2012 PERFORMANCE MONITORING REPORT ENVIRONMENTAL ENHANCEMENT AND MITIGATION PROGRAM

CACTUS WREN HABITAT LINKAGE ENHANCEMENT AND RESTORATION PROJECT

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EXECUTIVE SUMMARY

The Environmental Enhancement and Mitigation Program (EEMP) Cactus Wren Habitat Linkage Enhancement and Restoration grant project in Orange County was evaluated for the 2012 season as part of the monitoring program of the Nature Reserve of Orange County (NROC) and conditions of the grant. The EEMP grant was awarded by the California Natural Resources Agency and California Department of Transportation (Caltrans) to NROC and its partners for the project which includes the University of California, Irvine (UCI) and the Transportation Corridor Agencies (TCA) in April 2010. The project consisted of enhancement and restoration of cactus scrub habitat to facilitate movement for cactus wren (*Campylorhynchus brunneicapillus*) breeding populations within Upper Newport Bay, the UCI Ecological Preserve, and the San Joaquin Hills through the Salt Marsh, Bonita Creek and Coyote Canyon Habitat Linkage as well as to provide nesting habitat. The project is located in Orange County, California with restoration and enhancement sites in Upper Newport Bay, the UCI Ecological Preserve, and the San Joaquin Hills (at the Salt Marsh, Bonita Creek, and Coyote Canyon). This report documents the first year of performance monitoring for the enhancement and restoration project.

Project goals for the cactus scrub enhancement and restoration sites include establishment of ecologically appropriate cactus scrub habitat in disturbed areas within the NROC Reserve system and the UCI Ecological Preserve. The following objectives were determined for the enhancement and restoration sites based upon evaluation of existing conditions:

- Improve the movement of cactus wren individuals between isolated breeding populations
- Increase the suitable cactus scrub habitat for breeding pairs of cactus wrens

Restoration criteria were developed for the enhancement and restoration sites that will assess the functions and values of the cactus scrub habitat. The sites will be assessed as the habitat develops trends in cover, cactus growth, and species richness during establishment. The following performance standards were established for the sites and in accordance with the performance standards, the cactus scrub habitat will be considered "acceptable" when the following standards are met:

- The habitats resist invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grasses and less aggressive forb species. There shall be no target invasive species, such as artichoke thistle (*Cynara cardunculus*), mustard species, poison hemlock (*Conium maculatum*), and tree tobacco (*Nicotiana glauca*).
- At least 95 percent of the planted cactus demonstrates establishment and growth based on sampling estimates.

Installation of the project was done per the restoration specifications of the Environmental Enhancement and Mitigation Program: Cactus Wren Habitat Linkage Enhancement and Restoration Project Final Restoration Specifications (NewFields 2010). Installation was completed in phases with cactus material installed in October and November of 2010 and

seed application in November 2011. Establishment monitoring of the project was conducted following installation and will continue as the cactus scrub develops.

The purpose of this performance monitoring report is to document the trend of establishment of cactus scrub species in the enhancement and restoration sites in relation to the established performance standards for the project described above.

Quantitative monitoring was conducted March 13 through 15, 2012 for the first year of performance monitoring. Performance monitoring consisted of quantitative evaluation of cactus growth, plant cover, species richness, survivorship, and photo documentation. A sampling of cactus at each site was measured for total pads, branching from the main pad planted in the ground, and height to assess the development of the sites and habitat suitability for cactus wrens. Vegetation cover was measured along monitoring transects using the point intercept method. Species richness was determined by generating a species list for each site. A survey of planted cactus material was conducted at the sites where it was feasible to assess survivorship.

Results of the cactus measurement data show that survivorship of the planted coast prickly pear cactus (*Opuntia littoralis*) material across all sites was greater than 95 percent after one year of establishment. The mean total number of pads for all sites was five and the mean number of branches was 2. The average height for coast prickly pear cactus was 24 centimeters (cm). The dominant native species for all sites was coast prickly pear cactus.

The project is developing within an expected range of growth and species composition comparable with other non-irrigated restoration sites at a similar developmental stage and is on track towards the development of cactus scrub habitat. The planted cactus material exhibited new growth and was observed to be in flower and fruiting in the sites. The project will continue to be monitored and maintained by NROC as the restored habitat develops and the enhancement and restoration areas resist invasion of weed species.

The EEMP sites were surveyed for cactus wren and other bird use multiple times from planting in 2010 through April 2012. As documented by the vegetation surveys, the majority of the sites in the Bonita Creek (Sites 1, 2, 3, 4 and 5) and Coyote Canyon Linkage (Sites 7 and 8) are still developing and do not yet support cactus wrens; however, eighteen other species of birds were detected foraging at these sites and in the vicinity of the sites, including the California gnatcatcher (*Polioptila californica*). At the UCI Ecological Preserve (Site 6) a pair of cactus wrens was observed using the large transplanted clumps as part of their territory. This pair was identified as a new pair for the area. Twenty-two species were observed foraging within Site 4.

At this time, the project has met the performance criteria of the EEMP grant based on the vegetation and avian monitoring results. The cactus scrub has been installed and is developing. Avian species are using the sites, and one site is already being utilized by the target species, cactus wren. This type of restoration is a powerful management tool that can be used to augment declining populations within Orange County's Natural Community Conservation Planning/Habitat Conservation Plan (NCCP/HCP) and to maintain and enhance gnatcatcher populations. It is expected that the smaller restoration sites along the

Bonita Creek corridor will take several years to grow and become suitable for cactus wren use. NROC will continue to monitor restoration sites and document bird use as the restored habitat matures.

1 INTRODUCTION

1.1 BACKGROUND

This report documents the first year of performance monitoring of the Environmental Enhancement and Mitigation Program (EEMP) Cactus Wren Habitat Linkage Enhancement and Restoration grant restoration project after one year of establishment of the planted cactus material. Monitoring of the project is performed as part of the Nature Reserve of Orange County (NROC) Natural Community Conservation Plan (NCCP) monitoring program and conditions of the grant. The project consists of cactus scrub enhancement and restoration and was undertaken based on results of cactus scrub mapping and cactus wren surveys conducted by NROC in the Coastal Reserve during 2006 and 2007 (Mitrovich and Hamilton 2007). The project was funded in part by a grant from the California Natural Resources Agency and the California Department of Transportation

The purpose of the EEMP grant project is to improve the movement of cactus wrens (*Campylorhynchus brunneicapillus*) between isolated breeding populations along a habitat linkage, with a secondary goal of increasing suitable habitat for breeding pairs of cactus wrens. The grant was awarded to NROC and its partners, the University of California, Irvine (UCI) and the Transportation Corridor Agencies (TCA), in April 2010. Figure 1 shows the regional location of the project within Orange County and lands enrolled in the Nature Reserve of Orange County. The project will provide connection for disjunct breeding populations of cactus wren within Upper Newport Bay, the UCI Ecological Preserve, and the San Joaquin Hills through the Salt Marsh, Bonita Creek, and Coyote Canyon Habitat Linkage. Figure 2 shows the location of the enhancement and restoration sites.

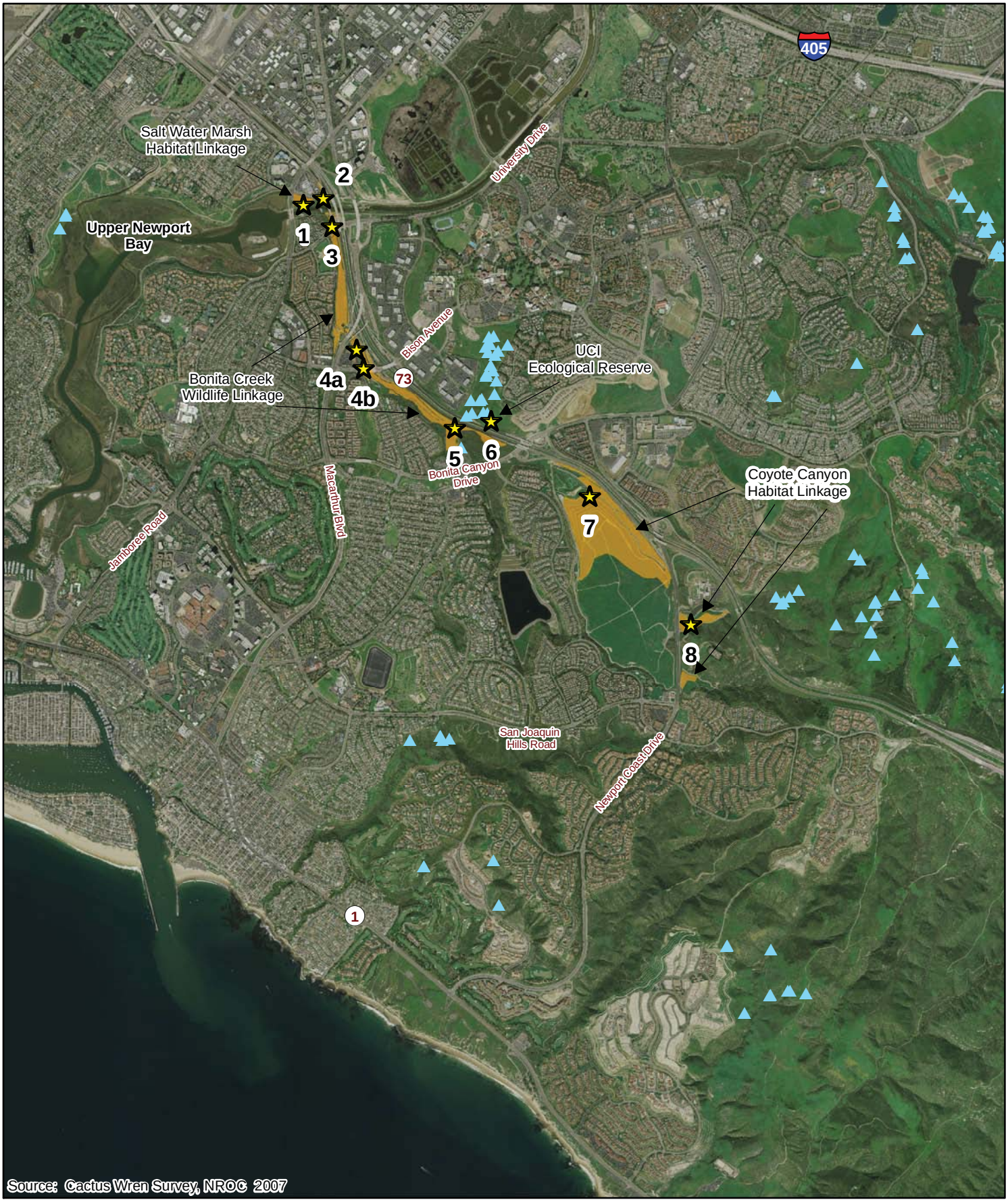
The coastal cactus wren is currently listed as a California State Species of Special Concern, a Cleveland National Forest Federal Sensitive Species, is one of three Target Species in the Central/Coastal Orange County NCCP/HCP (Habitat Conservation Plan) and a surrogate for conservation of coastal sage scrub habitat (Proudfoot et al. 2000). Annual surveys conducted by NROC from 1999 to 2004, and 2006 to 2008 have documented a significant decline in cactus wren populations in the NCCP (Mitrovich and Hamilton 2007, Leatherman 2009). A major cause for this decline is large wildfires that have burned cactus scrub and impacted wren populations in the Central and Coastal Reserves. Of particular concern is the increasing fragmentation and isolation of cactus wren populations due to wildfire caused loss of cactus scrub habitat. Cactus wrens do not migrate or make long-distance seasonal movements (Solek and Szijj 2004). As cactus wren populations become smaller and more isolated, they are more vulnerable to extinction from annual fluctuations in mortality and reproduction. If individual cactus wrens, particularly juveniles, are unable to disperse between populations, then these small isolated populations will not be augmented by immigrants or re-established following a local extinction event. Restoring cactus scrub to increase suitable habitat for cactus wren nesting and dispersal between isolated populations is likely to enhance persistence of cactus wren populations in the NCCP.

Figure 1.

Regional Location of Cactus Scrub Restoration Project and Proximity to Conserved Areas within the Nature Reserve of Orange County

Environmental Enhancement and Mitigation Program

Cactus Wren Habitat Linkage Restoration Project



Cactus Restoration Sites

Cactus Wren Locations Surveyed 2006-7

N W E S

4,000 2,000 0 4,000 Feet

Figure 2

Project Location of the Cactus Restoration Sites
Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

The project sites were prioritized based on the opportunity to enhance, restore, and create southern cactus scrub within and adjacent to existing coastal sage scrub habitat within the Coastal Reserve and the UCI Ecological Preserve. Sites outside of the San Joaquin Hills Transportation Corridor State Route 73 (SR-73) right-of-way were preferred for the project, and all sites are located on conserved land. The sites were dominated by non-native species and have favorable topography and location to channel dispersal of cactus wrens through the linkage.

Selection of the project restoration sites was based on facilitating movement between two disjunct breeding populations of cactus wren within the Upper Newport Bay and the existing populations to the south. The sites were also selected based on the large amount of disturbed habitat, lack of mature cactus patches, and the favorable topography for channeling dispersal through the linkage. The project is comprised of eight sites. The cactus scrub restoration sites occur along the following TCA mitigation areas; the Salt Marsh, Bonita Creek, and Coyote Canyon. One of the sites occurs within the UCI Ecological Preserve that currently has established breeding pairs of cactus wren.

This section of the monitoring report documents implementation and maintenance activities of the sites. Section 2 provides a description of the performance monitoring methodology. Section 3 provides results of the final EEMP performance monitoring. Recommendations for future maintenance activities and conclusions on the development of the sites are presented in Section 4.

1.2 ENHANCEMENT AND RESTORATION SITES DESCRIPTION

Potential sites were assessed by review of existing information and field surveys as well as discussions and site visits with ecologists from NROC, The Nature Conservancy, and the TCA in spring 2009. Existing information consisted of maps and reports on cactus scrub habitat and cactus wren locations within the Coastal Reserve and UCI Ecological Preserve. Once the locations were determined discussions were held with NROC, TCA and UCI to coordinate and share information concerning specific location, patch size, and cactus donor locations.

Final areas were determined based on field visits in spring 2010 with NROC staff to determine the best line-of-sight and connectivity from existing cactus patches and the project areas to facilitate movement between cactus wren populations. The project consists of eight distinct enhancement and restoration sites. All eight sites had a weedy component, primarily non-native grasses and forb species, and sufficient open area for cactus patches. Figure 3 shows the location of the eight sites. Table 1 summarizes the acreage and location of the sites.

Figure 3

Location of Cactus Scrub Enhancement and Restoration Sites

Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

Table 1 Summary of the Enhancement and Restoration Sites

Site	Acreage	Location
1	0.11	Salt Marsh
2	0.08	Salt Marsh
3	0.15	Bonita Creek
4	0.10	Bonita Creek
5	0.34	Bonita Creek
6	4.06	UCI Ecological Preserve
7	0.17	Coyote Canyon
8	0.17	Coyote Canyon

Focused field surveys in May 2010 were conducted to refine the specific enhancement and restoration sites. The surveys consisted of data collection at each site to describe existing plant species, soil characteristics, line-of-sight to existing cactus scrub, and access. The following are results of the focused surveys for each of the enhancement and restoration sites:

1.2.1 SITE 1 - SALT MARSH

- Location: Site 1 is an upland buffer slope adjacent to the salt marsh mitigation site and part of the Coastal Reserve.
- Linkage: This site is closest to the existing population of cactus wrens in Upper Newport Bay, and the slope can be seen by birds dispersing from the west
- Opportunity: The slope vegetation was inadvertently damaged during dredging activities in Upper Newport Bay, allowing for the invasion of weedy species.

1.2.2 SITE 2 - SALT MARSH

- Location: Site 2 is an upland mitigation slope, east of the salt marsh, north of San Diego Creek, west of SR-73, and part of the Coastal Reserve
- Linkage: This site connects the linkage from Site 1 and Site 3 further east, and to Site 4 along the slopes of Bonita Creek.
- Opportunity: The slope vegetation had a weed component with scattered native shrubs.

1.2.3 SITE 3 - BONITA CREEK

- Location: Site 3 is an upland mitigation slope to the southwest of the salt marsh, south of San Diego Creek, north of University Drive, and west of SR-73
- Linkage: This site is between San Diego Creek and Bonita Creek and the slope can be seen by birds dispersing from the west
- Opportunity: The slope vegetation had sparse areas, a weed component, and scattered native shrubs.

1.2.4 SITE 4 - BONITA CREEK

- Location: Site 4 is an upland mitigation slope, west of SR-73, and adjacent to Bonita Creek Wildlife Linkage
- Linkage: This site is close to both existing populations of cactus wrens in Upper Newport Bay and the UCI Ecological Preserve and can be seen by birds dispersing form the west.
- Opportunity: The slope vegetation had sparse areas, a weed component, and scattered native shrubs.

1.2.5 SITE 5 - BONITA CREEK

- Location: Site 5 is an upland mitigation conservation area, southwest of SR-73, south of Bonita Creek Wildlife Linkage, and west of UCI Ecological Preserve.
- Linkage: This site is close to both existing populations of cactus wrens in the UCI Ecological Preserve and can be seen by birds dispersing form the east.
- Opportunity: The area was dominated by weed species.

1.2.6 SITE 6 - UCI ECOLOGICAL PRESERVE

- Location: Site 6 is located on slopes within the UCI Ecological Preserve, east of Bonita Creek Wildlife Linkage, and north of SR-73.
- Linkage: This site is closest to the existing populations of cactus wrens in the UCI Ecological Preserve and the slope can be seen by birds dispersing from the west.
- Opportunity: The area was dominated by weed species.

1.2.7 SITE 7 - COYOTE CANYON LANDFILL – MAIN CANYON

- Location: Site 7 is located in Coyote Canyon Landfill in the Main Canyon and is south of SR-73.
- Linkage: This site is between the existing populations of cactus wrens in UCI Ecological Preserve and the San Joaquin Hills, and the slope can be seen by birds dispersing from the east or west
- Opportunity: The slope vegetation had sparse areas, a weed component, and scattered native shrubs.

1.2.8 SITE 8 - COYOTE CANYON LANDFILL – EAST CANYON

- Location: Site 7 is located in Coyote Canyon Landfill in the East Canyon and is south of SR-73.
- Linkage: This site is between the existing populations of cactus wrens in Bommer Canyon in the San Joaquin Hills, and the slope can be seen by birds dispersing from this area.
- Opportunity: The slope vegetation had sparse areas, a weed component, and scattered native shrubs.

1.3 PLAN PREPARATION AND IMPLEMENTATION

Restoration activities for the sites followed the specifications detailed in the Environmental Enhancement and Mitigation Program Cactus Wren Habitat Linkage Enhancement and Restoration Project Final Restoration Specifications (Restoration Specifications) prepared by NewFields (2010). Site selection and planting palettes were determined by assessment of the existing conditions, line-of-sight with other sites and existing cactus, and characteristics of cactus wren habitat.

The sites were determined to be in appropriate locations to establish cactus scrub habitat based on site-specific characteristics. Prior to restoration efforts, the sites were degraded and dominated by exotic grass and forb species and had sufficient open areas for cactus patches. Specific characteristics of the sites that are favorable for cactus scrub habitat include soil type, slope, and aspect. The arrangement of the sites in relation to each other and existing cactus scrub areas provides a linkage for cactus wren movement between disjunct populations in the Coastal Reserve and UCI Ecological Preserve.

1.3.1 SITE PREPARATION

The boundaries of the sites were flagged in the field by a NewFields restoration ecologist and the restoration contractor (Nakae & Associates) supervisor in September 2010 prior to starting site preparation activities. Site preparation activities included control of exotic species and weed thatch removal.

Initial weed control for the sites was performed from September 27 through October 12, 2010. Weed control methods included mowing, weed whipping, and removal with hand tools. All weeded thatch material was removed for the sites following initial weed control. The dominated weed species controlled included mustard species, non-native grasses, and poison hemlock.

1.3.2 INSTALLATION

Installation of the plant materials was completed in two phases. All cactus material was installed in October and November 2010 and the specified seed mixes for the sites were applied in November 2011. Installation of all material was completed November 28, 2011. Installation followed the specifications of the Restoration Specifications for all sites.

The planting palettes for the sites were based on species composition noted in native cactus scrub habitat within the regional location of the project. The species selected for the sites represent the more common and abundant cactus scrub species and early colonizing species in scrub habitats after disturbance such as fire. The seed mixes and planting palettes for the sites are presented in Appendix I.

Planting of the sites consisted of installing harvested coast prickly pear cactus (*Opuntia littoralis*) pad material at all sites and salvaged coast prickly pear cactus clumps at Site 6. Cactus clumps are included in the planting palette to include larger cactus material that will grow faster to a height usable by cactus wrens for nesting habitat.

All cactus material was salvaged from a donor site located on land owned by UCI that is slated for future development. Cactus clumps consisting of large multi-stemmed cactus material with intact developed root balls attached were salvaged from the donor site from October 13 through 28, 2010 and immediately planted at Site 6 upon collection. Cactus clumps were harvested using a backhoe and bobcat to carefully excavate the large cactus plants keeping as much of the root ball intact as possible with soil attached. The harvested cactus material was then placed on a bobtail dump truck for transport to Site 6. At the receiver sites, a bobcat and front end loader were used for unloading and planting the cactus material. The planting holes were excavated using a backhoe. The planting holes for the cactus clumps were large enough so that the entire root structure was accommodated.

Cactus pads of coast prickly pear cactus were harvested in October 2010 from the donor site. Cactus pad material for the most part consisted of a single pad. The cactus pads were allowed to harden-off for several weeks prior to planting. To plant the cactus pads, holes were hand-dug and the pads were planted just deep enough to bury approximately one inch of the pad to avoid rotting. Installation of cactus pads at all sites was completed November 29 through December 3, 2010.

Watering basins were created for each plant (pads and clumps) to capture rainfall and facilitate water movement into the root zone during precipitation and watering events. All watering basins were filled with water following planting.

Prior to installation of the cactus material at Site 6, specific colored pin flags were used for cactus clumps and cactus pad patches to mark the planting locations. The project restoration ecologist approved the flagging prior to planting activities. The cactus material was inspected by the project restoration ecologist and Nakae staff prior to installation and all material was approved before planting. Cactus were planted in patches approximately 12 meters in diameter, however at some of the sites, the patches were smaller given the patchiness of the sites within existing native habitat. The total number of patches at each site depended on the total size of the area. At Site 6, a large clump was planted in the center of a patch and cactus pads were then planted outward from the center. The large cactus clumps were planted mainly on the less steep portion of the site due to access limitations. A total of 110 cactus clumps were installed at Site 6. On the steeper slopes of the site, patches of cactus pads were planted. Table 2 summarizes the acreage and total number of planted cactus for each site.

Table 2 Summary of Installed Cactus within the Enhancement and Restoration Sites

Site	Acreage	Total Number of Coast Prickly Pear Cactus
1	0.11	120 pads
2	0.08	80 pads
3	0.15	150 pads
4	0.10	120 pads
5	0.34	240 pads
6	4.06	4,275 pads and 110 large cactus clumps
7	0.17	1,425 pads
8	0.17	1,260 pads

Seeding of the sites was accomplished by hand broadcast of the specified seed mixes per the Restoration Specifications in November 2011. Two seed mixes were generated for the sites; one for Site 6 and one seed mix for the rest of the sites. The seed mix for Site 6 was comprised of available species for special collection within the UCI Ecological Preserve and approved collection locations within Orange County.

Site 6 was seeded on November 22, 2011. Sites 1 through 5 and 7 and 8 were seeded on November 28, 2011. The seed mixes were broadcast with a bellygrinder and lightly raked into the soil after application to facilitate seed to soil contact. Prior to application of the seed material, a weeding event to control non-native species was performed by weed whipping on August 20, 2011. Prior to seeding, a follow-up treatment for exotic species was done with herbicide application on November 15, 2011 for all the sites. Weed thatch material was removed prior to seeding to facilitate seed to soil contact. Seeding was timed to take advantage of the entire rainy season. Seeding was implemented in fall 2011 to allow for a year of weed control following installation of the cactus material.

1.4 SITE MANAGEMENT

A NewFields restoration ecologist conducted horticultural and installation monitoring of the sites beginning in 2010 during site preparation, installation in 2010, and site establishment in 2011 through the present. The restoration contractor performed site preparation, installation, and horticultural maintenance from 2010 through the present. The following sections summarize maintenance activities of the sites after installation was complete.

1.4.1 IRRIGATION

Maintenance irrigation was only applied at Site 6 to promote establishment of the larger cactus clumps. It was determined that watering of the other sites was not necessary since winter 2010/2011 was an above average rain season. Two irrigation events occurred at Site 6 to water the large cactus clumps and pads. Watering consisted of hand-watering each planting basin at least once during a watering event. One watering event occurred the week of November 15, 2010 and a second watering event occurred the week of February 27, 2012 at Site 6.

1.4.2 INVASIVE PLANT SPECIES CONTROL

Site maintenance activities in the sites began following installation of the cactus material. The first weed control event occurred at Site 6 only on November 10 through November 23, 2010 with herbicide application to control sprouting weed species.

In 2011, a weed control event occurred the week of February 21 with herbicide application to control weeds at all sites. A second weed control event for all sites began March 24 through March 31. On April 16, 2011 spot spraying occurred at Site 6. A follow-up weed control event with spot spraying and hand-weeding of target species occurred at Site 6 on May 20 through May 26, 2011. A weed control event to prepare for installation of the seed mix was done on August 20, 2011 for all sites. The weed control event consisted of weed whipping and removal of weed thatch material. A follow-up treatment using herbicide application was done at all sites on November 15, 2011 prior to application of the seed mix.

In 2012, three weeding events occurred in January. On January 1, hand-weeding was done at Sites 1 through 5 and Site 7. On January 14, sites were hand-weeded for target exotic species. From January 16 through 18, all sites were hand-weeded, mainly targeting mustard species. Little germination was observed due to the lack of rainfall. One weeding event occurred in February on the 9th with hand-pulling and spot spraying of exotic species for all sites. In April, Sites 1 through 5, 7, and 8 were hand weeded. At Site 6, exotic species were hand-weeded and spot spraying occurred, mainly targeting mustard.

1.4.3 PLANT REPLACEMENT

A survey of the planted cactus material was conducted in May 2011 at all sites by the restoration contractor. Overall survival was 78 percent for the cactus pad material and 100 percent for the cactus clumps. As survival was lower than 80 percent, cactus replacement was deemed necessary at all sites. The restoration contractor collected 203 cactus pads from the donor site at UCI on August 4, 2011 to grow into 1-gallon container plants for planting at Sites 1 through 4 to increase the chance of survival of the replacement cactus. The 1-gallon container cacti were installed at Sites 1 through 4 on November 9, 2011. The container plants were soaked in water prior to planting to provide moisture to promote plant establishment. For replacement planting at Sites 5 through 8, 1,500 cactus pads were harvested from the donor site in on October 28 and 31, 2011 and allowed to harden off for several weeks prior to installation. The cactus pads were installed November 17, 2011 at Sites 5 through 8.

1.5 PERFORMANCE GOALS AND STANDARDS

Project goals for the cactus scrub enhancement and restoration sites include establishment of ecologically appropriate cactus scrub habitat in disturbed areas within the NROC reserve system and UCI Ecological Preserve. The following objectives were determined for the sites based upon evaluation of existing conditions:

- Improve the movement of cactus wren individuals between isolated breeding populations
- Increase the suitable cactus scrub habitat for breeding pairs of cactus wrens

Restoration criteria were developed for the sites to assess the functions and values of the cactus scrub habitat. The sites were assessed for trends in cover, cactus growth, and species richness during establishment. The following performance standards were established for the sites and in accordance with the performance standards, the cactus scrub habitat will be considered "acceptable" when the following standards are met:

- The habitats resist invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grasses and less aggressive forb species. There shall be no target invasive species, such as artichoke thistle (*Cynara cardunculus*), mustard species, poison hemlock (*Conium maculatum*), and tree tobacco (*Nicotiana glauca*).
- At least 95 percent of the planted cactus demonstrates establishment and growth based on sampling estimates.

2 PERFORMANCE MONITORING METHODOLOGY

Monitoring of the sites in 2011 and 2012 consisted of horticultural and performance monitoring. Horticultural monitoring consisted of site visits in 2011 following completion of the cactus installation. Site visits consisted of walking the sites to observe plant health and general site conditions. Based on the observations during site visits, maintenance schedules were created. Performance monitoring of the cactus scrub sites was conducted in late winter of 2012 for the first year. Data were collected over three days on March 13, 14 and 15, 2012. Performance monitoring consisted of quantitative evaluation of cactus growth, plant cover, survivorship and photo documentation.

Quantitative performance monitoring of the cactus scrub sites began in 2012 after one full year of plant establishment of the installed cactus material. The selection of variables quantitatively measured for performance monitoring is based on the performance standards for the cactus scrub enhancement and restoration outlined above, and developmental characteristics of the cactus scrub community. Variables measured included native species cover, exotic species cover, unvegetated cover, and cover of individual species using point intercept transects at the Coyote Canyon sites and the UCI Ecological Preserve site. Height measurements and pad counts for cactus were also measured at all sites to provide an additional parameter to assess habitat suitability for cactus wren. A survivorship count of the installed cactus material in Sites 1 through 5 was performed. Survivorship for Sites 6 through 8 was estimated based on collected sampling data. Photo documentation at the permanent photo points established in August 2011 is presented in this performance monitoring report. Species lists for each site were also generated to determine the species richness at the sites.

Sampling transects were read in the larger cactus sites at Coyote Canyon and the UCI Ecological Preserve for a total of nine sampling transects. The sampling transects were read to provide data on cover values for each site for year to year comparisons. Average absolute cover values for all transects at Coyote Canyon sites combined and all transects at UCI Ecological Preserve Transects combined is also presented. The number of transects to determine the average absolute cover will provide statistical confidence given there are four transects for 0.34 acres of at Coyote Canyon and five transects for 4.06 acres at UCI Ecological Preserve. Generally, one transect per two acres provides statistical confidence based on experience in coastal sage scrub habitat restoration in southern California (M. Griswold, personal observation).

Results of the performance monitoring will be used to evaluate the progress of the cactus scrub habitat toward the ultimate goals and performance standards of the project.

2.1 CACTUS HEIGHT

The height of cactus was measured to assess the development of the sites and habitat suitability for cactus wren. Height measurements were recorded for coast prickly pear cactus at each site. At Sites 1 through 5, 30 coast prickly pear cacti were randomly selected to measure the height. At Site 6, the largest site, 130 coast prickly pear cacti were measured.

At Site 7 and Site 8, 39 and 38 coast prickly pear cacti were measured respectively. In addition to measuring the height of cactus pads at Site 6, the height of installed cactus clumps were measured. Ten cactus clumps were measured that were encountered along the sampling transects.

Height data are reported as the average height in centimeters (cm) for coast prickly pear cactus within a site and all sites combined. The standard error of the mean is reported to provide a statement about the precision with which the population mean was estimated based on the number of cactus sampled.

2.2 CACTUS GROWTH

The number of pads per individual coast prickly pear cactus was counted to assess the development of the sites and habitat suitability for cactus wren. Total pads were only counted for planted cactus pad material and 1-gallon container plants, with a majority of the measured cactus consisting of cactus pad material. Pads of the large cactus clumps were not counted. The sample consisted of counting pads of the same randomly selected coast prickly pear selected for height measurements. Pad data is reported as the average number of pads within a site and all sites combined. The standard error of the mean is reported to provide a statement about the precision with which the population mean was estimated based on the number of cactus sampled.

In addition to counting total pads, the number of pads originating from the base pad planted in the ground was counted to assess the branching or horizontal expansion of the cactus. The data is reported as the average number of pads within a site and all sites combined. The standard error of the mean is reported to provide a statement about the precision with which the population mean was estimated based on the number of cactus sampled.

2.3 VEGETATION COVER

Qualitative evaluation of cover was done for Site 1 through 5 as the areas were not large enough to accommodate transects. Within each of these sites three to four points were assessed to estimate native cover, non-native cover, and bare ground.

At Site 6, five (5) 50-meter transects were read to assess the vegetative cover. Figure 4 shows the location of the transects at Site 6. Four (4) 25-meter transects were read to assess the vegetative cover of Sites 7 and 8 (see Figure 5). Transect length varied between the sites since Sites 7 and 8 were not large enough to accommodate a 50-meter transect. As such, the data for the UCI Ecological Preserve (Site 6) and Coyote Canyon (Sites 7 and 8) were analyzed separately. Locations of the sampling transects were stratified within the sites such that each transect was centered within a cactus patch. The trajectory of each transect through a site was randomly determined and permanently established. The start and end points of each transect were recorded using a sub-meter Global Positioning System (GPS) unit for repeated measure in subsequent years of monitoring.

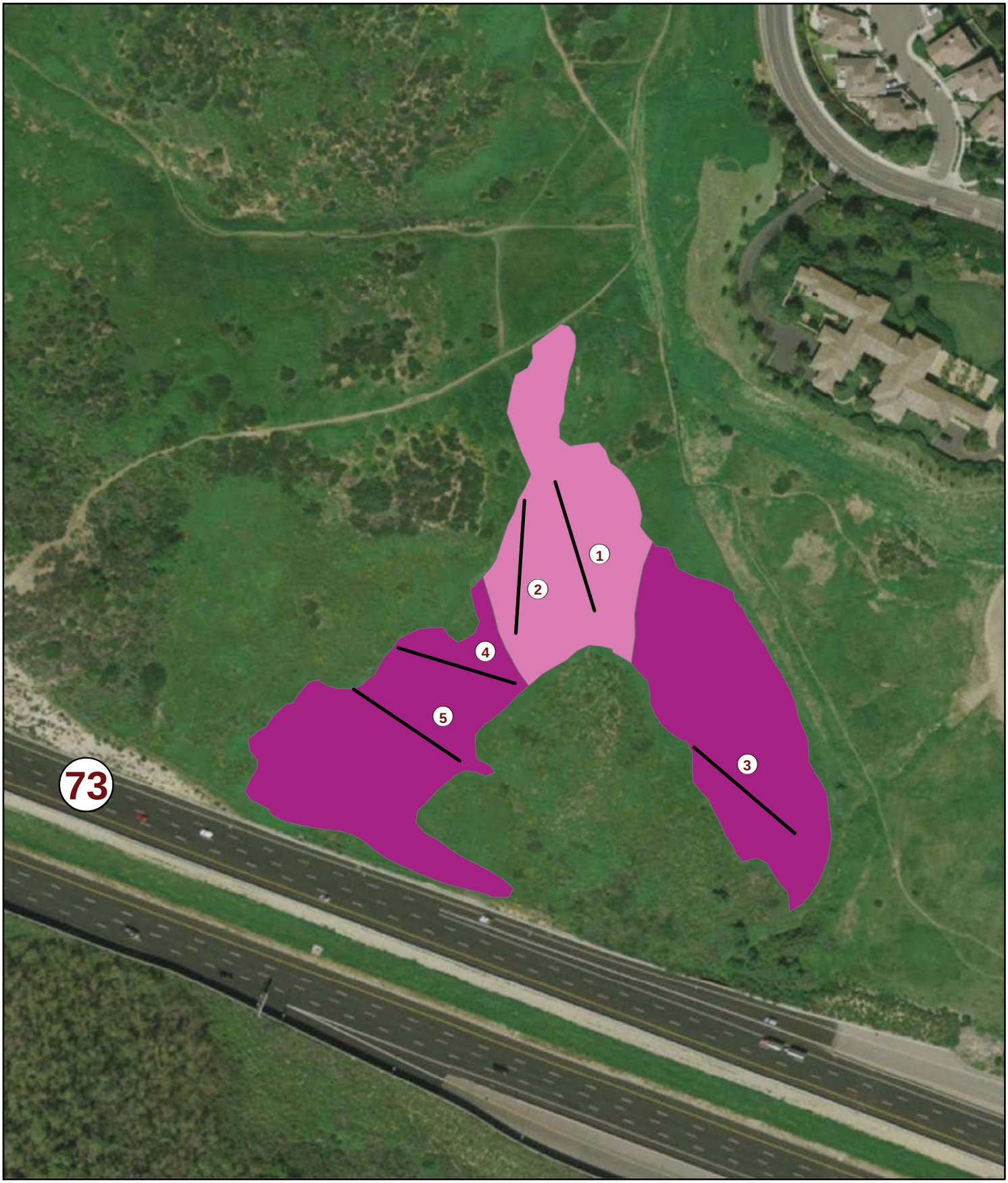


Figure 4
Location of Monitoring Transects Site 6
Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

Site 7

Site 8

Cactus Scrub Restoration Sites

N
W E
S

200 100 0 200 Feet

Figure 5

Location of Monitoring Transects at Sites 7 & 8

Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

The point intercept method was used to measure vegetation cover. This method is well suited to measure cactus scrub vegetation and provided an efficient method of estimating cover and species composition over the sites. The point intercept sampling method has been tested within NROC for accuracy and efficiency as documented by Deutschman and Strahm (2008). At each transect location a measuring tape was stretched taut and data recorded every half-meter along the 25-meter transects and every meter for the 50-meter transects for a total of 50 points per transect. Each plant species and ground cover type (bare ground or litter) that intersected the transect tape and the vertical plane above and below the tape were recorded. Bare ground was recorded in areas with no ground cover and litter recorded in areas with dead vegetative matter covering the ground.

Cover data are reported as absolute percent cover determined by dividing the total number of hits for each species or ground cover by the total number of points on the transect. Since multiple species can be recorded at each point, the total percent cover may be greater than 100 percent because of overlap of plants at each sampling point. The standard error of the mean is reported to provide a statement about the precision with which the population mean was estimated based on the number of transect samples. Native cover is reported as the percentage of the total count of native plants recorded in the sampling transects divided by the total number of sampling points. The same method was used for exotic cover and unvegetated cover calculations.

2.4 SURVIVORSHIP

A survey of all planted cactus material for survivorship was conducted during performance monitoring for the sites. The total number of coast prickly pear planted was 110 large clumps and approximately 7,577 pads. Survivorship counts were conducted at Sites 1 through 5. Survivorship counts were not performed at Sites 6 through 8 because the sites are larger and it was not feasible to conduct an accurate count of the planted material. Survivorship at Sites 6 through 8 was estimated based on collected sampling data. In addition, at Sites 7 and 8 a count of dead cactus was done during monitoring to estimate survivorship by comparing the number of dead cactus to the total number of installed cactus plants.

2.5 SPECIES RICHNESS

Species richness data was collected at the sites by generating a species list of all observed species within each site. Species richness is reported as the number of native species, non-native species, and total species encountered in each site. The mean for all sites combined is also reported. Species richness measurements are presented to provide information on the community structure of the sites.

2.6 PHOTO DOCUMENTATION

Permanent photo points of the sites were established to conduct photographic documentation on the development of the cactus scrub sites. The photo point locations were established in August 2011 and can continue in the same locations in subsequent performance monitoring years. Photo documentation consisted of taking pictures at the

photo point locations after one full year of establishment of the planted cactus patches in March 2012.

2.7 AVIAN SAMPLING

After the cacti were planted, NROC biologists assessed use of the EEMP restoration sites by California gnatcatchers, cactus wrens, and other bird species. There were several methods of assessment including: specific post-restoration bird surveys ("restoration surveys"), incidental observations during visits to check on restoration activities ("site visits"), and observations made as part of ongoing NROC studies of cactus wrens in the NCCP/HCP. This latter category included a study of cactus wren reproduction, dispersal and survival ("monitoring study") and a study of cactus wren foraging behavior ("foraging study").

Originally, it was planned that the restoration surveys would be conducted using the same methods that are used for Reserve-wide surveys to document cactus wren presence at a location. These surveys are six minutes in length and involve use of taped vocalizations to increase wren detectability. However, it became apparent that six minutes was insufficient to document wren use of a restoration site and that taped vocalizations could call in nearby birds that were not using restored habitat. NROC revised the survey methods to exclude the use of taped vocalizations and lengthen the survey period. In 2011, restoration site surveys were 15 minutes long and in 2012 surveys were extended to 20 minutes to increase the potential to detect wrens and gnatcatchers. During the surveys, the locations were mapped and the behavior of all cactus wrens and California gnatcatchers within the restoration sites and in the vicinity were recorded. A bird was considered within the vicinity site if it was ≤ 100 meters from a restoration site. A bird this close might well include the restoration site within its territory. Observations outside of the survey period were recorded, but these were noted as incidental detections. Observers also recorded all bird species using restored areas. Surveys were conducted from a vantage point that allowed unobstructed views of the restoration site. For larger sites, several surveys at different locations were required to record activity across the entire site.

The UCI Ecological Preserve was of special interest for monitoring as the large transplanted cacti had sufficient height and structure for potential use by cactus wrens. In contrast, the other sites were planted with only cactus pads, which can take many years to reach sufficient height for wrens to use for perching and nesting. The planting of large salvaged cactus is also a relatively new restoration method in coastal southern California, so it was important to document wren and gnatcatcher response. The UCI site was also unique because there are existing wren territories adjacent to the restoration area. These factors, combined with the larger restored area (4 acres), made it more likely that cactus wrens could begin using the UCI restoration site soon after the cactus was planted. To better document wren use of the UCI restoration site, additional restoration surveys were conducted and this data was augmented with information collected during site visits and from NROC's cactus wren monitoring and foraging studies.

3 SITE ASSESSMENT

3.1 CACTUS HEIGHT

The height of coast prickly pear cactus was measured to assess the development of the cactus scrub as cactus wren habitat. Generally, cactus wrens are found nesting in cactus that is on average 1.2 to 1.5 meters in height with the height of nest averaging 1 meter above ground level (Solek and Szijj 2004).

The average height of coast prickly pear cactus pads over all the sites is 24 cm. The standard error of the mean height of coast prickly pear cactus for all sites is low, which reflects the shared age and developmental rate of the cactus across the sites. The average coast prickly pear height was highest at Site 3 at 28 cm and the lowest at Site 5 at 19 cm. Table 3 shows the mean height of coast prickly pear cactus at each site and all sites combined.

Table 3 Mean Height (centimeters) of Coast Prickly Pear Cactus

Site Number	Mean Height(cm) of Coast Prickly Pear ± Standard Error	Number of Coast Prickly Pear Measured (n)
Site 1	24.90±1.40	30
Site 2	26.60±1.57	30
Site 3	28.37±1.64	30
Site 4	27.90±1.51	30
Site 5	19.40±1.57	30
Site 6	21.84±0.71	130
Site 7	26.38±1.33	39
Site 8	22.71±1.33	38
All Sites Combined	23.94±0.46	357

At Site 6, the heights of ten cactus clumps were measured. The average height of the cactus clumps was 76±4.57 cm and height ranged from 52 cm to 94 cm. The standard error of the mean height of the cactus clumps for all sites is high, indicating variation in the height of the cactus clumps.

3.2 CACTUS GROWTH

The mean number of total pads for all sites was 5 and the mean number of branches was 2. Site 6 had the highest mean number of total pads with 6 and Site 4 had the lowest mean number with 4. Site 7 had the highest mean number of branches with 3 and Site 4 had the lowest number with slightly less than 2 branches. The standard error of the mean total pads and branches of coast prickly pear cactus for all sites is low, which reflects the shared age and developmental rate of the cactus across the sites. It is important to note that Sites 6 through 8 had higher values of total pads and total branches compared to the other sites and for the most part the installed pad material at these sites consisted of a single pad demonstrating growth in the first year of establishment. Table 4 shows the mean growth measurements of coast prickly pear cactus at each site and all sites combined.

Table 4 Mean Growth Measurements of Coast Prickly Pear Cactus

Site Number	Mean Number of Total Pads ± Standard Error	Mean Number of Total Branches ± Standard Error	Number of Cactus Measured (n)
Site 1	4.50±0.46	2.00±0.17	30
Site 2	4.57±0.41	2.63±0.25	30
Site 3	4.47±0.44	2.30±0.27	30
Site 4	3.63±0.32	1.87±0.17	30
Site 5	3.90±0.59	2.00±0.31	30
Site 6	5.75±0.57	2.46±0.13	130
Site 7	5.15±0.52	2.67±0.30	39
Site 8	5.34±0.56	2.58±0.30	38
All Sites Combined	5.00±0.24	2.37±0.08	357

3.3 VEGETATION COVER

The qualitative cover estimates were similar for Sites 1 through 5 with native cover estimated at 5 to 10 percent for each site. Cactus comprised a majority of the native cover for all five sites with an estimated cover of 5 to 10 percent. Other natives contributing to cover included bush sunflower (*Encelia californica*), Spanish clover (*Lotus purshianus),* and foothill needlegrass (*Nassella lepida*). These species were present at all five sites and were the result of germination of the applied seed mix. Additionally, germination of goldfields (*Lasthenia californica*), miniature lupine (*Lupinus bicolor*), tarweed (*Deinandra fasciculata*), and California sagebrush (*Artemisia californica*) all present in the seed mix was noted. Exotic vegetation cover estimates were similar for the five sites as well with the highest

estimate at Site 1 with 10 to 15 percent cover and the remaining four sites with low exotic cover at 5 to 10 percent. The dominant exotic at Site 1 was poison hemlock (*Conium maculatum*), shortpod mustard (*Hirschfeldia incana*)at Site 2, slender leaved ice plant (*Mesembryanthemum nodiflorum*) at Site 3, non-native grasses at Site 4, and black mustard (*Brassica nigra*) at Site 5. All five sites were mostly unvegetated with estimates of 75 to 85 percent of the sites comprised of bare ground or plant litter. Table 5 shows the estimated percent cover of native vegetation, exotic vegetation, and unvegetated cover for Sites 1 through 5. Appendix II has a complete species list for Sites 1 through 5.

Table 5 Estimated Cover for Sites 1 through 5

Cover Type	Site 1 Cover	Site 2 Cover	Site 3 Cover	Site 4 Cover	Site 5 Cover
Native Vegetation	5-10%	5-10%	5-10%	5-10%	5-10%
Cactus Cover	5-10%	5-10%	5-10%	5-10%	5-10%
Exotic Vegetation	10–15%	5-10%	5-10%	5-10%	5-10%
Unvegetated	75-80%	80-85%	80-85%	80-85%	80-85%

The results of the five sampling transects at Site 6 show that native vegetation makes up on average six percent of the total absolute cover. Native cover is comprised mainly of coast prickly pear with an absolute cover of four percent with grassland goldenbush (*Ericameria palmeri* var. *pachylepsis*) also contributing to native cover. Exotic cover for Site 6 was low, comprising 11 percent of the absolute cover, however the higher standard error of the mean indicates exotic cover varied between measured transects. Black mustard comprised two-thirds of the exotic cover with non-native grasses and tocalote (*Centaurea melitensis*) also contributing to cover. Bare ground and plant litter make up a majority of the cover at Site 6 with 84 percent unvegetated cover. Table 6 shows the mean absolute percent cover of native vegetation exotic vegetation, and unvegetated areas for Site 6. Total absolute cover is also reported for individual native and exotic species, bare ground, and litter in Appendix III for Site 6. Appendix III also shows representative photos and the geographic coordinates for the start and end points of the monitoring transects for Site 6.

The results of the four sampling transects at Site 7 and 8 show that native vegetation makes up on average 14 percent of the total absolute cover. Native cover is mainly comprised of coast prickly pear with an absolute cover of nine percent. Cactus appears to be evenly distributed throughout Sites 7 and 8 as indicated by the low standard error of the mean. Other natives contributing to cover include bush sunflower, black sage (*Salvia mellifera*), and foothill needlegrass. Exotic cover for Site 7 and 8 was 55 percent of the absolute cover, however the higher standard error of the mean indicates exotic cover varied between measured transects. Non-native grasses were the dominant exotic for Site 7 and 8 (comprising 36 percent of exotic cover) with sweet clover (*Melilotus indicus*), tocalote, and shortpod mustard also contributing to exotic cover. Bare ground and plant litter makes up

slightly less than half of the cover at Site 7 and 8 with 40 percent unvegetated cover. Table 6 also shows the mean absolute percent cover of native vegetation, exotic vegetation, and unvegetated areas for Site 7 and 8. Total absolute cover is also reported for individual native and exotic species, bare ground, and litter in Appendix III for Sites 7 and 8. Appendix III also shows representative photos and the geographic coordinates for the start and end points of the monitoring transects for Site 7 and 8.

Table 6 Mean Percent Absolute Cover for Sites 6 through 8

Cover Type	Site 6 Combined Mean Absolute Cover ±Standard Error	Site 7 & 8 Combined Mean Absolute Cover ±Standard Error
Native Vegetation	5.60±2.48	13.50±2.99
Cactus Cover	4.40±1.72	8.50±0.50
Exotic Vegetation	11.20±4.08	54.50±3.30
Unvegetated	83.60±3.49	40±2.58

3.4 SURVIVORSHIP

Overall, the estimated survivorship for all planted cactus material is greater than 95 percent for all sites combined. Survivorship of the planted cactus material at Sites 1 through 5 was 94 percent. Survivorship of the planted cactus material at Sites 6 through 8 is estimated to be greater than 95 percent based on visual observations and data collection. At Site 6, no dead cactus were encountered along the sampling transects and only one dead cactus was encountered in the random sample of measured cactus. The survival of the 110 planted cactus clumps at Site 6 was 100 percent. At Sites 7 and 8, no dead cactus were encountered along the sampling transect or encountered during the random sample of cactus for growth measurements. Additionally, a count of dead cactus within Sites 7 and 8 was conducted during monitoring and the survivorship is estimated to be approximately 96 percent.

3.5 SPECIES RICHNESS

The mean for species richness for all the sites is 9 native species, 10 exotic species and 20 total species. Site 6 had the greatest number of native species at 14 and also had the highest number of total species at 28. Site 8 had the lowest number of native species with 5 and the lowest number of total species at 14. All the sites had comparable numbers of native and exotic species while species composition at Site 8 was comprised of approximately one-third native species and two-thirds exotic species. Table 7 shows the species richness at each site and all sites combined. Appendix II has a complete species list for Sites 1 through 8.

Table 7 Species Richness for the Cactus Enhancement and Restoration Sites

Site Number	Native Species	Nonnative Species	Total Species
Site 1	7	9	16
Site 2	10	9	19
Site 3	11	12	23
Site 4	9	10	19
Site 5	8	7	15
Site 6	14	14	28
Site 7	11	13	24
Site 8	5	9	14
Mean Number of Species for all Sites Combined	9.38±0.98	10.38±0.84	19.75±1.73

3.6 PHOTO DOCUMENTATION

Figure 6 shows representative photos of Sites 1, 2, 3 and 4 prior to restoration activities taken in May 2010. Figure 7 shows representative photos of Sites 5, 6, and 7 prior to restoration activities. The areas were dominated with exotic species and had sufficient open areas for cactus patches prior to enhancement and restoration.

Figure 8 through 11 shows the location of the permanent photo points for each site. Photo documentation at the permanent photo point locations presented in this performance monitoring report was conducted March 13 through 15, 2012. Figures 12 through 22 show the conditions of the sites after one full year of establishment of the planted cactus material. Figure 12 shows representative views of Site 1 facing east at Photo Point 1 and northwest at Photo Point 2. Figure 13 is a panorama of Site 1 at Photo Point 3. Figure 14 shows representative views of Site 2 facing south at Photo Point 4 and north at Photo Point 5. Figure 15 shows representative views of Site 3 facing southwest at Photo Point 6 and south at Photo Point 7. Figure 16 shows representative views of Site 4 facing north at Photo Point 8 and south at Photo Point 9. Figure 17 shows representative views of Site 5 facing northeast at Photo Point 10 and southwest at Photo Point 11. Figure 18 shows representative views of the large cactus clump area at Site 6 facing southwest at Photo Point 12 and north at Photo Point 13. Figure 19 shows representative views of cactus pad patches at Site 6 on the west slope facing northwest at Photo Point 14 and facing southeast on the east slope at Photo Point 15. Figure 20 are representative photos of an installed large cactus clump and a cactus pad patch at Site 6. Figure 21 shows a panorama of Site 7 at Photo Point 16 along with representative photos of growth and fruit development of the installed cactus material. Figure 22 shows representative views of Site 8 facing northeast at Photo Point 17 and southeast at Photo Point 18.

A. Site 1, Salt Marsh. Non-native poison hemlock. 5-13-2010.

B Site 2, Salt Marsh East. Non-native mustard in scrub. 5-13-2010.

C. Site 3, Bonita at University. Non-native grasses, tocalote. 5-13-2010.

D. Site 4, Bonita at Bison. Bare patches within scrub. 5-13-2010

Figure 6. Typical Photos. Site conditions prior to cactus planting.

A. Site 5, Bonita near Bonita Canyon Drive. 5-13-2010.

B Site 6, UCI Preserve. Non-native mustard and grasses. 5-13-2010.

C Site 6, UCI Preserves. Mustard thatch. 9-30-2010.

D. Site 7, Coyote Canyon Landfill. 5-13-2010.

Figure 7. Typical Photos. Site conditions prior to cactus planting.

Figure 8

Photo Point Locations for Cactus Scrub Sites 1 - 3
Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

Figure 9

Photo Point Locations for Cactus Scrub Site 4

Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

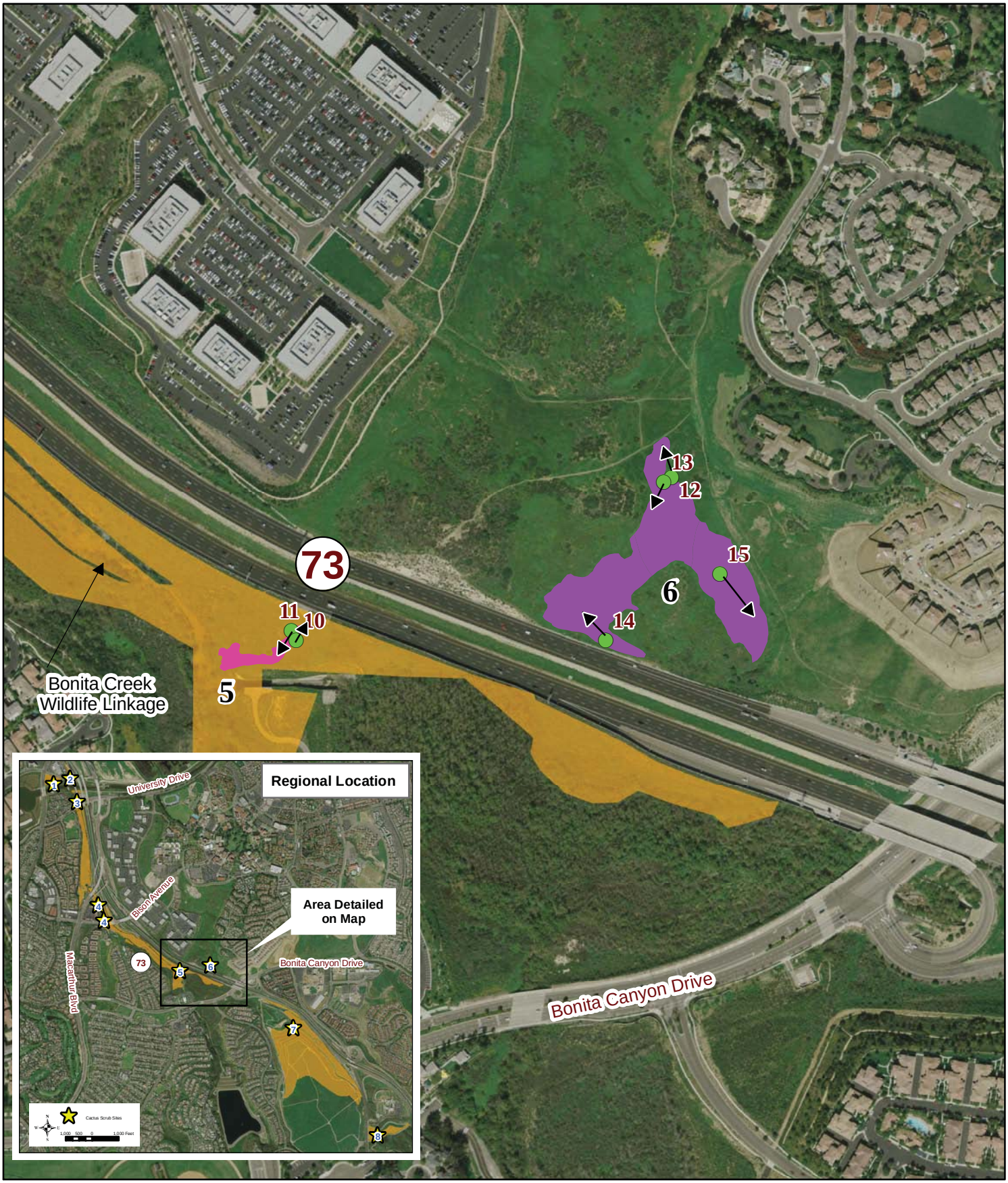


Photo Points

Cactus Scrub Enhancement

Cactus Scrub Restoration

N

W E

S

360 180 0 360 Feet

Figure 10

Photo Point Locations for Cactus Scrub Sites 5 & 6

Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

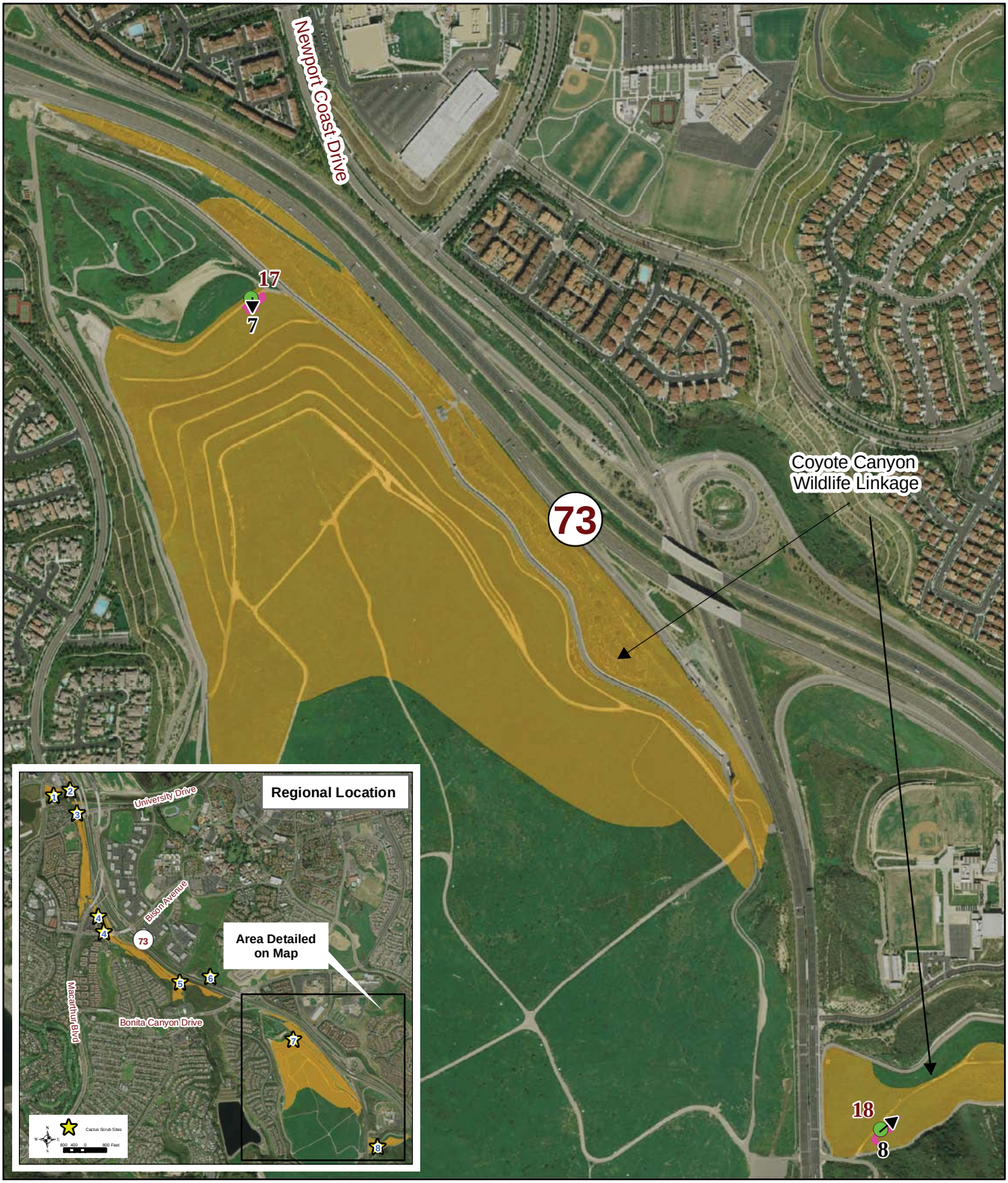


Figure 11
Photo Poin Locations for Cactus Scrub Sites 7 & 8
Environmental Enhancement and Mitigation Program
Cactus Wren Habitat Linkage Restoration Project

A. Photo Point 1 looking east. 3-13-2012

B. Photo Point 2 looking northwest. 3-13-2012.

Figure 12. Site 1 – Salt Marsh. Cactus planted on the slopes along the southern boundary of the salt marsh.

A. Photo Point 3 looking southeast. 3-13-2012.

Figure 13. Site 1- Salt Marsh. Panorama of cactus restoration sites planted on the slopes along the southern boundary of the salt marsh. Arrows show planted areas.

A. Photo Point 4 looking south. 3-13-2012

B. Photo Point 5 looking north. 3-13-2012

Figure 14. Site 2 – Salt Marsh East. Cactus planted along eastern boundary of salt marsh.

A. Photo Point 6 looking southwest. 3-13-2012

B. Photo Point 7 looking south. 3-13-2012

Figure 15. Site 3 – Bonita at University. Cactus planted on southeast corner of near Bonita Creek

A. Photo Point 8 looking north. 3-13-2012

B. Upslope of Photo Point 9 looking south. 3-13-2012

Figure 16. Sites 4a and 4b – Bonita at Bison. Cactus planted on southern slopes adjacent to Bonita Creek and north of Bison Avenue overcrossing.

A. Photo Point 10 looking northeast. 3-13-2012

B. Photo Point 11 looking southwest. 3-13-2012

Figure 17. Site 5 – Bonita near Bonita Canyon Drive. Cactus planted on slopes between Bonita Reservoir and SR73 tollroad, north of Bonita Canyon Drive.

A. Photo Point 12 looking southwest. Large cactus clumps area in central portion of site. 3-15-2012.

B. Photo Point 13 looking north. Northern portion of large cactus clumps area 3-15-2012.

Figure -18. Site 6 – University of California Irvine Ecological Preserve. Cactus clumps planted within the preserve.

A. Photo Point 14 looking northwest. West slope cactus pad planted area. Arrows show clouds of pads. 3-15-2012.

B. Photo Point 15 looking southeast. East slope cactus pad planted area. 3-15-2012.

Figure 19. Site 6 – University of California Irvine Ecological Preserve. Cactus pads planted on the west and east slopes of the site.

A. Large cactus clump salvaged and planted. 3-15-2012.

B. Looking northwest upslope. Cloud of cactus pads. 3-15-2012

Figure 20. Site 6 – University of California Irvine Ecological Preserve. Examples of cactus planted onsite.

A. Photo Point 16 looking south. Panorama of planted Site 7. 3-14-2012.

B. Cactus pad growth. 3-14-2012.

C. Fruit development on cactus pad. 3-14-2012.

Figure 21. Site 7- Coyote Canyon Landfill, Main Canyon. Cactus restoration site on landfill slope in main canyon west of SR-73.

A. Photo Point 17 looking northeast. 3-14-2012

B. Photo Point 18 looking southeast. 3-14-2012

Figure 22. Site 8 – Coyote Canyon Landfill, East Canyon. Cactus planted on portion of restored landfill in the canyon east of Newport Coast Drive.

3.7 AVIAN SURVEY RESULTS

Following the cactus planting in fall 2010, NROC biologists conducted multiple surveys at EEMP sites in 2011 and 2012 (listed in Table 8). Two surveys were made of the Bonita Creek sites which included Sites 1-5 and 7-8. There were no cactus wrens detected at these sites or in their vicinity. A California gnatcatcher was detected at restoration Site 5 in April 2012 and gnatcatchers were observed in the vicinity of Sites 4, 5, 7 and 8 over the course of the surveys. A total of 18 bird species were detected in the Bonita Creek restoration sites following cactus restoration (see Table 9). A least Bell's vireo (*Vireo bellii pusillus*) was detected in April 2012 in riparian vegetation immediately adjacent to Site 3.

The UCI Ecological Preserve restoration site (Site 6) was visited 22 times between January 4, 2011 and April 10, 2012 (Table 8). A pair of cactus wrens was observed foraging in the large planted cactus and on bare ground at the restoration site during the first survey. These birds had formed a pair bond and established a territory after the cactus was planted. Previously, the adjacent intact cactus scrub had only occasionally been used by a nearby wren pair. Both members of the pair using the restoration site were color banded as nestlings at the UCI Ecological Preserve and their ages and natal territories were known. The female was hatched in 2009 and had not a previous mate or permanent territory. The male was hatched in 2010 at the nearest territory to the restoration site. This pair and their offspring were observed within or less than 3m of the restoration site on 41 percent of visits. They were within 100 meters of the restoration site on 32 percent of visits and not detected the remaining 27 percent of visits. The pair used the restoration area for foraging while nesting in a large cholla patch about 30 m from the edge of the restoration area. They produced two fledglings in 2011 and by April 10, 2012 they had fledged two young and the female was already incubating a second clutch of eggs. The pair has been observed foraging in the restoration site during both incubation and nestling phases of the breeding cycle. The pair also defends the restoration site from intrusion by other wrens.

On the first visit to the UCI restoration site following cactus installation, a California gnatcatcher was detected foraging in shrubs that had been retained within the mosaic of existing native plants and planted cactus at the restoration site (Table 8). During subsequent visits it was determined that two pairs of California gnatcatchers had included different portions of the restoration site within their territories. They forage in native shrubs that were at the site prior to restoration and in forbs that have emerged since the site was cleared of non-native plants and cactus was planted. Gnatcatchers were observed within or at the edge of the restoration area on 45 percent of 22 visits. There were gnatcatchers in the vicinity on 32 percent of visits and no gnatcatchers recorded on 23 percent of visits.

Twenty-five bird species were detected using the UCI restoration site (Table 9). Most birds used the site for foraging; many foraging on bare ground while others used existing vegetation or newly planted cactus.

Table 8 Surveys of EEMP Restoration Sites in 2011-2012

Date, location, observer(s), survey type, and occurrence of cactus wrens and California gnatcatchers at or in the vicinity of EEMP cactus scrub restoration sites.

Date	Area	Observer(s)*	Type of Survey	Use of Restoration Site by Target Species**	
				Cactus Wren	California Gnatcatcher
1/4/2011	UCI Site	KP	Restoration Survey	Using Site	Using Site
1/6/2011	UCI Site	KP	Monitoring Study	Using Site	Edge of Site
2/1/2011	Bonita Creek Sites	KP	Restoration Survey	Vicinity	Vicinity
2/22/2011	UCI Site	KP	Restoration Survey		
3/15/2011	UCI Site	KP	Monitoring Study	Using Site	Using Site
3/29/2011	UCI Site	KP	Restoration Survey	Vicinity	Vicinity
4/4/2011	Bonita Creek Sites	KP	Restoration Survey	Using Site	Vicinity
6/6/2011	Bonita Creek Sites	KP	Restoration Survey		Vicinity Site 4
6/6/2011	UCI Site	KP	Restoration Survey	Using Site	Using Site
6/21/2011	Bonita Creek Sites	KP	Restoration Survey		Edge of Sites 7 & 8
8/29/2011	UCI Site	KP	Restoration Survey		Using Site
8/30/2011	UCI Site	KP	Monitoring Study	Edge of Site	
10/10/2011	UCI Site	KP	Monitoring Study	Using Site	Using Site
10/19/2011	UCI Site	KP	Site Visit		Using Site
11/21/2011	UCI Site	KP	Site Visit		Using Site
1/11/2012	UCI Site	KP	Restoration Survey		Edge of Site
2/9/2012	UCI Site	KM/KP	Site Visit	Vicinity	
3/1/2012	UCI Site	KM/KP	Monitoring Study	Vicinity	
3/6/2012	UCI Site	KM/KP	Foraging Study	Vicinity	Vicinity
3/13/2012	UCI Site	KM/KP	Foraging Study	Using Site	Using Site
3/19/2012	UCI Site	KM/KP	Foraging Study	Using Site	Vicinity
4/3/2012	UCI Site	KM/KP	Foraging Study	Vicinity	
4/5/2012	Bonita Creek Sites	MM	Restoration Survey		Vicinity
4/5/2012	Bonita Creek Sites	MM	Restoration Survey		
4/6/2012	Bonita Creek Sites	MM	Restoration Survey		
4/9/2012	UCI Site	MM	Restoration Survey		Vicinity Sites 5, 7 & 8
4/10/2012	Bonita Creek Sites	MM	Restoration Survey		Vicinity
4/10/2012	UCI Site	MM	Restoration Survey		Edge of Site
4/10/2012	Bonita Creek Sites	KM/KP	Foraging Study	Vicinity	
4/11/2012	Area	MM	Restoration Survey		Edge Site 5 & Vicinity Sites 7 & 8

* KM= Karly Moore, NROC contracted biologist, KLP = Dr. Kristine Preston, NROC Science Program Director, MM = Dr. Milan Mitrovich, NROC Ecologist **Edge of site is defined as a bird within 3 meters of the restored area and vicinity is within 100 meters.

Table 9 Bird Species Detected at EEMP Restorations following Cactus Installation in Fall 2010

Common Name	Scientific Name	UCI Restoration Site	Bonita Creek Restoration Sites
Allen's Hummingbird	*Selasphorus sasin*	X	X
American Crow	*Corvus brachyrhynchos*	X	
American Kestrel	*Falco sparverius*	X	
American Pipit	*Anthus rubescens*	X	
Anna's Hummingbird	*Calypte anna*	X	X
Bewick's Wren	*Thryomanes bewickii*		X
Black Phoebe	*Sayornis nigricans*	X	
Bushtit	*Psaltriparus minimus*		X
Cactus Wren	*Campylorhynchus brunneicapillus*	X	
California Gnatcatcher	*Polioptila californica*	X	X
California Quail	*Callipepla californica*	X	
California Towhee	*Melozone crissalis*	X	X
Cassin's Kingbird	*Tyrannus vociferans*	X	
Cliff Swallow	*Petrochelidon pyrrhonota*	X	
Common Yellowthroat	*Geothlypis trichas*	X	X
Cooper's Hawk	*Accipiter cooperii*	X	
Greater Roadrunner	*Geococcyx californianus*	X	
House Finch	*Carpodacus mexicanus*	X	X
House Wren	*Troglodytes aedon*		X
Least Bell's Vireo	*Vireo bellii pusillus*		X
Lesser Goldfinch	*Spinus psaltria*	X	X
Mourning Dove	*Zenaida macroura*	X	X
Northern Mockingbird	*Mimus polyglottos*	X	X
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	X	X
Orange-crowned Warbler	*Oretothlypis celata*		X
Say's Phoebe	*Sayornis saya*	X	
Song Sparrow	*Melospiza melodia*		X
Spotted Towhee	*Pipilo maculatus*		X
Turkey Vulture	*Cathartes aura*	X	
Western Kingbird	*Tyrannus verticalis*	X	
Western Meadowlark	*Sturnella negelcta*	X	
White-crowned Sparrow	*Zonotrichia leucophrys*	X	X

4 RECOMMENDATIONS AND CONCLUSIONS

4.1 SITE ESTABLISHMENT

The sites demonstrate a trend toward establishment of cactus scrub habitat in the second year of establishment of the installed cactus material. Survivorship of the planted cactus material for all sites is estimated to be greater than 95 percent. Growth of new pads in the second year of establishment for coast prickly pear cactus was observed for a majority of the cactus sampled as the average number of pads was five for all sites combined since for the most part, installed plant material consisted of a single pad. The large clump planting showed 100 percent survival and also demonstrated new growth. The cover values are comparable with other non-irrigated restoration sites at a similar developmental stage. Flowering and fruiting of coast prickly pear cactus was observed at all sites. Flowering and seed production demonstrates that the vegetation is capable of re-seeding the sites, which is an indication of a trend toward establishment and sustainability of the cactus scrub community. Several species included in the seed mix were observed to have germinated including shrub species which demonstrates over time native cover will increase and aid in the suppression of exotic species in the sites.

The sites do not yet compare to mature cactus scrub. As the sites continue to develop, changes over time in the growth and cover of cactus species will provide an indication of suitable habitat development for the cactus wren. The main components of native cover for the sites was comprised of coast prickly pear cactus, juvenile shrubs, and perennial grasses that indicate the sites are still developing and over time, the typical cactus scrub species will increase in cover and distribution over the sites.

4.2 HORTICULTURAL RECOMMENDATIONS

The following are recommended maintenance actions for the project in 2013:

- The sites shall be monitored and invasive plant species control implemented as required. It is anticipated the sites will need at least one weeding event in late winter/early spring prior to seed set to control exotic species.

4.3 CONCLUSIONS

The cactus scrub sites are developing within an expected range for plant growth, cover and species distribution for a non-irrigated site (Sites 1 through 5, 7 and 8). Site 6 received only limited irrigation with two watering events following installation mainly to establish the larger salvaged cactus clumps. Survivorship of the planted cactus material was greater than 95 percent after one full year of establishment. Growth of the planted cactus material was observed as illustrated by the mean total pad value of 5 and mean height of 24 cm for all sites combined. Exotic cover is estimated to be below 25 percent of the absolute cover for all sites combined.

The EEMP cactus scrub restoration project provides foraging habitat for one pair of cactus wrens and two pairs of California gnatcatchers at the UCI Ecological Preserve (Site 6). The rapid use of the site is attributed to planting of large cacti, retention of existing native vegetation, and presence of gnatcatchers and wrens in the vicinity of the site. Within months of cactus installation the number of cactus wren territories at the UCI Ecological Preserve increased from five to six. This type of restoration is a powerful management tool that can be used to augment declining populations within Orange County's NCCP/HCP and to maintain and enhance gnatcatcher populations. It is expected that the smaller restoration sites along the Bonita Creek corridor will take several years to grow and become suitable for wren use. NROC will continue to monitor restoration sites and document bird use as the restored habitat matures.

5 REFERENCES

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APPENDICES

APPENDIX I

PLANT PALETTES FOR THE ENHANCEMENT AND RESTORATION SITES

FROM THE *ENVIRONMENTAL ENHANCEMENT AND MITIGATION PROGRAM CACTUS WREN HABITAT LINKAGE RESTORATION SPECIFICATIONS* (NEWFIELDS 2010)

S&S SEEDS
PO BOX 1275
6155 CARPINTERIA AVE
CARPINTERIA · CA 93013 · USA
PHONE: 805·684·0436
FAX: 805·684·2798
WWW.SSSEEDS.COM

Date: 14-Nov-11 SO #BL-7238

Job #941: NROC - EEMP
Mix: 130,680 Sq Ft - 3.00 Acs

Lbs/Ac	Species
0.50	ARTEMISIA CALIFORNICA
2.50	DEINANDRA FASCICULATA
0.50	ENCELIA CALIFORNICA
0.50	GRINDELIA CAMPORUM
1.50	ISOCOMA MENZIESII
1.00	LASTHENIA CALIFORNICA
3.00	LOTUS SCOPARIUS
2.50	LUPINUS BICOLOR
1.50	LOTUS PURSHIANUS
1.50	NASSELLA LEPIDA DEAWNED
15.00	

Net Wt: 30.00 Lbs* - 43,560 Sq Ft-1.00 Ac
1 of 3 Bags

*includes 50% Wheat Bran

SEE REVERSE SIDE FOR WARRANTY & CALIFORNIA NURSERY STOCK CERTIFICATE

Seed Mix Applied to Sites 1 - 5 and Site 7 & 8

S&S SEEDS
PO BOX 1275
6155 CARPINTERIA AVE
CARPINTERIA · CA 93013 · USA
PHONE: 805·684·0436
FAX: 805·684·2798
WWW.SSSEEDS.COM

Date: 14-Nov-11 · SO #BL-7239

Job #941: NROC - UCI EEMP
Mix: 152,460 Sq Ft - 3.50 Acs

Lbs/Ac	Species
0.30	ARTEMISIA CALIFORNICA Collection Source: Camp Pendleton
2.50	DEINANDRA FASCICULATA Collection Source: Camp Pendleton
0.50	ENCELIA CALIFORNICA Collection Source: Irvine Ranch
0.30	GRINDELIA CAMPORUM Collection Source: Camp Pendleton
3.00	LOTUS SCOPARIUS Collection Source: Irvine Ranch
2.50	LUPINUS BICOLOR
9.10	Collection Source: El Toro

Net Wt: 19.10 Lbs* - 43,560 Sq Ft-1.00 Ac
1 of 4 Bags
*includes 50% Wheat Bran

SEE REVERSE SIDE FOR WARRANTY & CALIFORNIA NURSERY STOCK CERTIFICATE

Seedm Mix Applied to Site 6 - UCI Ecological Preserve

NROC EEMP SEEDS.

FROM DONNA.

#1 ENC- CAL. 5 oz. Bonita Creek.
Added to Area Fwy side.

#2 Enc- CAL. 8 oz
Added to .5 Ac.

Specially Collected Seed Added to Sites

#1 Enc- CAL 5 oz UCI RESERVE
Added to .5 Ac.

#2 GRI - CAM 6 oz
Added to .5 Ac.

#3 ISO - ARB 1 oz
Added to .5 CA.

#4 ERI - FAS 1 Lb. 13 oz

1 Lb added to .5 Ac.

13 oz. splited 4+ oz P/Acre bag.

Mycorrhizal. Mustard areas.

Specially Collected Seed Added to UCI Ecological Preserve

APPENDIX II

SPECIES LISTS FOR ENHANCEMENT AND RESTORATION SITES 1 THROUGH 8

Appendix Table AII-1. List of Recorded Species at the Cactus Enhancment and Restoration Sites

Scientific Name	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Amsinckia menziesii	Menzie's fiddleneck		X				X		
Anagallis arvensis	Scarlet pimpernel	X			X	X	X		X
Artemisia californica	California sagebrush	X		X	X		X	X	X
Atriplex lentiformis	Big saltbush		X						
*Avena fatua**	Wild oats							X	
Baccharis pilularis	Coyote bush				X				
Baccharis salicifolia	Mulefat		X	X				X	
*Brassica nigra**	Black mustard	X			X	X	X	X	X
*Bromus diandrus**	Ripgut brome							X	X
*Bromus hordeaceus**	Soft chess brome								X
*Bromus madritensis**	Red brome			X	X			X	X
*Centaurea melitensis**	Tocalote	X	X	X			X	X	X
Chenopodium album	Lamb's quarters						X	X	
*Conium maculatum**	Poison Hemlock	X	X			X	X		
Croton setigerus	Dove weed						X		
Cryptantha sp.	Popcorn flower						X		
Cucurbita foetidissima	Coyote gourd					X			
*Cynara cardunculus**	Artichoke thistle						X		
Deinandra fasciculata	Tarweed			X	X		X	X	
Descurainia pinnata	Tansy mustard	X	X						
Dichelostemma capitatum	Blue dicks						X		
Encelia californica	Bush sunflower	X	X	X	X	X	X		X
Ericameria palmeri var. pachylepis	Palmer's goldenbush						X		
*Erodium botrys**	Broad leaf filaree						X		
Erodium cicutarium	redtem filaree		X		X		X	X	
*Euphorbia peplus**	Petty spurge	X							
Gnaphalium californica	California everlasting			X	X	X	X	X	
Heterotheca grandiflora	Telegraph weed							X	
*Hirschfeldia incana**	Shortpod mustard	X	X	X				X	X
*Hypochaeris glabra**	Smooth cat's ear						X		
*Lactuca serriola**	Prickly lettuce							X	
Lasthenia californica	Goldfields	X	X	X		X		X	
Lotus purshianus	Spanish clover	X	X	X	X	X		X	
Lupinus bicolor	Miniature lupine		X	X					
Lupinus succulentus	Arroyo lupine						X		X
*Malva parviflora**	Cheeseweed	X			X	X		X	
Marah macrocarpus	Wild cucumber						X		
*Marrubium vulgare**	Common horehound						X		
Matricaria discoidea	Pineapple weed			X					
*Medicago polymorpha**	Bur clover			X				X	X
*Melilotus albus**	Yellow sweetclover			X					
*Melilotus indicus**	Annual yellow sweet clover	X	X	X	X			X	X
*Melilotus sp.**	Sweet clover				X	X	X		
*Mesembryanthemum nodiflorum**	Slender leaved iceplant			X					
Mimulus aurantiacus	Stickly monkeybush								X
Nassella lepida	Foothill needlegrass	X	X	X	X	X		X	
	Non-native grass*	X	X	X	X	X	X	X	
	Moss				X				
Opuntia littoralis	Coast prickly pear cactus	X	X	X	X	X	X	X	X
Peritoma arborea	Bladder pod						X		
*Picris echioides**	Bristly ox tongue							X	
*Polygonum sp.**	Knotweed			X					
Salvia mellifera	Black sage							X	
*Sisymbrium irio**	London Rocket		X	X					
Solanum douglasii	Douglas' nightshade					X	X		
*Sonchus asper**	Spiny sowthistle			X			X		
*Sonchus oleraceus**	Common sow thistle		X						
*Sonchus sp.**	Sow thistle							X	
*Urtica urens**	Dwarf nettle		X		X	X			
*Vulpia myuros**	Rattail fescue				X				
	Unknown Aster*						X		

* Indicates Exotic Species

APPENDIX III

PERCENT ABSOLUTE COVER OF ALL SPECIES IN THE MONITORING TRANSECTS, REPRESENTATIVE TRANSECT PHOTOS, AND GEOGRAPHIC COORDINATES FOR THE START AND END POINTS FOR SITES 6, 7, AND 8

Appendix Table AIII-1. Percent Absolute Cover and Mean Absolute Cover of all Species in the Monitoring Transects at Site 6

Scientific Name	**Common Name**	6-1	6-2	6-3	6-4	6-5	Mean Cover for All Transects	SE
	Bare ground	62	48	52	62	60	56.8	2.87
*Brassica nigra**	Black mustard	0	0	16	4	18	7.6	3.92
*Centaurea melitensis**	tocalote	0	0	0	0	2	0.4	0.40
Ericameria palmeri var. pachylepsis	Grassland goldenbush	4	2	0	0	0	1.2	0.80
	Litter	24	32	24	34	20	26.8	2.65
	Non-native grass	0	12	4	0	0	3.2	2.33
Opuntia littoralis	Coast prickly pear cactus	10	6	4	0	2	4.4	1.72
	TOTALS	10	6	4	0	2	100.4	

* Indicates Exotic Species

Appendix Table AIII-2. Percent Absolute Cover and Mean Absolute Cover of all Species in the Monitoring Transects at Site 7 and 8

Scientific Name	**Common Name**	7-1	7-2	8-1	8-2	Mean Cover for All Transects	SE
*Anagalis arvensis**	Scarlett pimpernel	0	0	0	2	0.50	0.50
Artemisia californica	California sagebrush	0	0	2	0	0.50	0.50
*Avena fatua**	Wild oats	14	0	0	0	3.50	3.50
	Bare Ground	34	28	32	42	34.00	2.94
*Bromus diandrus**	Ripgut Brome	14	0	2	0	4.00	3.37
*Bromus madritensis**	Red Brome	0	0	8	2	2.50	1.89
*Centaurea melitensis**	Tocalote	4	0	2	8	3.50	1.71
Encelia californica	Bush sunflower	0	0	10	0	2.50	2.50
*Hirschfeldia incana**	Shortpod mustard	0	2	0	10	3.00	2.38
	Litter	8	10	2	4	6.00	1.83
Lupinus succulentus	Arroyo lupine	0	0	2	0	0.50	0.50
*Medicago polymorpha**	Bur clover	4	0	0	0	1.00	1.00
*Melilotus indicus**	Sweet clover	2	14	12	10	9.50	2.63
Nassella lepida	Foothill needlegrass	2	0	0	0	0.50	0.50
	Non-native grass	8	42	36	18	26.00	7.87
Opuntia littoralis	Coast prickly pear cactus	10	8	8	8	8.50	0.50
Salvia mellifera	Black sage	0	4	0	0	1.00	1.00
*Sonchus sp**	Sow thistle	0	0	2	0	0.50	0.50
	Unknown Aster*	2	0	0	0	0.50	0.50
	TOTALS	102	108	118	104	108.00	

* Indicates Exotic Species

Appendix Table AIII-3. Geographic Coordinates of the Start and End Points of the Permanent Monitoring Transects

Site Number	Transect Number	Start Point		End Point	
		Latitude	Longitude	Latitude	Longitude
6	6-1	33.63382692780	-117.84527113400	33.63340377540	-117.84510612200
	6-2	33.63376137670	-117.84539442100	33.63331265090	-117.84542235000
	6-3	33.63291348170	-117.84466136500	33.63263668950	-117.84426756300
	6-4	33.63311848280	-117.84541311300	33.63324925990	-117.84591030400
	6-5	33.63309813600	-117.84608757200	33.63285393830	-117.84564931400
7	7-1	33.62696085600	-117.83544708400	33.62683038250	-117.83566371100
	7-2	33.62679240180	-117.83559805800	33.62692917260	-117.83537327000
8	8-1	33.61547857340	-117.82454059200	33.61531492870	-117.82472030900
	8-2	33.61525608750	-117.82476496200	33.61534101770	-117.82450873400

A. Transect 6a. 3-14-2012.

B. Transect 6b. 3-14-2012.

Figure AIII-1. Site 6 Transects, University of California Irvine Preserves.

A. Transect 6c. 3-15-2012.

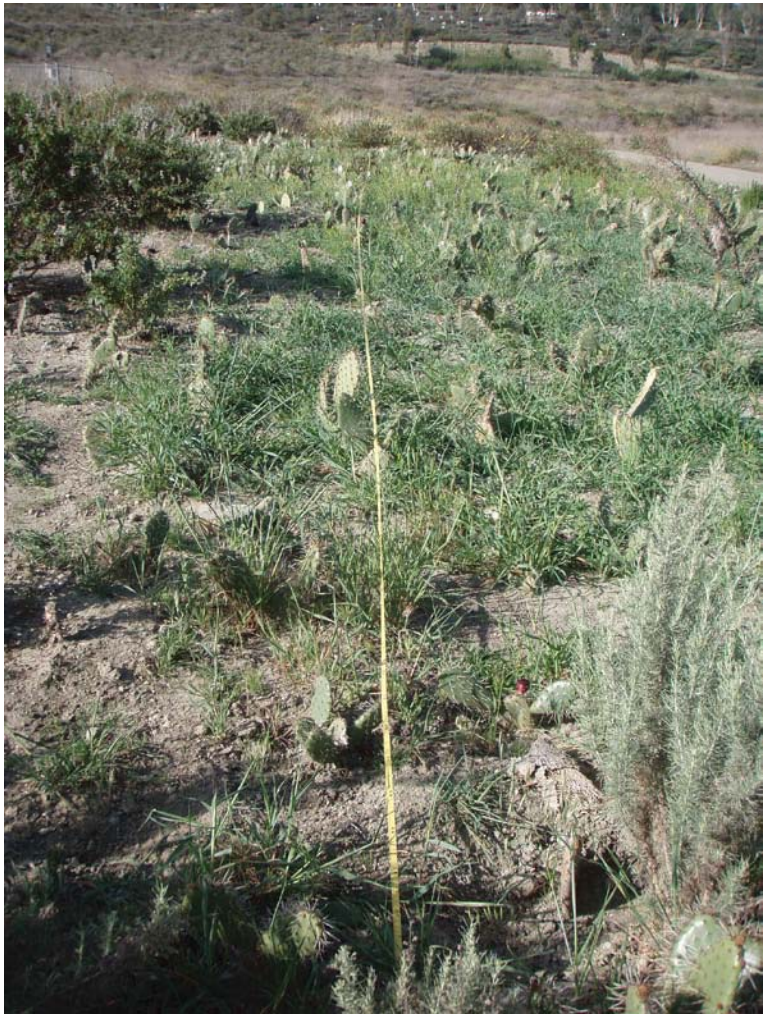
B. Transect 6d. 3-15-2012.

Figure AIII-2. Site 6 Transects, University of California Irvine Preserves.

A. Transect 6e 3-15-2012.

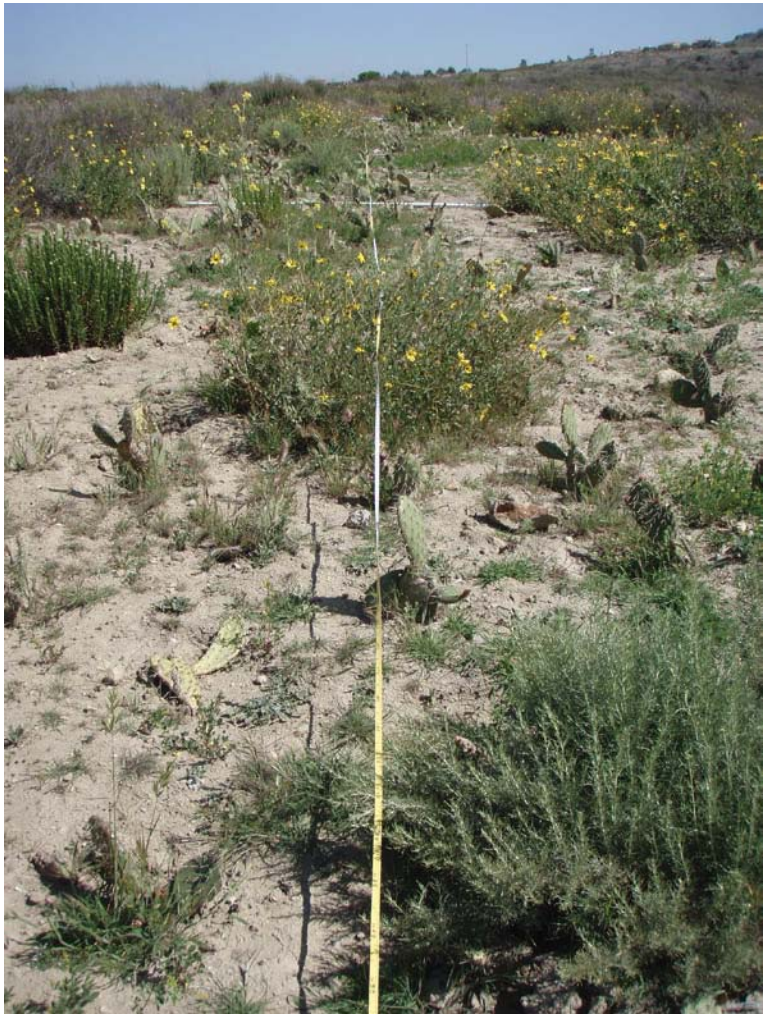
Figure AIII-3. Site 6 Transects, University of California Irvine Preserves.

A. Transect 7a. 3-14-2012.



B. Transect 7b. 3-14-2012.

Figure AIII-4. Site 7 Transects, Coyote Canyon Landfill.



A. Transect 8a. 3-14-2012.

B. Transect 8b. 3-14-2012.

Figure AIII-5. Site 8 Transects, Coyote Canyon Landfill, East Canyon.

APPENDIX IV

GEOGRAPHIC COORDINATES AND COMPASS DIRECTION OF THE PHOTO POINT LOCATIONS

Appendix Table AIV-1. Geographic Coordinates and Cardinal Direction of Permanent Photo Point Locations

Site Number	Photo Point	Location	Cardinal Direction	Latitude	Longitude
1	1	Salt Marsh	East	33.65167097	-117.86554288
1	2	Salt Marsh	Northwest	33.65154625	-117.86610648
1	3	Salt Marsh	Southeast	33.65191187	-117.86662725
2	4	Salt Marsh East	South	33.65241503	-117.86348596
2	5	Salt Marsh East	North	33.65223683	-117.86337574
3	6	Bonita at University	Southwest	33.64981639	-117.86243286
3	7	Bonita at University	South	33.65000113	-117.86257577
4	8	Bonita at Bison Avenue	North	33.63841776	-117.85930557
4	9	Bonita at Bison Avenue	South	33.63763983	-117.85890668
5	10	Bonita near Bonita Canyon Drive	Northeast	33.63234331	-117.84888712
5	11	Bonita near Bonita Canyon Drive	Southwest	33.63243325	-117.84893649
6	12	University of California Irvine Ecological Preserve	Southwest	33.63400972	-117.84516966
6	13	University of California Irvine Ecological Preserve	North	33.63396596	-117.84525314
6	14	University of California Irvine Ecological Preserve	Northwest	33.63253869	-117.84585119
6	15	University of California Irvine Ecological Preserve	Southeast	33.63315049	-117.84463464
7	16	Coyote Canyon Landfill, Main Canyon	South	33.62695584	-117.83554346
8	17	Coyote Canyon Landfill, East Canyon	Northeast	33.61535453	-117.82470684
8	18	Coyote Canyon Landfill, East Canyon	Southeast	33.61535453	-117.82470684