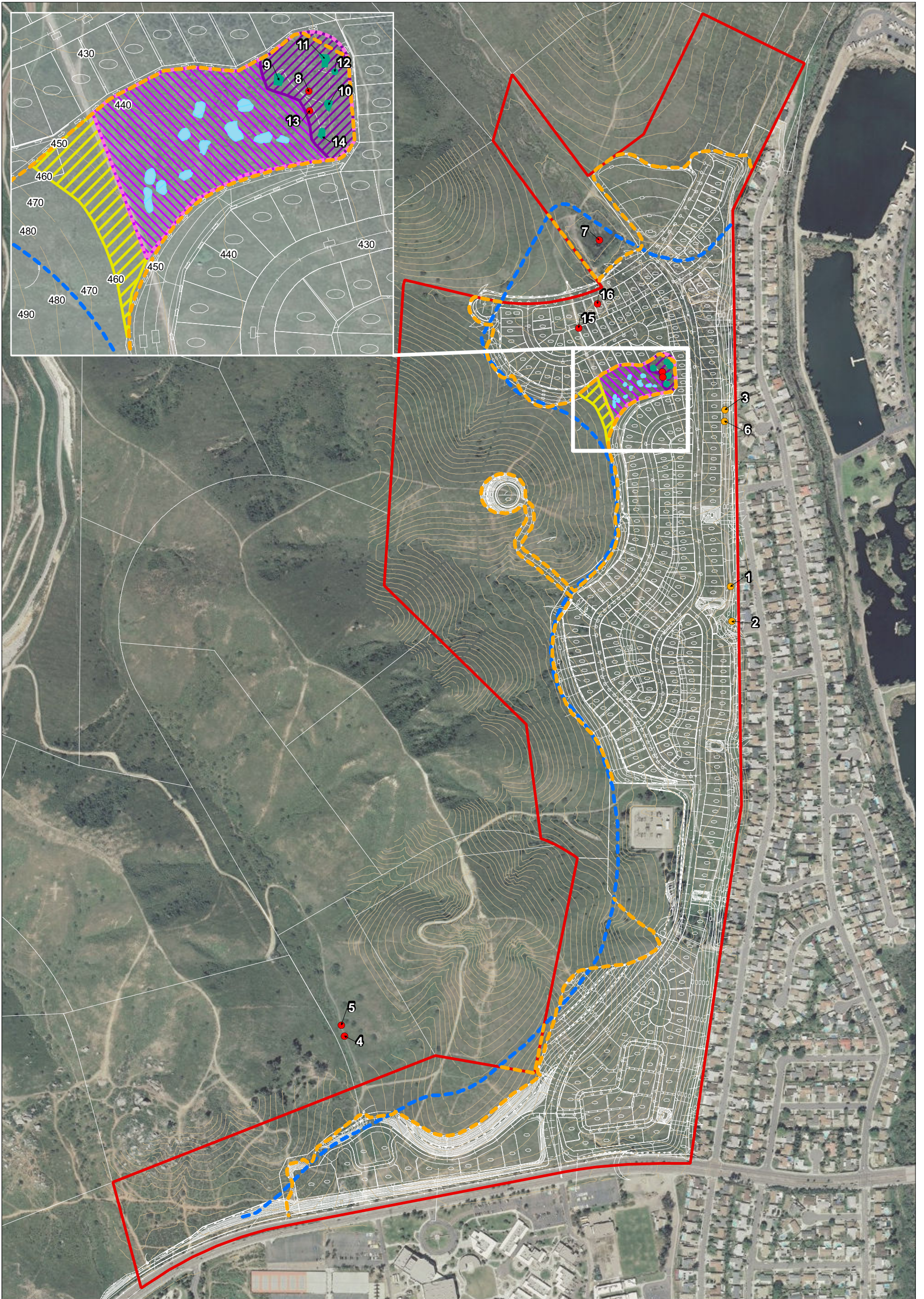


FIGURE 3a

Annexation Scenario Vernal Pool Preserve for Proposed Project



- | | | |
|-----------------------------------|---|----------------|
| Project Boundary | Vernal Pool Preserve Area | Feature Number |
| Proposed MHPA | Existing Vernal Pool Area | |
| Existing MHPA | Vernal Pool Restoration Area (San Diego Fairy Shrimp Mitigation Area) | |
| Proposed Restoration Vernal Pools | Extended Weed Control Area | |
| Preserved Vernal Pools | Features | |
| | Features Containing San Diego Fairy Shrimp | |

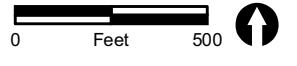


FIGURE 3b

No Annexation Scenario Vernal Pool Preserve for Proposed Project

TABLE 1
VERNAL POOL EVALUATION SUMMARY MATRIX

Feature No.	Year Surveyed	Indicator Plants	Fairy Shrimp	Description	Vernal Pool?
1	2003/2004	Absent	Present	Dirt road/trail depression.	No
2	2003/2004	Absent	Present	Dirt bike jump depression.	No
3	2003/2004	Absent	Present	Dirt road/trail depression.	No
4	2003/2004	Absent	Absent	Located off-site. Was formerly a rut in a dirt access road.	No
5	2003/2004	Absent	Absent	Located off-site. Was formerly a rut in a dirt access road.	No
6	2004/2005	Absent	Present	Dirt road/trail depression.	No
7	2004/2005 2010/2011	Absent	Absent	Emergent wetland with ponding.	No
8	2004/2005 2010/2011	Absent	Absent	Part to the mima-mound complex.	No
9	2004/2005 2010/2011	Present	Absent	100-square-foot depression. Disturbed. Part to the mima-mound complex. <i>Psilocarphus brevissimus</i> present.	Yes
10	2004/2005 2010/2011	Present	Absent	Two small tire ruts within a larger depression. Each rut is approximately 15 square feet (for a total of 30 square feet). Within the mima-mound complex. <i>Psilocarphus brevissimus</i> present.	Yes
11	2004/2005 2010/2011	Present	Absent	80-square-foot depression. Part to the mima-mound complex. <i>Deschampsia danthonioides</i> and <i>Psilocarphus brevissimus</i> present.	Yes
12	2004/2005 2010/2011	Present	Absent	15-square-foot depression. Part to the mima-mound complex. <i>Psilocarphus brevissimus</i> present.	Yes
13	2004/2005 2010/2011	Absent	Absent	Part to the mima-mound complex.	No
14	2004/2005 2010/2011	Present	Absent	30-square-foot depression. Part to the mima-mound complex. <i>Psilocarphus brevissimus</i> and <i>Deschampsia danthonioides</i> present.	Yes
15	2010/2011	Present	Absent	Dirt road depression flushed by seasonal drainage. Vernal pool indicator vegetation present.	No
16	2010/2011	Present	Absent	Dirt road depression. Vernal pool indicator vegetation present.	No

An additional 0.48-acre Extended Weed Control Area is located within native grassland habitat adjacent to the Preserve and would be the target of additional weed control activities (Figures 4a, 4b, and 5). The restoration and enhancement activities identified in this document are designed ensure the continued existence of the vernal pools contained within the Preserve and to mitigate impacts to road ruts that support San Diego fairy shrimp. The upland habitat enhancement and maintenance program around the preserved and restored vernal pools is intended to protect against indirect impacts. The proposed project design features avoidance and minimization measures, including buffers, drainage features, and barriers, to ensure that the proposed project would not directly impact the vernal pools and their dependent species and indirect impacts to the Preserve would be less than significant.

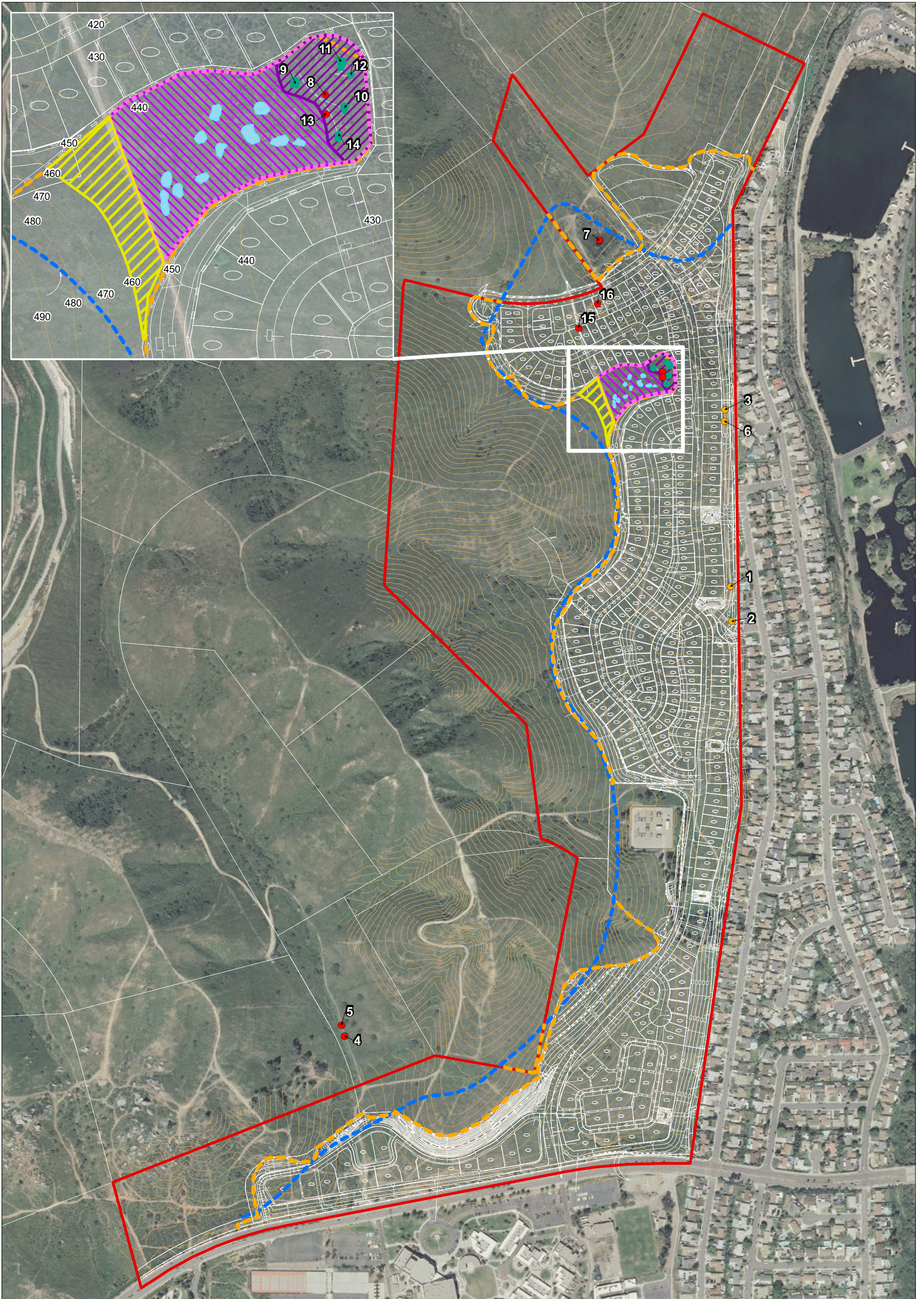
3.0 Goals of Mitigation

3.1 Types of Habitat to Be Restored/Created

Land adjacent to the five preserved San Diego mesa hardpan vernal pools would be restored to vernal pool habitat as mitigation impacts to road ruts that support San Diego fairy shrimp (see Figures 4a, 4b and 5). The restored vernal pools are designed to support San Diego fairy shrimp and vernal flora characteristic of the preserved pools on-site. Restoration of pools with a minimum of 1,260 square feet (3:1 mitigation ratio, NRC 2012) of vernal pool surface area and the associated watershed area needed to support these pools is anticipated to ensure success of this restoration project.

San Diego mesa hardpan vernal pools are shallow, isolated, ephemeral wetlands. The micro-topography surrounding vernal pools often consists of small mima mounds or hummocks. Vernal pools fill with water during winter rains and the water evaporates after the rains cease. Plants in vernal pools may be aquatic or may germinate following the drying of the pool. San Diego Mesa hardpan vernal pools generally support a characteristic suite of plant and animal species. Hardpan vernal pools are primarily found north of Otay Mesa (Holland 1986). Vernal pools are considered to be sensitive habitat by local, state, and federal governments, and it is estimated that over 95 percent of the vernal pool habitat in San Diego County has been destroyed (Bauder 1986). Thus, preservation or restoration of any habitat containing vernal pool features or characteristics would constitute a reduction in this estimate of loss.

When possible, during topographic reconstruction, the watershed and exit points for overflow from the restored vernal pools would be contoured to enable water to flow from the restored vernal pools to the adjacent existing pools.



- Project Boundary
- Proposed MHPA
- Existing MHPA
- Proposed Restoration Vernal Pools
- Preserved Vernal Pools
- Vernal Pool Preserve Area
- Existing Vernal Pool Area
- Vernal Pool Restoration Area (San Diego Fairy Shrimp Mitigation Area)
- Extended Weed Control Area
- Features
- Features Containing San Diego Fairy Shrimp
- 13 Feature Number

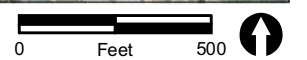


FIGURE 4a

Vernal Pool Preserve - Annexation Scenario

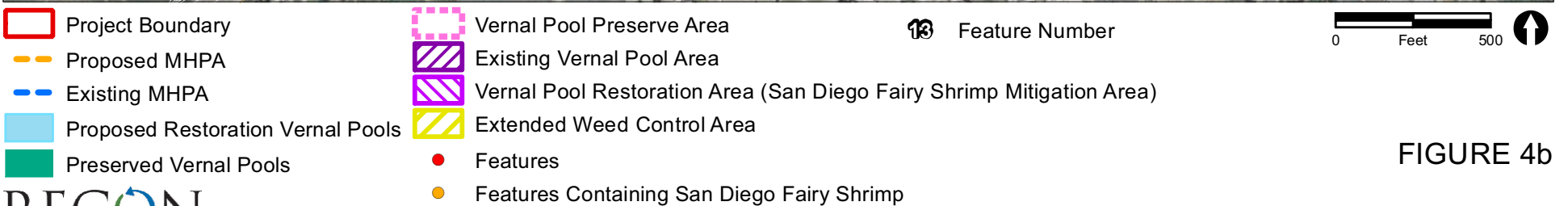
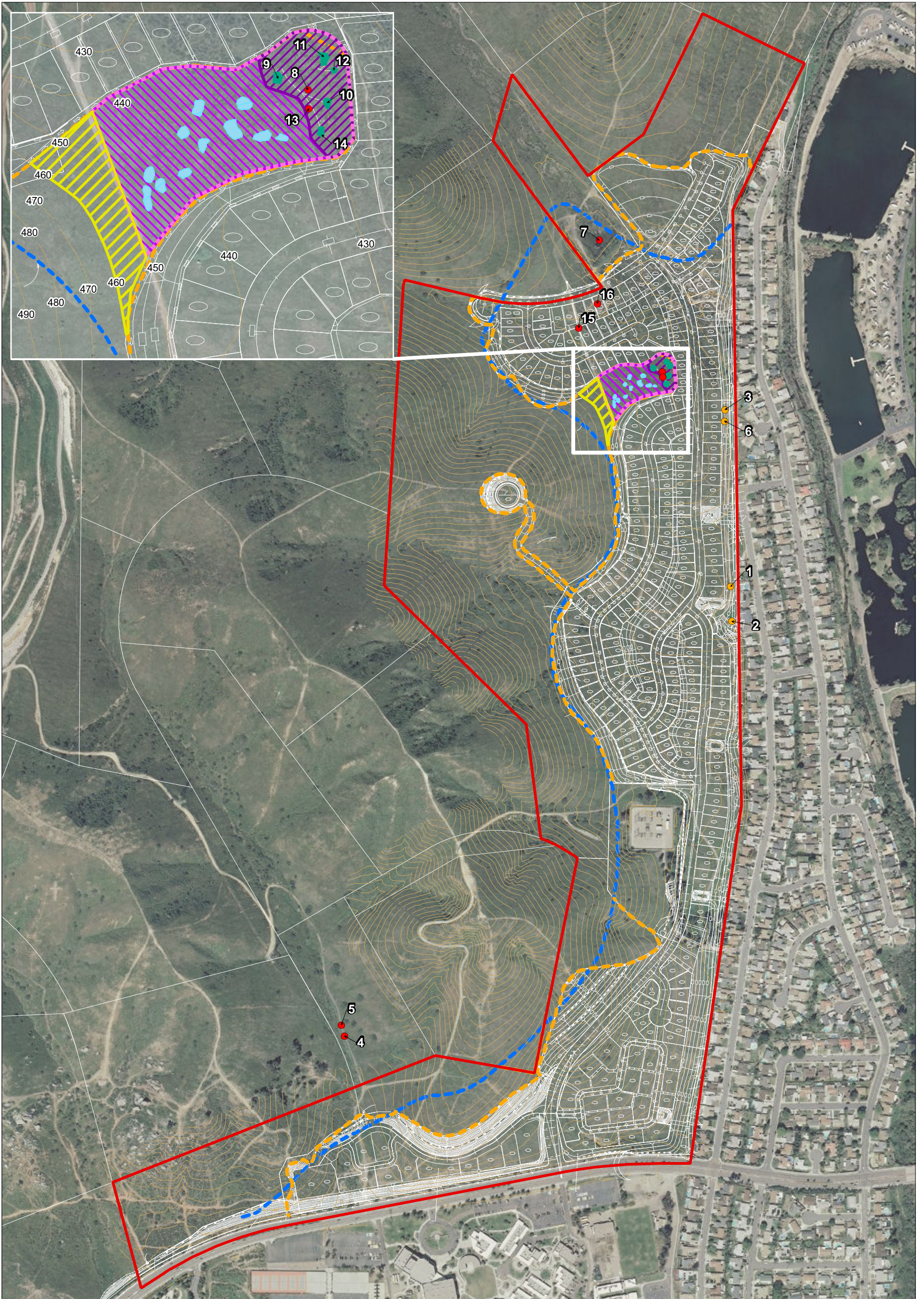
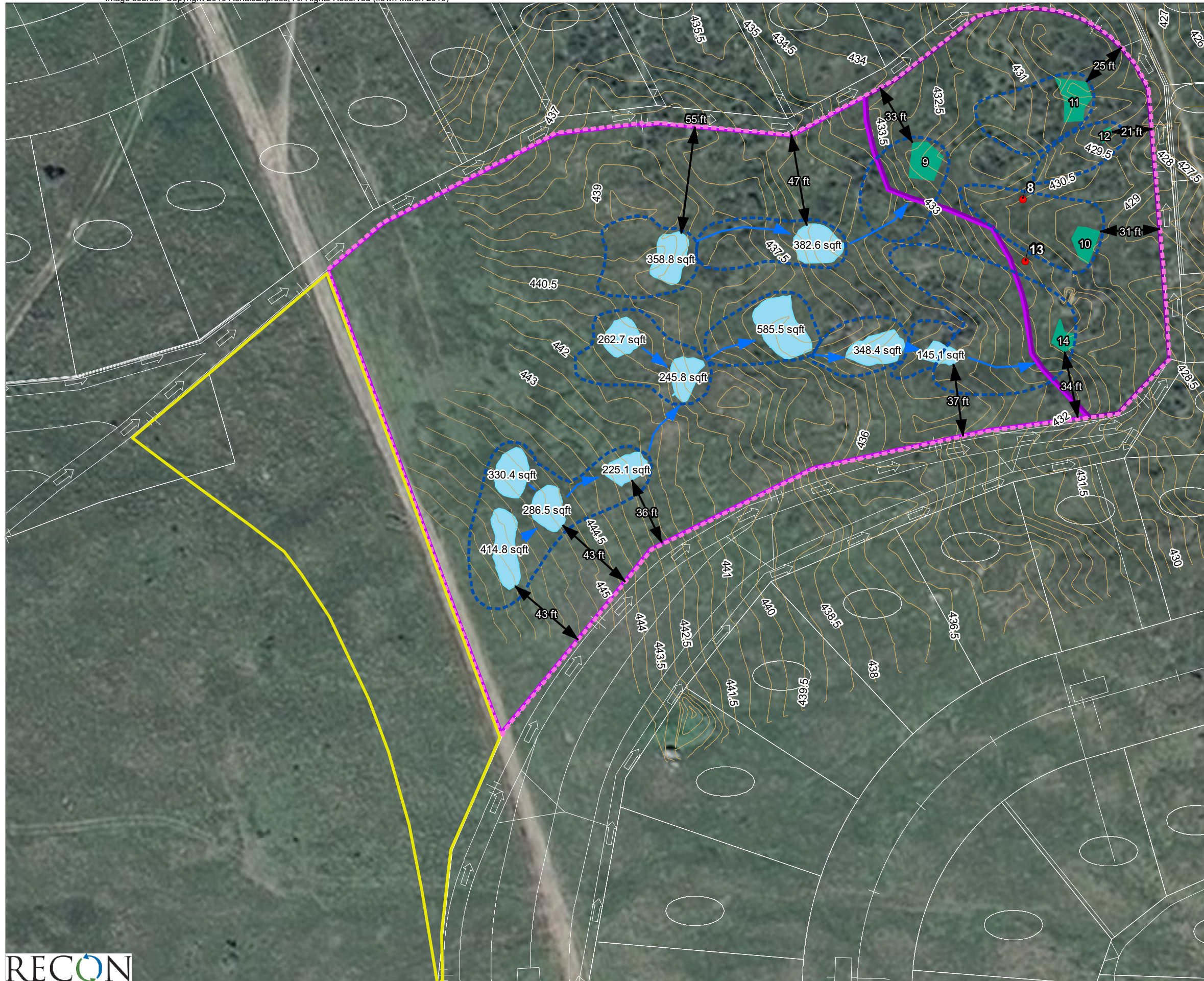


FIGURE 4b

Vernal Pool Preserve - No Annexation Scenario



- Vernal Pool Preserve Area
- Existing Vernal Pool Area
- Vernal Pool Restoration Area
- Extended Weed Control Area
- Proposed Restoration Vernal Pools
- Preserved Vernal Pools
- Features
- Vernal Pool Watershed Area
- 6" Contours
- Flowlines

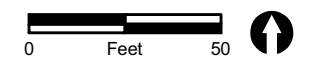


FIGURE 5

Vernal Pool Preserve Detail

3.2 Functions and Values of Habitat to Be Restored/Created

3.2.1 Communities

3.2.1.1 San Diego Hardpan Vernal Pools

Hardpan vernal pools hold water due to an impermeable cemented hardpan layer that slows or prevents the drainage of water. Vernal pools in the Castlerock area typically occur in openings in surrounding coastal sage scrub and grassland communities. Vernal pools on and in the vicinity of the project site are not known to support sensitive vernal pool plant species. Compared to other better developed vernal pool complexes in San Diego County, the existing pools at the Castlerock site support a relatively small number of vernal pool plant species. Table 2 lists vernal pool indicator species present in the vicinity (City of San Diego 2003 and GLA 2012).

**TABLE 2
VERNAL POOL PLANT INDICATOR SPECIES FOR THE
CASTLEROCK–MISSION TRAILS AREA**

Plant Species	Type
Water-starwort <i>Callitriche marginata</i>	Annual; vernal pools and moist openings
Stone-crop <i>Crassula aquatica</i>	Annual; vernal pools and ephemeral wetlands
Annual hairgrass <i>Deschampsia danthonioides</i>	Annual; vernal pool specialist in region
Slender spikerush <i>Eleocharis acicularis</i>	Perennial; ephemeral wetlands
Pale spikerush <i>Eleocharis macrostachya</i>	Perennial; ephemeral wetlands
Toad rush <i>Juncus bufonius</i>	Annual; weedy native of ephemeral wetlands
Flowering quillwort <i>Triglochin [Lilaea] scilloides</i>	Annual; ephemeral wetlands, streams & lake edges
Plantain <i>Plantago elongata</i>	Annual; vernal pools, saline and alkaline places
Dwarf woolly-heads <i>Psilocarphus brevissimus</i>	Annual; vernal pool specialist

SOURCE: City of San Diego 2003 and Glenn Lukos Associates 2012.

NOTE: Vascular plant species known to occupy natural vernal pools in the Castlerock and Mission Trails region. Species identified as “vernal pool specialists” are found almost exclusively in natural vernal pools in the region.

The federally endangered San Diego fairy shrimp does occur in man-made features on the Castlerock site, but the shrimp were not detected in the preserved vernal pools. This

lack of shrimp in the existing vernal pools is probably due to the pools having insufficient ponding durations to allow the San Diego fairy shrimp to complete its life cycle. This restoration plan focuses on the restoration of vernal pool habitat for San Diego fairy shrimp.

To provide the best chance for success this program would restore up to eleven vernal pools with a minimum 1,260 square feet of vernal pool surface area within the Preserve (Figure 5). The watershed for the restored vernal pools would be of sufficient size to support the necessary hydrological conditions for San Diego fairy shrimp.

3.2.2 Endangered Species

3.2.2.1 San Diego Fairy Shrimp (*Branchinecta sandiegonensis*)

The San Diego fairy shrimp is federally listed as endangered and is covered by the City of San Diego's Multiple Species Conservation Program (MSCP) (1995). This species is restricted to vernal pools in coastal southern California and south to northwestern Baja California, Mexico (USFWS 2000). The life cycle of fairy shrimp is relatively simple, with larvae hatching out of dormant cysts after being covered with water for a prescribed period of time, developing into adults, and mating and laying eggs before the pool dries. The development time is influenced both by the water temperature and the species-specific responses to environmental cues including water chemistry. San Diego fairy shrimp are found in vernal pools and other ponded areas that are generally less than 30 centimeters deep. This species takes between three and eight days to hatch and development to the adult stage takes between seven and twenty days.

4.0 Proposed Mitigation Site

4.1 Location and Size of Mitigation Area

The total area of permanent impact to man-made features containing San Diego fairy shrimp by the project development is 420 square feet, or approximately 0.009 acre. Impacts would be compensated by restoring vernal pools with a minimum of 1,260 square feet (a ratio of 3:1) within the Preserve, adjacent to the existing preserved vernal pools (see Figures 4a, 4b and 5) (NRC 2012).

The restored vernal pools are intended to support a sustainable population of San Diego fairy shrimp and this would require an adequate watershed for the pools to function properly (RECON 1997). The proposed mitigation plan incorporates the appropriate watersheds to ensure adequate ponding durations for San Diego fairy shrimp (see Figures 4a, 4b and 5).

4.1.1 Existing Restoration Site Conditions

The restoration site is currently dominated by annual grasses, and scattered patches of native bunchgrasses in the swales and remnant coastal sage scrub on the existing mounds. Under the current high level of annual weed invasion, the native floral diversity of the uplands is relatively low.

Elevation within the Preserve ranges from approximately 400 to 500 feet above mean sea level (MSL). Most of the site has relatively gently sloping topography, with mima mounds and swales. Soils in the preserve consist of Diablo-Olivenhain complex (DoE). This soil type is characterized as having 9 to 30 percent slopes, moderate erosion potential, and high runoff characteristics (U.S. Department of Agriculture 1973).

4.2 Ownership Status

The lands covered by this restoration and enhancement plan total approximately 1.92 acre (Preserve) and would be owned and managed in accordance with this plan (funded by Pardee) by a third-party entity approved by the City of San Diego. Transfer would only be allowed to an entity where in perpetuity requirements would continue to be guaranteed.

5.0 Implementation Plan

5.1 Rationale for Expecting Implementation Success

Existing examples of vernal pool restoration projects in the San Diego region range in age from 1 to over 25 years. In the oldest example, which was a controlled study evaluating the effects of topographic restoration and seed dispersal facilitation (Scheidlinger et al. 1985), vegetation in the restored pools and disturbed areas of the site with persisting pool hydrology was equivalent after 14 years to that of natural pools (Patterson 1995). In restoration programs conducted on California Terraces on Otay Mesa (RECON 2005), restoration success criteria similar to those proposed herein were met within the five-year maintenance and monitoring period. Other successful vernal pool restoration projects have been undertaken on Otay Mesa, Marine Corps Air Station Miramar, and Camp Pendleton.

5.1.1 Restorationist Qualifications

The restoration project biologist or team should have a minimum of five years of vernal pool restoration experience in coastal southern California. The project biologist or team must be able to demonstrate an understanding of the special growing requirements of vernal pool plant species as they relate to the restoration and enhancement of vernal pools. The project biologist or biology team must have the necessary state and federal permits to work with listed vernal pool plant and animal species.

6.0 Site Preparation

6.1 Preliminary Design and Engineering

The proposed project includes a 1.92-acre Preserve. The Preserve contains the five preserved vernal pools and two non-vernal pool features in a 0.45-acre enhancement area. The Preserve also contains a 1.47-acre Vernal Pool Restoration Area, consisting of restored vernal pools and native grassland upland habitat. A minimum of 1,260 square feet of vernal pool surface area would be restored using topographic reconstruction, weed dethatching, soil translocation, and barrier construction methods discussed below. The 1,260 square feet of restoration would be provided via several pools (see Figure 5). An additional 0.48-acre Extended Weed Control Area is located within native grassland upland habitat adjacent to the Preserve and would be the target of additional weed control activities (see Figures 4a, 4b, and 5).

The location for the proposed vernal pool restoration was determined and mapped in the field (see Figures 4a, 4b and 5). The sites chosen for vernal pool restoration have been previously disturbed and the areas are dominated by weeds. After reconstruction, the boundary of the restored vernal pools will be recorded in the field using post-processed global positioning system (GPS) with a horizontal accuracy of less than one foot. The as-built grading plans would be replotted at 1 inch equals 40 feet, showing pool boundaries, existing path and level, and finished 0.5-foot topographic contours.

6.1.1 Avoidance Measures

Both the Annexation Scenario and No Annexation Scenario designs provide avoidance measures to ensure that the existing hydrology (rain water runoff and subsurface flows) of the preserved vernal pools is maintained during grading, construction, and implementation (NRC 2012). These measures include: (1) avoidance of the vernal pools watersheds, (2) maintaining buffers between the project footprint and preserved and restored vernal pools, (3) drainage features to direct runoff away from the Preserve, and (4) a solid wall to deflect irrigation spray from lots located above the Preserve.

To avoid impacts the existing hydrology, topography, and vegetation of pools, the project footprint would avoid the vernal pool watersheds completely and maintain buffers surrounding the existing and restored vernal pools ranging in width from 21 to 65 feet. The limits of grading will be staked so that the watersheds of each vernal pool are avoided during construction. A 21- to 48-foot buffer would be maintained at the preserved vernal pools and a 40- to 65-foot buffer would be maintained at the proposed restoration vernal pools (see Figure 5).

Grading adjacent to the preserved vernal pools would be conducted such that all of the project development area runoff would drain away from the vernal pools and their associated watersheds. The project design also includes a solid block wall surrounding the lots above the preserved vernal pools to deflect irrigation spray away from the Preserve (NRC 2012). Fencing would be designed to ensure that animal movement would still be possible. A portion of the grading along the perimeter of the preserved vernal pool acreage would drain toward the Preserve; however, the project design incorporates drainage swales at the base of these manufactured slopes that would catch any direct runoff away from the pools and into the development area (NRC 2012). These adjacent areas would be landscaped with native, non-invasive species compatible with vernal pool habitat.

6.2 Weed Dethatching

Prior to topographic reconstruction, labor crews would use weed whips and hand tools to cut, rake, and remove the accumulated weedy thatch that currently covers the 2.40-acre Vernal Pool Restoration Area and Extended Weeding Area. The labor crews may also use leaf blowers to concentrate the thatch material and weed seeds for removal. The weed thatch would be collected and taken to a landfill or put into a green waste dumpster for removal. Removal of the weedy thatch material would enable the project biologist and grader operator to see the soil surface so that the proper vernal pool elevations can be excavated. Removal of the thatch would also help reduce future weed growth that is aided by the mulching effect of the thatch.

6.3 Topographic Reconstruction

In general, vernal pool restoration would reverse the topographic disturbance on the site, which consists primarily of erosion and flattening of mounds and the filling in of intermound depressions, resulting in the reduced capacity of the site to capture and store rainwater. The primary physical change accomplished by topographic reconstruction would be the removal of a portion of the fill material to restore vernal pools and to enhance ponding and water retention. Material removed would be used to

reconstruct low swales to enlarge the surface water retention volume of the site. Any excess fill material not used in mound reconstruction would be removed from the site.

Grading activities would be conducted outside of the rainy season in late summer or early fall between August 15 and October 15 to minimize unintended compacting of the soils by grading equipment. The grading would be conducted under the direction of a qualified biologist with a minimum of five years of vernal pool restoration experience. Areas that are to remain unaffected by restoration grading activities would be marked prior to implementation. Grading would be implemented using a small dozer. The grading operator would also be experienced in vernal pool restoration work.

6.4 Translocation of Soils

Soils from the four man-made road rut features containing San Diego fairy shrimp cysts would be collected prior to any construction impacts. This soil would be used to inoculate the newly restored vernal pools. To minimize the chance that the salvage cyst soil contains the common versatile fairy shrimp (*Branchinecta lindahli*), the soil will be tested by a qualified/permitted biologist for the presence of the versatile fairy shrimp prior to placing the soil into the restored pools. The detailed protocol for salvage of shrimp cyst bearing soils is outlined in Section 7.3.

6.5 Barriers

Concurrent with restoration grading, a temporary fence would be erected and maintained around the perimeter of the restoration site to bar unauthorized vehicle access.

Once the topographic reconstruction is complete, signs would provide notice that the area is an ecological preserve, notify that trespassing is prohibited, and cite penalties for trespass violation including liability for repair of any damage to soil or biological resources within the barrier. Signs in both Spanish and English would be mounted at approximately 200-foot intervals around the Preserve.

If necessary, the Preserve would be permanently fenced, at strategic locations, to prevent unauthorized entry and to minimize vandalism. Protection of the restoration site from human disturbance is essential for success. Of particular importance is protection of the restoration site from pedestrians and off-road vehicles. Any permanent fencing would be installed in consultation with the project owner and the City of San Diego.

If bicycle or foot trails are observed within the Preserve, natural methods would be used to discourage trail use. These methods include piling of brush material at the entrance of the new trail and planting of shore cactus (*Opuntia littoralis*).

7.0 Planting and Restoration Plan

7.1 Reintroduction of Vernal Pool Biota

Restoration of vernal pool habitat within the Preserve requires the reintroduction of plants and animals at the site in addition to the physical reconstruction described above. The restoration of vernal pool habitat can be greatly accelerated by the active transport of propagules from donor sites into the restored vernal pools (Scheidlinger et al. 1985; RECON 1999). This would be accomplished by the redistribution of seeds, spores, bulbs, invertebrate eggs, fairy shrimp cysts, and other propagules from on-site vernal pools and made-made road rut features, as well as by the translocation of the propagules of individual species from off-site habitats.

7.2 Seed Collection

Vernal pool seed collection would be conducted both at the Castlerock site and adjacent open space areas that may support vernal pools. Seeds would be collected within five miles of the proposed restoration and enhancement site. Vernal pool indicator species listed in Table 2 for the East Elliot area should be considered for introduction to the vernal pools. The hand-collected vernal pool seeds would either be distributed in the restored vernal pools immediately following the completion of topographic reconstruction or just prior to or after significant rain events at the discretion of the project biologist. Vernal pool seeds may also be distributed to enhance the preserved vernal pools prior to or after significant rain events at the discretion of the project biologist.

7.3 Translocation of Endangered Species

The San Diego fairy shrimp are known to occupy four man-made features at the Castlerock property. The following translocation guidelines would be adhered to for the fairy shrimp translocation effort.

- Cyst bearing soil would be collected when it is dry to avoid damaging or destroying fairy shrimp cysts, which are fragile when wet.
- A hand trowel or similar instrument shall be used to collect the sediment. Whenever possible, soil shall be collected in chunks. The trowel shall be used to pry up intact chunks of sediment, rather than loosening the soil by raking and shoveling which can damage the cysts. The soil from donor features would be stored individually in labeled boxes with adequate ventilation and away from direct sunlight. Salvaged soil

would be kept at the RECON seed storage facility that provides the appropriate conditions of light and temperature.

- Prior to placing any salvaged cyst-bearing soil into the restored pools, the soil will be tested for the presence of the versatile fairy shrimp. If the soil contains versatile fairy shrimp cysts that salvaged soil will not be placed into the restored pool.
- Salvaged soil would be placed in the bottom of restored vernal pools to give the greatest chance for the material to be inundated during the rainy season.

7.4 Establishment of Vernal Pool Target Species

Necessary criteria for this mitigation plan include establishment of populations of San Diego fairy shrimp. Following topographic reconstruction, the restored vernal pools would be inoculated with shrimp cyst bearing soils collected on-site. After the restored vernal pools have demonstrated suitable hydrologic conditions, San Diego fairy shrimp cysts would be introduced into the restored vernal pools following the guidelines listed above.

7.5 Off-Site Translocation for Species Diversity

In order to meet target species diversity criteria, plant species listed in Table 2 and animal species listed in Table 3 may be translocated to the restored vernal pools. Species proposed for introduction to the site shall be considered to be indicative of vernal pool habitat quality.

**TABLE 3
TARGET INDICATOR WILDLIFE SPECIES**

Group	Species
Anostraca	<i>Branchinecta sandiegonensis</i> (San Diego fairy shrimp)
Conchostraca	<i>Cyzicus</i> sp. (clam shrimp)
Ostracoda	<i>Bradleycypris</i> sp., <i>Eucypris</i> sp., <i>Heterocypris</i> sp., <i>Lymnocythere</i> sp., <i>Pseudoilicypris</i> sp. (seed shrimp)
Dytiscidae	<i>Agabus</i> sp. (predaceous water beetles)
Pelobatidae	<i>Spea hammondi</i> (western spadefoot toad)

7.6 Upland Restoration – Native Grassland

Approximately 1.43 acres of native grassland would be restored in the Vernal Pool Restoration Area. The following criteria for native cover, species diversity, and weed

cover only apply to restored native grassland upland habitat in the Vernal Pool Restoration Area and not the 0.45-acre preserved vernal pool area.

The restoration area currently supports an open, disturbed non-native grassland and small patches of coastal sage scrub. All seed used for plant propagation would come from the East Elliot and Mission Trails area. The restoration of native plant communities at this site would be based on a principle of reestablishing suitable soil conditions, including mycorrhizal fungi, and native seed banks.

Vegetation in the Vernal Pool Restoration Area is designed to be a low-growing, open native grassland community. Restoration techniques would include hand-broadcasting locally collected seed as well as installing container stock grown from the same seed source. The reestablishment of a fully diverse native grassland community would rely on appropriate initial conditions and intensive weed control efforts. Target species for native grassland restoration are listed in Table 4 and include purple needlegrass (*Nassella pulchra*) and foothill needlegrass (*Nassella lepida*), which would dominate the site.

**TABLE 4
TARGET PLANT SPECIES FOR NATIVE GRASSLAND RESTORATION**

Scientific Name	Common Name
<i>Bothriochloa barbinodis</i>	Cane bluestem
<i>Chlorogalum parviflorum</i>	Wavy-leaved soap plant
<i>Mirabilis californica</i>	Wishbone bush
<i>Nassella lepida</i>	Foothill needlegrass
<i>Nassella pulchra</i>	Purple needlegrass
<i>Sisyrinchium bellum</i>	Western blue-eyed-grass

The target values for the native grassland at the Vernal Pool Restoration Area would be based on a reference site used to define the target vegetation and establish target values for cover, diversity, wildlife usage, and weed abundance. A reference site would be chosen from open space areas on the Castlerock property or nearby Mission Trails Regional Park.

7.7 Irrigation

Water inputs to the vernal pools would be confined to natural rainfall. The upland plantings would be timed to coincide with natural rainfall events. If necessary, a water truck would be used to irrigate newly planted shrubs and grasses in upland areas until they become established. Watering will be performed by crews that have experience with vernal pool restoration so that runoff towards the restored pools is minimized.

7.8 Extended Weed Control Area

The Extended Weed Control Area currently supports 0.48 acre of native grassland that would be enhanced through weed control activities. Hand-seeding of locally sourced native grassland seed from the native grassland plant palette may also occur in this area, if needed. Control of non-native species in the Extended Weed Control Area would include an initial dethatching using weed whips, and follow up control using herbicide. Approved glyphosate herbicide would be used to control weeds with appropriate buffers and never prior to a rain event. When herbicide is used, there must be little to no wind present, as overspray may potentially harm native plants. Prosecurator® and Roundup® are approved for use in natural areas by the USFWS and CDFG, and must be applied by a licensed applicator under the supervision of a certified pest control adviser.

8.0 As-Built Implementation Reporting

The construction-year implementation and monitoring report would include a final as-built plan. The as-built/year 1 status report would include topographic mapping showing as-built topographic vernal pool contours, barriers, photographs of the restoration site, and a summary of project activities taken place. The status of endangered species, planting, and weeding efforts, and the progress towards reaching the restoration goals at the end of the construction year would be discussed.

9.0 Maintenance during the Monitoring Period

9.1 Maintenance Activities

Regular maintenance of the Preserve and Extended Weed Control Area, including weeding, would be required during the five-year monitoring period. On-going maintenance of the barriers and prohibition of trespassing would also be necessary. Maintenance activities would include but are not limited to the following:

- Removal of aggressive non-native weeds shall be implemented during the five-year monitoring periods for the vernal pools and adjacent upland habitats in the Preserve and Extended Weed Control Area. All weeding shall be done by hand in the preserved and restored vernal pools.
- Approved herbicide, such as glyphosate, would be used to control weeds in the surrounding uplands, with appropriate buffers and never prior to a rain event.

Herbicide has been successfully used in the vernal pool restoration programs on Otay Mesa and elsewhere to control weeds. In these projects the success criteria for listed fairy shrimp have been met or exceeded with no visible negative effects on San Diego fairy shrimp.

- The monitoring biologist shall direct weeding crews to remove weeds that require control during the five-year monitoring period. The need for weeding is expected to decrease substantially by the end of the monitoring period provided successful habitat restoration has been achieved.
- All fencing and signs shall be checked and repaired as necessary.
- Trash in the Preserve shall be removed once every month, if present.
- Any persons found willfully damaging the habitat within the Preserve, including but not restricted to trash dumping, off-road-vehicle activity, trespass, plant removal, and destruction of barriers, shall be prosecuted to the full extent of the law.
- After initial planting, the Vernal Pool Restoration Area would be checked twice a week by the project biologist for the first two months, once a week for the next four months, and monthly thereafter.
- Other site problems such as vehicle damage and erosion shall be reported to the land owners with recommendations for remedial measures.

9.2 Schedule

Maintenance activities described above would be performed at the intervals listed in Table 5 within the Vernal Pool Restoration Area.

**TABLE 5
APPROXIMATE MAINTENANCE SCHEDULE FOR THE VERNAL POOL RESTORATION
AREA**

Type/Task	Year 1	Year 2	Year 3	Year 4	Year 5
Site protection	Monthly	Quarterly	Quarterly	Quarterly	Quarterly
Weed control	As-needed	As-needed	Quarterly	Three times per year	Twice per year
Trash removal	Monthly	Quarterly	Quarterly	Quarterly	Quarterly
Replanting/seeding	Winter	Winter	Winter	--	--

10.0 Monitoring Plan

10.1 Monitoring Methods

10.1.1 Hydrology

Hydrological characteristics of the restoration site to be monitored include assessment of the depth, periodicity, and duration of inundation in the created, restored, and control pools. Precipitation is recorded at the nearest reporting weather station. Field methods for the hydrological monitoring are described below.

- The restored vernal pools shall be topographically mapped at one-foot contour intervals.
- The restored vernal pools would be measured for water depth every two weeks until the standing water is gone. Water depth would be measured using a ruler placed in the low point of each pool.
- A water-depth versus time chart shall be prepared illustrating water depth and ponding periodicity over the low point of each pool.

10.1.2 Vernal Pool Vegetation and Invertebrate Monitoring

Biological parameters of the Vernal Pool Restoration Area to be monitored include species presence and relative cover (for plants) within each restored and control vernal pools. For target and indicator species, a qualitative assessment of reproductive success would be made. Photo documentation would provide an overview of the vegetative community of each vernal pool.

- Biological observations shall be made by a field biologist trained in the methods described below and familiar with the plant and animal taxa listed in Tables 2 and 3.
- During the aquatic phase of the monitored vernal pools, all plant and animal taxa observed shall be recorded.
- During the aquatic phase, the monitored vernal pools shall be dip-net sampled for aquatic invertebrates using pole-mounted dip-nets in appropriate mesh size to capture cladocerans, ostracods, branchiopods, and tadpoles following USFWS protocol survey methods (1996).
- The monitored vernal pools shall be sampled for plant species presence and estimated cover using a meander survey of at least a 15-minute duration per basin within 45 days of the disappearance of standing water.

- The monitored vernal pools shall be photographed from an established photo point during the vegetation sampling period.

10.1.3 Location of Control Habitat

For the Castlerock San Diego fairy shrimp restoration program, two control vernal pools shall be chosen from natural (not restored), undisturbed vernal pools on the Castlerock site and two vernal pools at the west Mission Trails Regional Park site owned by the City of San Diego. Control vernal pools at these two sites shall be chosen to include the ranges of both physical and biotic characteristics that meet the mitigation goals. All control vernal pools shall support vernal pool vegetation, as defined below in the target vegetation and cover criteria.

10.2 Vernal Pool Performance Criteria

The minimum 1,260 square feet of restored vernal pools within the 1.47-acre Vernal Pool Restoration Area would be subject to the performance criteria listed below. The remaining 1.44 acres of non-native grassland habitat being restored to native grassland in the Vernal Pool Restoration Area would be subject to the success criteria listed in Section 10.3. The 0.45-acre enhancement area containing the preserved vernal pools would only be subject to the target weed species success criteria outlined in Section 10.2.4. Intermediate yearly performance criteria demonstrating progress towards the final criteria are difficult to quantify due to the unpredictability of seasonal precipitation patterns and the sensitivity of recovering vernal pool and ephemeral wetland communities to that variability. Therefore, the yearly target criteria are semi-quantitative.

- Each of the specified success criteria would be evaluated following the completion of seasonal field monitoring to determine if the final success criteria have been met and to assess the likelihood that the criteria would ever be met (taking into account the seasonal conditions).
- The final assessment of success would be based on the combined performance over the monitoring period and an analysis of the trends established.

10.2.1 Target Vegetation and Cover

- For each of the restored vernal pools, the area of vernal pool vegetation shall be defined for purposes of this section as coincident with the area supporting a combined relative pool species cover of more than 50 percent, measured within 45 days of the disappearance of standing water. In a drought year, this criterion shall be considered to be met if the total relative cover by vernal pool species equals that of the averaged value of control vernal pools having similar hydrological characteristics

in that year and if the qualifying area has met this criterion in a previous monitoring year.

- For each of the restored vernal pools, the total absolute vegetative cover in areas of qualified vernal pool vegetation, not including target weed species, shall equal or exceed 50 percent of the averaged value of control vernal pools having similar hydrological characteristics.

10.2.2 Target Plant Species Diversity

The restored vernal pools shall support reproducing populations of a minimum number of vernal pool plant species equivalent to that supported by the control vernal pools. Equivalence is met if (1) the vernal pool species richness value for the restored vernal pools is equal to or greater than the minimum value found in the control vernal pools and (2) the value of vernal pool species richness in the restored vernal pools is equal to or greater than that of the control vernal pools.

10.2.3 Target Indicator Wildlife and Endangered Shrimp Species

Characteristic animal species of vernal pools in the East Elliot area are primarily aquatic invertebrates and amphibians, although terrestrial invertebrate (especially insect) and vertebrate species are important components of the vernal pool community (Zedler 1987). Of the aquatic invertebrates, species of branchiopods, which includes fairy shrimp (Anostraca), clam shrimp (Conchostraca), and tadpole shrimp (Notostraca), are among the most distinctive inhabitants of ephemeral aquatic habitat (Pennak 1989). Unlike most aquatic invertebrates, these species are found almost exclusively in ephemeral freshwater habitats.

A number of branchiopods that are thought to occur almost exclusively in natural vernal pools have been listed or proposed for listing as endangered by the USFWS, including the San Diego fairy shrimp which are found in the man-made features at Castlerock.

The seed shrimp (subclass Ostracoda) is another small crustacean group that is highly distinctive in vernal pools. In the United States, freshwater seed shrimp have been comprehensively studied only in the several eastern and midwestern states and in Washington (Pennak 1989). Vernal pools in the region invariably support one or more seed shrimp species, some of which may be undescribed endemic taxa (Zedler 1989).

The target indicator wildlife species listed in Table 3 includes species that are found primarily in natural vernal pools within the region and are therefore considered indicators of habitat quality and restoration success.

- The restored vernal pools within the Vernal Pool Restoration Area shall support populations of at least two of the species listed in Table 3 (vernal pool indicator

species). At least one of the species that must be present is the San Diego fairy shrimp and it must occupy a minimum of 1,260 square feet of vernal pool surface area.

10.2.4 Target Weed Species

Non-native weed species expected to be potential significant factors in the vegetation of the vernal pools include annual grasses: wild oat (*Avena* spp.), brome grasses (*Bromus* spp.), rabbitfoot grass (*Polypogon monspeliensis*), brass buttons (*Cotula coronopifolia*), loose-strife (*Lythrum hyssopifolia*), filaree (*Erodium* spp.), sand-spurrey (*Spergularia bocconii*), curly dock (*Rumex crispus*), common knotweed (*Polygonum arenastrum*), perennial ryegrass (*Lolium perenne*), and Italian ryegrass (*Lolium multiflorum*). Of these, the *Lolium* species are some of the most significant competitors with native vernal pool vegetation as it becomes established.

- Within each preserved vernal pool, California Invasive Plant Council List High, Moderate, and Alert species shall not be present. Within each restored vernal pool, the relative cover of non-native species shall not exceed 5 percent.

10.3 Native Grassland Criteria

Success criteria monitoring in the native grassland upland habitat in the Vernal Pool Restoration Area and Extended Weed Control Area would be conducted over a five-year period. The success criteria for 1.44 acres of native grassland upland habitat in the Vernal Pool Restoration Area would be based on a control site used to define the target vegetation and establish target values for cover, diversity, wildlife usage, and weed abundance. Yearly target values for cover and diversity of native grassland in the Vernal Pool Restoration Area are presented in Table 6. The 0.48-acre Extended Weed Control Area would only be subject to the target weed species success criteria outlined in Section 10.3.3.

**TABLE 6
NATIVE GRASSLAND TARGET VALUES,
AS A RELATIVE PERCENTAGE OF REFERENCE AREA VALUES**

Year	Coverage of Native Grasses	Coverage of Native Annual Herbs	Species Diversity
1	10		
2	20	20	50
3	40	35	60
4	50	45	70
5	60	50	75

10.3.1 Cover

It is anticipated that the native grassland would become established within the first two years of the program, although full maturation of the community may take longer. The success criteria are based on a five-year standard. At the end of the five-year monitoring program, required native grassland upland cover values in the Vernal Pool Restoration Area would be 60 percent of the control site for native grass cover and 50 percent of the control site for herbaceous cover.

10.3.2 Species Diversity and Composition

Overall species richness and species diversity by taxon shall be evaluated for the control and restoration sites. The native grassland within the Vernal Pool Restoration Area shall be considered to meet the diversity and composition criteria if 75 percent of its upland plant taxa are shared with the control site after the five-year monitoring period.

10.3.3 Weeds

Target weed species, defined as those species that have the potential to become established as permanent detractive elements of the plant community, shall be controlled in the native grassland upland habitat in the Vernal Pool Restoration Area and Extended Weed Control Area. Within the native grassland habitat in the Vernal Pool Restoration Area, the relative cover of all non-native species shall not exceed an absolute value of 10 percent. Within the Extended Weed Control Area, no California Invasive Plant Council List High, Moderate, and Alert species shall be present.

10.3.4 Wildlife Usage

A list of wildlife species observed using the restored habitat would be prepared and included in the annual reports.

10.4 Target Hydrological Regime

In coastal southern California, annual precipitation is highly seasonal, with most of the rainfall occurring in the winter and early spring from December through April. On the coastal mesas, summer and fall precipitation is rare and is never of sufficient magnitude to cause ponding in natural vernal pools. The first major rainfall event of the season rarely fills natural vernal pools; this water being used to wet and recharge surface soils dried during the summer drought. Subsequent storms charge the perched water table formed in the low-permeability soil profile of natural vernal pool landscapes, which is expressed as surface ponding in basins and topographic depressions.

The formation of a perched water table and the occurrence of surface ponding requires a soil profile with very low permeability but is also highly dependent on the topography of the site. Depressions must be present as places for the ponding to be expressed and as reservoirs to capture precipitation. The shape of the perched water table surface is influenced by the pattern and capacity of basins, interbasin soil permeability, slope of the overall site, and variations in subsoil permeability such as sand and/or clay lenses and holes in the hardpan. It is this surface shape, changing over time under the influence of gravity, evaporation, and precipitation, which determines the depth and duration of ponding in the depressions.

The depth and duration of water in these temporal ponds is highly dependent upon the magnitude and number of storm events, the time interval between each event, and the climactic determinants of evaporation and transpiration (temperature, humidity, sunlight, and winds) between each storm event. Annual occurrences of winter rains in the region are remarkably variable. Therefore, the success criteria for hydrological characteristics also depend on a comparison with control habitats representing the expression of performance goals during each monitoring year.

10.5 Watershed Analysis

The restoration of mound and basin topography at the Vernal Pool Restoration Area is expected to result in the restoration of natural hydrologic conditions to the preserved vernal pools. Topographic restoration is anticipated to reestablish the ability of the landscape to capture and retain precipitation.

10.6 Duration, Periodicity, and Depth of Inundation

- All monitored vernal pools, including the control vernal pools, shall be monitored to record water depth over the low point in each pool during the course of five rainy seasons following restoration. From this data, a water depth–time curve shall be prepared for each basin illustrating depth and periodicity of inundation.
- Prior to the end of the monitoring period, the restored vernal pools shall demonstrate hydrological patterns of duration, periodicity, and depth of inundation which fall within the range of variation observed in the control vernal pools.

10.7 Implementation Schedule

Table 7 depicts the proposed implementation schedule for the restoration and enhancement program at the Castlerock project site. This schedule is subject to revision based on the timing of project permitting and the initiation of grading.

**TABLE 7
ESTIMATED SCHEDULE**

Task	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
Site Grading (Fall 2013)	■											
Seed Collection (2013–2014)	■	■	■	■	■	■	■	■	■	■	■	■
Planting/Seeding (2013–2014)		■	■	■	■	■	■	■	■	■	■	■
Weed Control (2013–2018)	■	■	■	■	■	■	■	■	■	■	■	■
Monitoring (2013–2018)	■	■	■	■	■	■	■	■	■	■	■	■
Annual Report (2014–2018)			■	■	■	■	■	■	■	■	■	■

11.0 Annual Reports

Annual reports presenting the monitoring results shall be submitted to USFWS, the U.S. Army Corps of Engineers, and the City of San Diego by December 1. These reports shall assess both the attainment of yearly target criteria and progress toward the final success criteria. Annual reports would be submitted following each of the five project years for the vernal pool restoration.

Annual reports shall include, at the minimum, the following:

- Names, titles, and organizations of everyone who participated in the monitoring activities for the year, including those who wrote the report.
- Quantitative and qualitative results for each monitored vernal pool, including statements of success, failure, and remedial actions recommended to reach the success goals.
- A photograph of each vernal pool.
- Topographic maps showing and identifying each monitored vernal pool.

11.1 Contingency Measures

If the success criteria, as described in this plan, are not met, then the restoration and monitoring schedule may include an additional year or years that would be added to the program.

12.0 Completion of Mitigation

12.1 Notification of Completion

If the final success criteria have been met at the end of the five-year monitoring program, notification of these events shall be provided with the fifth-year report.

If the final success criteria have not been met by the end of the five-year monitoring program, the fifth-year report would discuss the possible reasons and recommendations for remedial measures to cause the site to meet the criteria.

12.2 Agency Confirmation

Following receipt of the final annual report, the USFWS and the City of San Diego shall be invited to visit the restoration site to confirm completion of the mitigation effort. The San Diego Fairy Shrimp/Vernal Pool Restoration and Enhancement Plan requirement shall be deemed complete when written approval by the City of San Diego and USFWS has been received.

13.0 References Cited

Bauder, Ellen T.

- 1986 San Diego Vernal Pools, Recent and Projected Losses, Their Condition, and Threats to Their Existence 1979-1980. Prepared for the California Department of Fish and Game, Endangered Plant Project, Sacramento. U.S. Fish and Wildlife Service, EP 85 II-1.

Glenn Lukos Associates

- 2012 Letter Report Summarizing Preliminary Findings of U.S. Army Corps of Engineers, California Department of Fish and Game, and City of San Diego Jurisdiction for the Castlerock Project, City of San Diego, San Diego County, California.

Holland, Robert F.

- 1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. Nongame-Heritage Program, California Department of Fish and Game. October.

Natural Resource Consultants

- 2012 A Biological Resources Assessment of the Approximately 203.64-Acre Castlerock Site Located in the City of San Diego, County of San Diego, California.

Patterson, C.

- 1995 Field notes from May 19, 1995. Eastgate Mall (EPA Study Area) I6 Pool Series.

Pennak, Robert W.

- 1989 *Freshwater Invertebrates of the United States*. John Wiley & Sons, New York.

RECON

- 1997 Dennerly Canyon Vernal Pool, Coastal Sage Scrub, and Mule Fat Scrub Restoration and Preservation Plan. Prepared for Hewitt & McGuire.
- 1999 As-Built Plan for the Dennerly Canyon Vernal Pool, Coastal Sage Scrub and Mule Fat Scrub Restoration and Preservation Plan. November 17.
- 2005 Year 5 Annual Report for Dennerly Canyon Vernal Pool, Coastal Sage Scrub, and Mule Fat Scrub Restoration and Preservation Plan. September 7.

San Diego, City of

- 1995 Draft Multiple Species Conservation Plan (MSCP).
- 2003 City of San Diego Vernal Pool Inventory 2002-2003.

Scheidlinger, C., C. Patterson, and P. Zedler

- 1985 Recovery of Vernal Pools and Their Associated Plant Communities Following Disturbance: Miramar, San Diego County, Ca. U.S. Environmental Protection Agency.

U.S. Department of Agriculture

- 1973 *Soil Survey, San Diego Area, California*. Edited by Roy H. Bowman. Soil Conservation Service and Forest Service. December.

U.S. Fish and Wildlife Service

- 1996 Interim Survey Guidelines to Permittees Recovery Permits under Section 10(a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods
- 2000 Final Determination of Critical Habitat for the San Diego Fairy Shrimp. *Federal Register*, October 23.

Zedler, Paul H.

- 1987 *The Ecology of Southern California Vernal Pools: A Community Profile*. National Wetlands Research Center, Research and Development, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.
- 1989 The Development of Artificially Created Pools on Del Mar Mesa: Year 2. Caltrans, District 11. San Diego.