Appendix
LAX Master Plan Final EIS

A-3c. Los Angeles/El Segundo Dunes Habitat Restoration Plan

January 2005

Prepared for:

Los Angeles World Airports

U.S. Department of Transportation
Federal Aviation Administration

Prepared by:

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LOS ANGELES/EL SEGUNDO DUNES HABITAT RESTORATION PLAN

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SECTION 1.0
INTRODUCTION

The U.S. Department of Transportation Federal Aviation Administration (FAA) intends to issue its Record of Decision (ROD) in support of the Final Environmental Impact Report (EIR) for the Los Angeles International Airport (LAX) Master Plan in February 2005.[1] Prior to issuance of the ROD, the FAA is seeking the California Coastal Commission's (CCC's) consistency concurrence with the FAA's Coastal Consistency Determination for Relocation of Existing Navigational and Safety Aids[2] in support of Alternative D of the LAX Master Plan. At the request of CCC staff, the FAA is submitting this coastal dune Habitat Restoration Plan for the Los Angeles/El Segundo Dunes (Dunes) at LAX to the CCC in support of the Coastal Consistency Determination pursuant to Section 930.32 *et seq.* of the National Oceanic and Atmospheric Administration Federal Consistency Regulations (Title 15, *Code of Federal Regulations*, Part 930).

This Habitat Restoration Plan (Plan) for the Dunes was developed following guidelines provided to the FAA (Mr. David Kessler) by the CCC (Mr. John Dixon).[3] The Plan provides for the establishment and/or enhancement of (referred to herein as "the restoration of") 5.8 acres of coastal dune habitat within the Dunes to mitigate impacts to 2.92 acres of coastal dune habitat resulting from the installation of navigational aids in support of Alternative D (1.53 acres) and the disturbance associated with the removal of existing navigational aids (1.4 acres). The amount of mitigation is consistent with the 2:1 mitigation ratio requested by the CCC. It is understood that the feasibility of the ultimate restoration of areas where navigational aids are to be removed may be further reviewed and evaluated by the CCC and FAA. However, the Plan assumes that all areas where navigational aids are scheduled for removal will be restored to the appropriate coastal dune plant community.

Located at the western terminus of LAX, the 302-acre Dunes are bound on the north by Napoleon Street and Waterview Street, on the south by Imperial Highway, on the east by Pershing Drive, and on the west by Vista del Mar Boulevard. The subject area contains environmentally sensitive areas, as defined in Section 30107.5 of the California Coastal Act (CCA) of 1976, as amended. Pursuant to Section 30240 of the CCA, Environmentally Sensitive Habitat Areas (ESHAs) shall be protected against any significant disruption of habitat values. Additionally, in 1992, the City of Los Angeles, by way of Ordinance No. 167940, established the 302–acre site as the Los Angeles Airport/El Segundo Dunes Specific Plan "in order to restore and preserve the natural ecology of the Dunes and those native dune-dependent species that exist thereon" consistent with the CCA, as amended. Within the 302-acre site, that is located entirely within the California Coastal Zone Boundary, the ordinance additionally established a 200-acre ecosystem preserve currently designated as the El Segundo Blue Butterfly Habitat Restoration Area (HRA) and home to the federally endangered El Segundo blue butterfly. Section 3 of the ordinance describes land use regulations for the specific plan area. Subsection F of Section 3 states "notwithstanding any other provisions of this Specific Plan, no use, development or activity regarding the Specific Plan Area may compromise the safety

[1] City of Los Angeles. April 2004. *Final Environmental Impact Report*. Available at: http://www.laxmasterplan.org.

[2] U.S. Department of Transportation, Federal Aviation Administration. August 2004. Federal Aviation Administration, Los Angeles International Airport, City of Los Angeles, California Coastal Consistency Determination for Relocation of Existing Navigational Aids. Contact: U.S. Department of Transportation, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591.

[3] Dixon, J. 30 September 2004. "Suggested language for a filing requirement for a Restoration and Monitoring Plan when resource impacts and mitigation are anticipated." Contact: California Coastal Commission, 45 Fremont, Suite 2000, San Francisco, CA 94105.

of airport flight operations in any way. Final authority for determining whether airport flight operation safety is compromised rests with the Federal Aviation Administration."

In accordance with the Federal Coastal Zone Management Act of 1972 (CZMA), as amended, the FAA has determined that the relocation of existing navigational aids and associated service roads at LAX is consistent, to the maximum extent practicable, with the California Coastal Management Program (CCMP) pursuant to the requirements of the CZMA and the CCA, as amended. This determination was based on a consistency analysis between policy sections of the CCC (Division 20, California Public Resources Code) and FAA proposals and actions at LAX within the California Coastal Zone Boundary, specifically the proposed relocation of existing navigational and safety aids in support of Alternative D of the LAX Master Plan.

Under Alternative D, a navigational aid system known as Approach Lighting System (Flashing)-2 (ALSF-2) and associated service roads would be constructed (Figure 1-1, *ALSF-2 Towers in the Los Angeles/El Segundo Dunes*). The ALSF-2 consists of 23 lighting standards spaced at 100 feet with upwardly directed lighting that would be used during nighttime for aircraft approaching LAX from the west when low visibility Santa Ana conditions (strong easterly winds) are present. During normal operations, only one-half of the lights would be illuminated. The construction of navigational aids and associated service roads would result in impacts to 66,675 square feet (1.53 acres) of state-designated sensitive habitat within the Dunes (Figure 1-2, *Location of Proposed Navigational Aids - Alternative D*). Of the 1.53 acres of impact to the Dunes, 0.77 acres are located within the HRA, 0.24 acres of which are habitat for the El Segundo blue butterfly. Additionally, an estimated 1.4 acres of state-designated sensitive habitat will be impacted by the removal of existing navigational aids. Mitigation for impacts to 2.92 acres will take place at a 2:1 ratio for a total 5.8 acres.

Measures to compensate for the conversion of 1.53 acres of habitat within the Dunes are described in the Final EIR for the LAX Master Plan. However, impacts associated with the removal of existing navigational aids are not addressed in the Final EIR because it was anticipated that the navigational aids would be abandoned in place. However, the CCC has requested that the existing navigational aids be removed. Thus, this Habitat Restoration Plan revises those mitigation measures that compensate for impacts within the California Coastal Zone Boundary pursuant to ongoing coordination and discussions between the FAA and CCC. Revisions to the measures include the designation of the FAA as being responsible for the design, implementation, maintenance, and monitoring of measures that compensate for impacts within the California Coastal Zone Boundary. Additionally, revisions incorporate a 2:1 ratio for impacts resulting from the permanent conversion of 1.53 acres of habitat within the Dunes, as well as the estimated impact to 1.4 acres as a result of the removal of navigational aids no longer required to guide aircraft that approach LAX from the west. A total of 5.8 acres will be restored pursuant to this Habitat Restoration Plan: 4.4 acres within Subsite 23 and 1.4 acres "in situ." The revised mitigation measures are summarized below.

MM-BC-1: CONSERVATION OF STATE-DESIGNATED SENSITIVE HABITAT WITHIN AND ADJACENT TO THE EL SEGUNDO BLUE BUTTERFLY HABITAT RESTORATION AREA

The FAA, or its designee, shall take all necessary steps to ensure that the state-designated sensitive habitats within and adjacent to the HRA are conserved and protected during construction, operation, and maintenance, by the implementation of construction avoidance measures, as described in this Habitat Restoration Plan.

FIGURE 1-1
ALSF-2 Towers in the Los Angeles/El Segundo Dunes

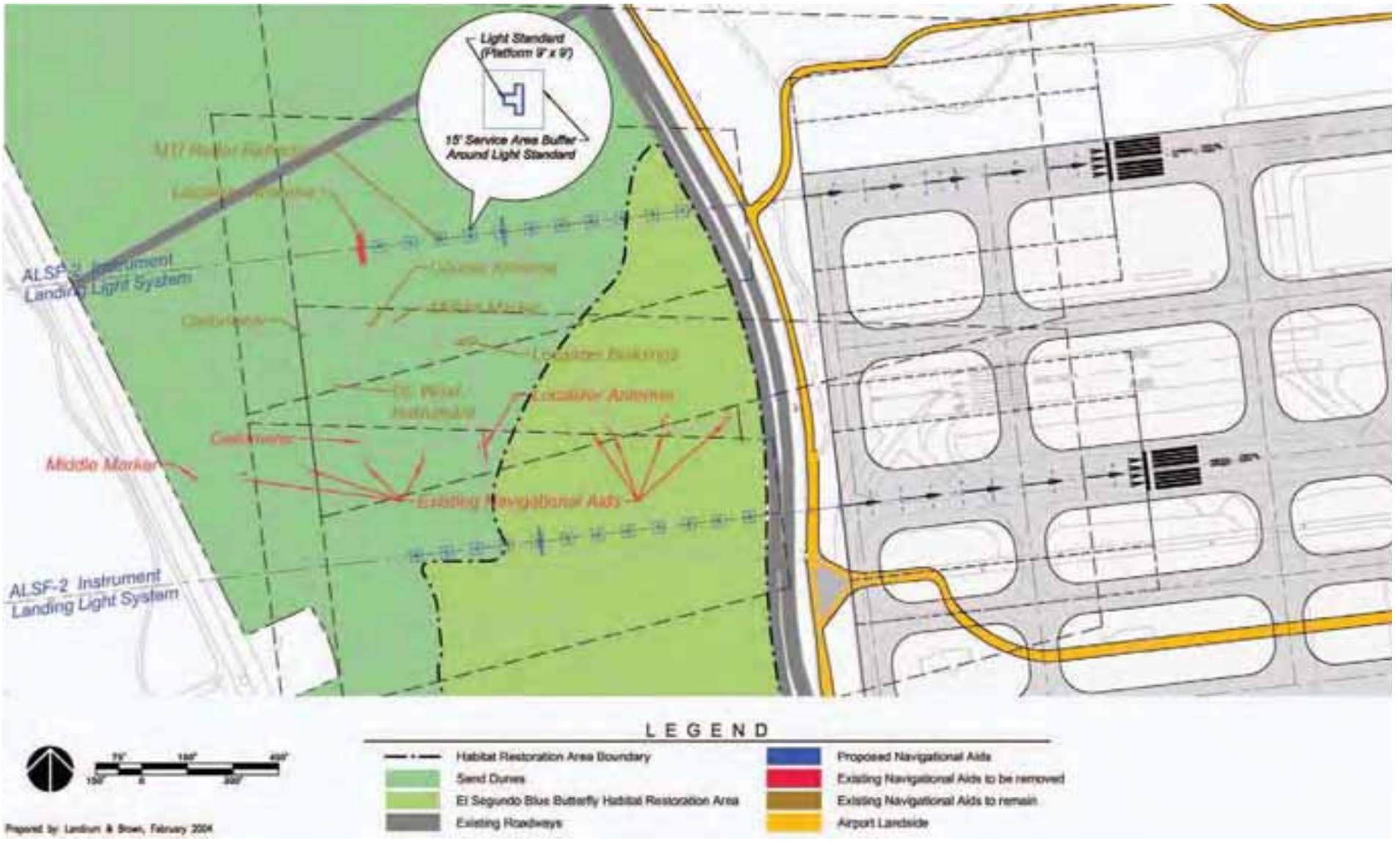


FIGURE 1-2
Location of Proposed Navigational Aids - Alternative D

MM-BC-2: CONSERVATION OF FLORAL RESOURCES: LEWIS' EVENING PRIMROSE

The FAA, or its designee, shall implement a plan to compensate for the loss of individuals of the sensitive Lewis' evening primrose, currently located within the HRA, as described in this Habitat Restoration Plan.

MM-BC-9: CONSERVATION OF FAUNAL RESOURCES

The FAA, or its designee, shall conduct preconstruction surveys to determine the presence of individuals of sensitive arthropod species, the silvery legless lizard, the San Diego horned lizard, and the burrowing owl within the proposed area of impact in the Dunes. Surveys will be conducted at the optimum time to observe these species. Should an individual be observed, they will be relocated to suitable habitat for that species within the HRA, as described in this Habitat Restoration Plan.

MM-BC-13: REPLACEMENT OF STATE-DESIGNATED SENSITIVE HABITAT

The FAA, or its designee, will restore at a 2:1 ratio impacts to 1.4 acres of state-designated sensitive habitat to the appropriate state-designated sensitive plant community. An estimated 1.4 acres of state-designated sensitive habitat currently occupied by navigational aids that are scheduled for removal have the potential of being disturbed during removal activities. A total of 2.92 acres will be restored, with 1.4 acres taking place "in situ" and 1.4 acres taking place within Subsite 23 of the HRA, as described in this Habitat Restoration Plan. Implementation of MM-ET-4 and MM-BC-13 will provide for a total of 4.4 acres of Southern Foredune habitat within Subsite 23. Table 1-1, *Impacts Associated with the Removal of Navigational Aids,* describes the impacts associated with navigational aid removal.

TABLE 1-1
IMPACTS ASSOCIATED WITH THE REMOVAL OF NAVIGATIONAL AIDS

Impact Areas	Southern Foredune (acres)	Valley Needlegrass Grassland (acres)
Los Angeles/El Segundo Dunes*	1.19	0.20
Habitat Restoration Area	0	0.20
El Segundo Blue Butterfly–occupied habitat	0	0

NOTE:
*A total of 1.39 acres of the Los Angeles/El Segundo Dunes is impacted as a result of the removal of navigational aids.

MM-ET-4: EL SEGUNDO BLUE BUTTERFLY CONSERVATION: HABITAT RESTORATION

The FAA, or its designee, shall restore 3.0 acres of coastal dune habitat designated as Southern Foredune[4] within Subsite 23 of the HRA and relocate coast buckwheat individuals that have the potential to be impacted as a result of the installation of ALSF-2 navigational aids in support of Alternative D. In conformance with the Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS) on April 20, 2004, for the Alternative D of the LAX Master Plan, activities associated with navigational aid development shall be limited to the existing roads and proposed

[4] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

impacts areas, as described in the Final EIR. Habitat restoration will take place at a minimum of three years prior to the impact (scheduled for 2012–2013), as described in this Habitat Restoration Plan. Implementation of MM-ET-4 and MM-BC-13 will provide for a total of 4.4 acres of Southern Foredune habitat within Subsite 23. Table 1-2, *Impacts Associated with the Installation of Navigational Aids in Support of Alternative D*, describes the impacts associated with navigational aid installation.

TABLE 1-2
IMPACTS ASSOCIATED WITH THE INSTALLATION OF NAVIGATIONAL AIDS IN SUPPORT OF ALTERNATIVE D

Impact Areas	Southern Foredune (acres)	Valley Needlegrass Grassland (acres)
Los Angeles/El Segundo Dunes*	0.87	0.66
Habitat Restoration Area	0.24	0.53
El Segundo Blue Butterfly–occupied habitat	0.24	0

NOTE:
*A total of 1.53 acres of the Los Angeles/El Segundo Dunes is impacted as a result of the installation of navigational aids.

SECTION 2.0
EXISTING CONDITIONS

2.1 PROJECT LOCATION

The Los Angeles/El Segundo Dunes (Dunes), which lie between the west end of the Los Angeles International Airport (LAX) and the Pacific Ocean, are the largest remaining representation of coastal dune community within Southern California (Figure 2.1-1, *Regional Location Map*). Formerly known as the "Airport/El Segundo Dunes," the 302-acre Dunes site is bordered by Napoleon and Waterview Streets on the north, Imperial Highway on the south, Pershing Drive on the east, and Vista del Mar on the west (Figure 2.1-2, *Project Location*). The site is owned and managed by Los Angeles World Airports (LAWA).

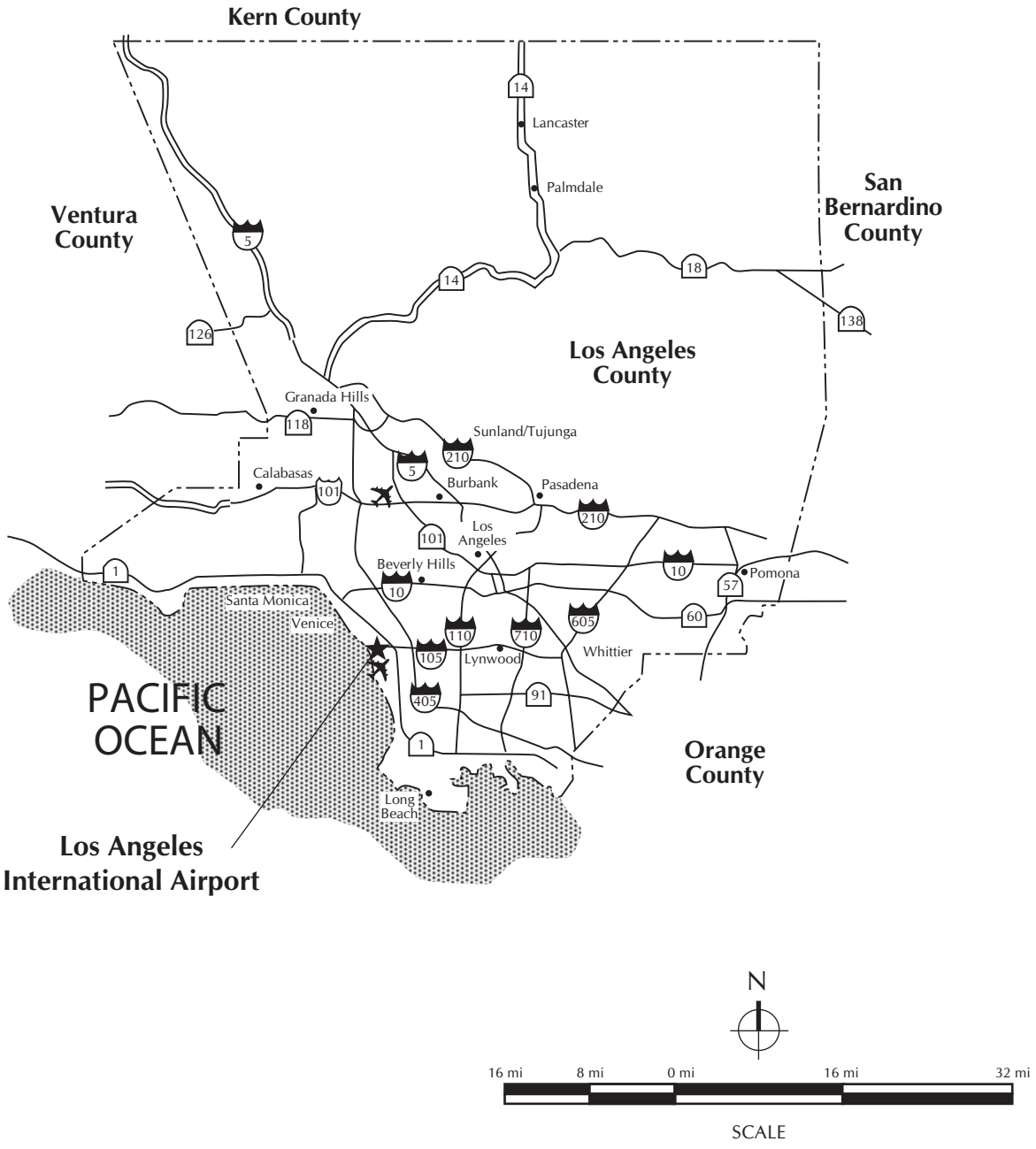
2.2 ECOLOGICAL SIGNIFICANCE OF THE LOS ANGELES/EL SEGUNDO DUNES

The ecological significance of the Dunes is recognized by both federal and state governments, as well as by the City and County of Los Angeles and the California Coastal Commission (CCC). In spite of a long history of land disturbance and increasing isolation from related habitats, the Dunes are unique in their richness of sand-obligate species (species whose survival depends on the free flowing sand characteristic of dunes systems) and in the number of sensitive species or species of limited distribution that inhabit them. Among the Dunes sensitive species is the federally-endangered El Segundo blue butterfly (*Euphilotes battoides allyni*), whose habitat is now reduced to a few coastal dune fragments between Playa del Rey and Malaga Cove. The Dunes are reported to support over 900 species of plant and animals; at least 35 of these species, including the El Segundo blue butterfly, are limited in range to Southern California dunes.[5]

As early as 1972, even before all houses had been removed from the Dunes for reasons of public safety for airport operations, the County of Los Angeles Environmental Resource Committee, in recognition of the Dunes' ecological value, identified the Dunes as a high priority habitat area that should be restored and preserved. The County of Los Angeles (County) designated the Dunes a Significant Ecological Area (SEA No. 28) in the 1976 revised County General Plan. The Southern California Association of Governments included the Dunes among its designated "Areas of Regional Significance and Concern," recommending that the entire area be preserved and restored. The Dunes area was also designated as an Environmentally Sensitive Habitat Area (ESHA) pursuant to Section 30240 of the California Coastal Act (CCA) of 1976, as amended. Southern coastal dune habitat is considered by the Heritage program of the California Department of Fish and Game (CDFG) to be amongst the most highly imperiled natural communities in California. Forming a continuum in response to topography and proximity to the ocean, southern coastal dune habitat at the Dunes is expressed as Southern Foredune, Southern Dune Scrub, and Valley Needlegrass Grassland according to the Holland classification of natural communities.[6] All three plant community types—Southern Foredune, Southern Dune Scrub, and Valley Needlegrass Grassland—are considered state-designated sensitive plant communities. Finally, the International Union for Conservation of Nature and Natural Resources (IUCN) listed the Dunes as a "Threatened

[5] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

[6] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.



LEGEND

★ Project Location

FIGURE 2.1-1
Regional Location Map

SOURCE: The Thomas Guide Digital Edition 2003/2004

LEGEND

★ El Segundo Dunes

FIGURE 2.1-2
Project Location

Community" in their IUCN Invertebrate Red Data Book, published in 1983, noting the site's ecological significance as habitat for several endemic invertebrates and populations of vulnerable plants.

As a result of a protracted planning history, 200 acres of the site are now designated in the City of Los Angeles Conservation Plan as an "Ecologically Important Area" and as the "Dunes Habitat Preserve," or simply "Preserve," in the Draft Los Angeles/El Segundo Dunes Specific Plan. Restoration efforts, which began in the late 1980s and were completed in 1994, have received wide support from the scientific community, local elected officials, state and federal resource agencies, and the general public.

2.3 BIOTIC COMMUNITIES

Biotic communities are typically named for the dominant or characteristic floral components that comprise the community. Biotic communities are consistent with the descriptions provided in the Final Environmental Impact Report (EIR) for the LAX Master Plan and follow the Holland classification.[7] Some wildlife species may be limited to a specific community and may be characteristic of that community; however, many wildlife species are associated with several different biotic communities. The biotic communities and vegetation types found within the Dunes are described in accordance with designations and definitions provided by Holland and are further identified by element code numbers. There are six biotic communities that describe the Dunes (Figure 2.3-1, *Biotic Communities of the Los Angeles/El Segundo Dunes*), which are located within two generally designated open areas within the coastal zone:

- The El Segundo Blue Butterfly Habitat Restoration Area (HRA), located to the west of the airfield, is comprised of approximately 202.8 acres. Four biotic communities are represented: Southern Foredune (135.6 acres), Southern Dune Scrub (24.4 acres), Valley Needlegrass Grassland (17.1 acres), and Developed (25.7 acres).

- Approximately 104.3 acres of non-restructured dunes adjacent to and north of the HRA are comprised of three biotic communities: Disturbed Dune Scrub/Foredune (74.6 acres), Nonnative Grassland/Ruderal (16.9 acres), and Developed (12.8 acres).

2.3.1 Southern Foredune (CNDDB Element Code 21230)

Southern Foredune plant communities are typically dominated by perennial species with a high proportion of suffrutescent (slightly woody at base) plants up to 30 cm tall. Species such as red sand verbena (*Abronia maritima*), beach burr (*Ambrosia* sp.), and the nonnative sea rocket (*Cakile* sp.) usually occur in exposed sites, and pink sand verbena (*Abronia umbellata*) and morning-glory (*Calystegia* sp.) occur in less exposed sites.[8] Establishment of these plants reduces the amount of blowing sand, partially stabilizing the dunes. The mitigation site for restoration of 4.3 acres of dune habitat is located within Subsite 23 the Southern Foredune community (Figure 2.3.1-1, *Mitigation Site for Southern Foredune Restoration*). Photographs of the Dunes are provided in Figure 2.3.1-2, *Site Photographs*.

[7] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

[8] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

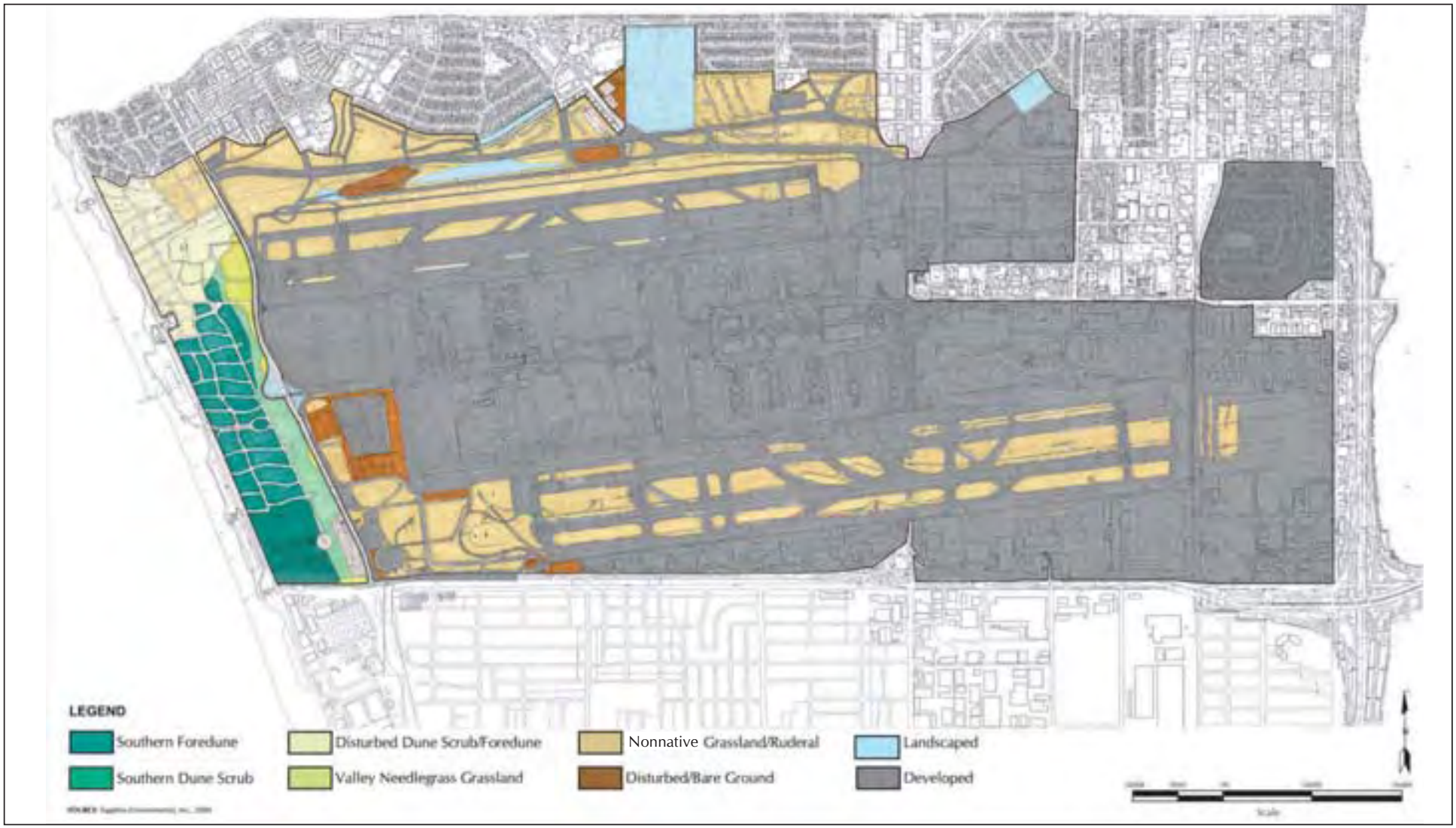


FIGURE 2.3-1
Biotic Communities of the Los Angeles/El Segundo Dunes

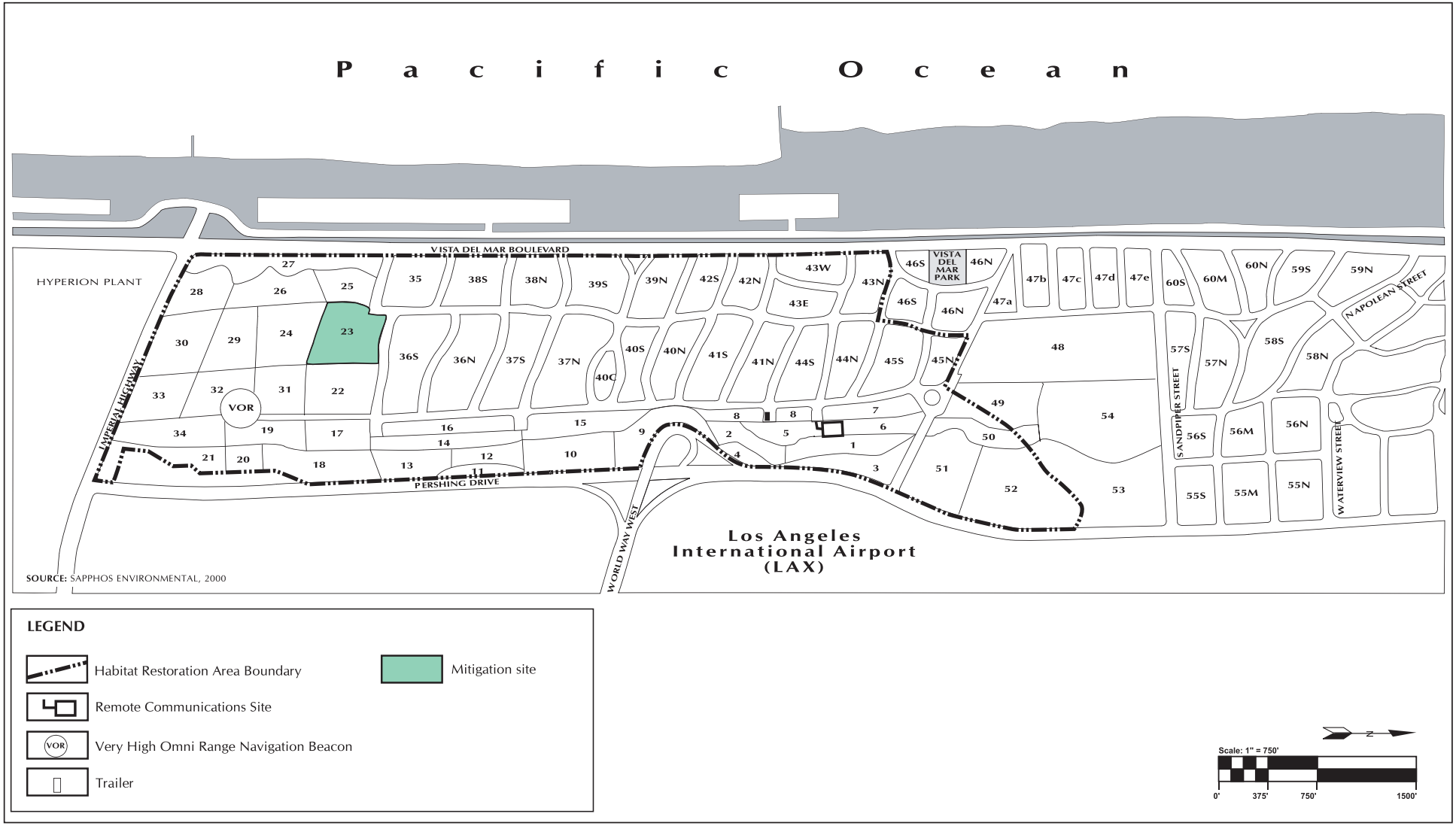


FIGURE 2.3.1-1
Mitigation Site for Southern Foredune Restoration

PHOTO 1
View of the Dunes from Subsite 23 looking south towards Hyperion.

PHOTO 2
View of the Dunes from Subsite 31 looking west towards Santa Monica.

PHOTO 3
View of the Dunes from the crest of backdune
looking east towards LAX. Coastal buckwheat in the forefront.

FIGURE 2.3.1-2
Site Photographs

The Southern Foredune community, identified in Figure 2.3-1, is inhabited by a number of wildlife species, including the federally-listed El Segundo blue butterfly (*Euphilotes battoides allyni*). Historical surveys have recorded a large number of wildlife species (many of which no longer occur at the Dunes) and 151 species of invertebrates. Of the 34 sensitive wildlife species designated by federal or state agencies that were determined to have the potential to occur within the LAX Master Plan Boundaries, 24 were identified within the coastal zone. There are 18 sensitive arthropods (14 sensitive insect species and four sensitive arachnids), all of which were located within the Dunes. Two sensitive reptiles, the silvery legless lizard and the San Diego horned lizard, were determined present within the Dunes. Two sensitive bird species, the burrowing owl and the loggerhead shrike, were detected in the Dunes.

Within the coastal zone, 135.6 acres are found within the HRA of the Dunes. Relatively undisturbed areas (about 40 acres) surrounding the Very High Omni Range Navigation Beacon provide the most representative example of this community. Ecological restoration efforts undertaken between 1987 and 1994 have restored an additional 95.6 acres. The host plant and primary food source for the El Segundo blue butterfly is coast buckwheat (*Eriogonum parvifolium*), which is found in this biotic community. Southern Foredune may intergrade with Southern Dune Scrub.[9]

There are 20 sensitive plant species designated by federal or state agencies that were determined to have the potential to be present within the LAX Master Plan Boundaries. Surveys conducted for sensitive plant species identified three sensitive plant species within the coastal zone. Lewis' evening primrose (*Camissonia lewissi*), El Segundo duneflower (*Pholisma paniculaum*), and California spineflower (*Mucronea californica*) were identified within the Southern Foredune community. The remaining 17 sensitive plant species were determined absent within the coastal zone.

2.3.2 Southern Dune Scrub (CNDDB Element Code 21330)

Southern Dune Scrub is a dense coastal scrub community of scattered shrubs, subshrubs, and herbs that are generally less than 1 meter in height, often developing considerable cover, and often succulent.[10] Characteristic species include saltbush (*Atriplex leucophylla*), California croton (*Croton californicus*), desert tea (*Ephedra californica*), coast goldenbush (*Isocoma menziesii* var. *vernonioides*), bush lupine (*Lupinus chamissonis*), box thorn (*Lycium brevipes*), prickly pear (*Opuntia littoralis*), lemonade-berry (*Rhus integrifolia*), jojoba (*Simmondis chinensis*), and the nonnative crystalline iceplant (*Mesembryanthemum crystallinum*). Along the coast, Southern Dune Scrub intergrades with the Southern Foredune plant community.[11] Many of the wildlife species in the Southern Foredune community are also found in the Southern Dune Scrub community.

Southern Dune Scrub is considered by the CDFG Heritage Program to be among the most highly imperiled natural communities in California. The Dunes contain virtually the only remaining example of this plant community in mainland Southern California. Within the Dunes, the Southern

[9] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

[10] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

[11] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

Dune Scrub community is found only within the HRA along the steep slope of the backdune (Figure 2.3-1). The Southern Dune Scrub community is comprised of 24.4 acres. The host plant and primary food source for the El Segundo blue butterfly is coast buckwheat, which is found in this biotic community. Because the backdune is subject to lower thermal stress and wind dehydration, the vegetative cover of the Southern Dune Scrub community is typically denser than that of the Southern Foredune community.

2.3.3 Valley Needlegrass Grassland (CNDDB Element Code 42110)

The deflation plain east of the backdune consists of loosely consolidated (incipient) sandstone covered to variable depths with aeolian (wind-transported) sand. Such deflation areas are commonly found behind coastal dune systems and where erosion down to or near the water table occurs, commonly supporting vernal pools.[12] Limited information is available regarding the historic vegetation of the deflation plain of the Dunes and the sand-dominated substrates that extend inland because extensive disturbance occurred before any botanical studies could be conducted. Historical documents refer to the area as "meadow." Recently, the area has been referred to as the "Los Angeles Coastal Prairie." Although the Los Angeles Coastal Prairie has been overlooked by Holland[13] as a distinct association, Mattoni has reported on the unique characteristics of this habitat, including the predominance of an herbaceous plant community with extensive vernal pools.[14] This community is considered an instance of Valley Needlegrass Grassland. The deflation plain area is referred to herein as "Valley Needlegrass Grassland," as classified by Holland. The Valley Needlegrass Grassland community occupies 17.1 acres within the HRA and is limited to three distinct areas adjacent to and west of Pershing Drive (Figure 2.3-1). According to Pierce and Pool,[15] the "meadow" was historically composed of the perennial nodding needlegrass (*Nassell*a *[Stipa] cernua*), several annual native grasses, and a number of flowering forbs (herbaceous plants that are not grasses but are associated with grasses). A photograph of the area in 1938 shows a predominance of forbs over grasses.

Many common species of birds are known to utilize this biotic community, including western meadowlark (*Sturnella neglecta)*, English sparrow (*Passer domesticus*), killdeer (*Charadrius vociferous)*, and mourning dove (*Zenaida macroura*). Butterflies and moths known to occur in this community are the cabbage white butterfly (*Pieris rapae*), the buckeye (*Junonia coenia)*, and the common hairstreak (*Strymon melinus)*. Reptiles known to occur in this community include the side-blotched lizard (*Uta stansburiana)* and southern alligator lizard (*Gerrhonotus multicarinatus*).

The Valley Needlegrass Grassland community has been significantly altered and degraded by development activities. The floral components typically associated with it are now almost completely absent due to extensive grading and paving and the invasion of exotic annual grasses. No vernal pools exist in the community today.

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[12] Barbour, M.G. and A.F. Johnson. 1998. "Beach and dune." In Terrestrial Vegetation of California, 2nd Edition. Edited by Barbour, M.G. and J. Major.

[13] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

[14] Mattoni, R. and T.R. Longcore. 1997. "The Los Angeles Coastal Prairie, A Vanished Community," Crossosoma 23(2): 71-102.

[15] Pierce, W.D. and D. Pool. 1938. "The Fauna and Flora of the El Segundo Sand Dunes." *Bulletin of the Southern California Academy of Science* 37:93-97.

2.3.4 Disturbed Dune Scrub/Foredune

This community is made up of 74.6 acres and is located north of the HRA, south of Waterview Street, west of Pershing Drive, and east of Vista Del Mar Boulevard, and it is bisected by Sandpiper Street (Figure 2.3-1). This biotic community is heavily disturbed and is dominated by invasive species that drive out native vegetation. Nonnative species present include acacia, iceplant, exotic annual grasses, and several large patches of giant reed (*Arundo donax*). The few coastal dune elements are patchy and include burbush, dunes evening primrose, bush lupine, pink sand verbena, and deerweed. Coast buckwheat, a plant species necessary to support the El Segundo blue butterfly, is absent from this site. Structural remnants belonging to former residences and an abundance of varied debris can be found among the sandy substrate.

2.3.5 Nonnative Grassland (CNDDB Element Code 42220)/Ruderal

Nonnative Grassland/Ruderal areas are those that have been subjected to past disturbance. They are dominated by exotic annual grasses with nonnative forbs interspersed. The red fox (*Vulpes vulpes*) has invaded this community and uses it for foraging. Birds commonly found foraging and nesting in this biotic community include western meadowlarks (*Sturnella neglecta*), English sparrows, killdeer, mourning doves, American kestrels (*Falco sparverius*) and red-tailed hawks (*Buteo jamaicensis)*. The same butterflies, moths, and reptiles found within the Valley Needlegrass Grassland community are found here.

This biotic community is comprised of 16.9 acres within the coastal zone that was once a residential area (Figure 2.3-1). Currently, the community undergoes regular operations maintenance and is routinely mowed.

2.3.6 Developed

Developed areas within the Dunes occupy 25.7 acres within the HRA and 12.8 acres within the non-restructured dunes adjacent to and to the north of the HRA. Developed areas include the airfield, terminals, parking, roads, support facilities, and the network of streets within the Dunes as well as current navigational aids and associated service roads.

2.4 WETLANDS

A comprehensive wetlands analysis addressing the potential effects of the LAX Master Plan on lakes, rivers, streams, wetlands, and other special aquatic habitats protected by the federal and state governments, is fully described in Section 4.12, *Wetlands,* of the Final EIR.[16] Field efforts undertaken between 1997 and 1998 in support of the wetlands analysis did not identify wetlands within the Dunes. Until 1994, a small artificial freshwater marsh was supported by a leaking water pipe to the south of the entrance to the site; however, it did not meet the U.S. Army Corps of Engineers criteria for wetland soils, hydrology, or vegetation. There are no wetlands within the Dunes; therefore, further discussion of wetlands is not warranted.

[16] City of Los Angeles. April 2004. *Final Environmental Impact Report*. Available at: http://www.laxmasterplan.org.

SECTION 3.0
PROJECT GOALS

This section addresses the goals set forth for the habitat restoration of 5.6 acres of coastal dune habitat within the coastal zone as a result of the construction of navigational aids in support of Alternative D of the Los Angeles International Airport (LAX) Master Plan and the removal of navigational aids no longer required to assist aircraft approaching LAX from the west. The goals are five-fold and include the conservation of state-designated sensitive habitats within and adjacent to the El Segundo Blue Butterfly Habitat Restoration Area (HRA), the conservation of floral resources (Lewis' evening primrose), the conservation of faunal resources, the replacement of state-designated sensitive habitats, and the conservation of the El Segundo blue butterfly. The goals are reflected in five mitigation measures, namely MM-BC-1, M-BC-2, MM-BC-9, MM-BC-13, and MM-ET-4, which have been revised as a result of ongoing coordination between the U.S. Department of Transportation Federal Aviation Administration (FAA) and the California Coastal Commission (CCC).

MM-BC-1: CONSERVATION OF STATE-DESIGNATED SENSITIVE HABITAT WITHIN AND ADJACENT TO THE EL SEGUNDO BLUE BUTTERFLY HABITAT RESTORATION AREA

The goal of MM-BC-1 is to ensure that the state-designated sensitive habitats within the HRA are conserved and protected during construction, operation, and maintenance. A description of construction avoidance measures and preconstruction evaluation is described in Section 6.0, *Maintenance and Monitoring Plan*.

MM-BC-2: CONSERVATION OF FLORAL RESOURCES: LEWIS' EVENING PRIMROSE

MM-BC-2 is designed to compensate for the loss of individuals of the sensitive Lewis' evening primrose within the HRA that will be removed as a result of the construction of navigational aids in support of Alternative D of the LAX Master Plan. The goal of this mitigation measure is to ensure the establishment the same number of plants as the number impacted. A description of directed surveys to be undertaken for the Lewis' evening primrose and subsequent restoration efforts are described in Section 4.0, *Restoration Plan*, where details of the restoration efforts for MM-BC-13 and MM-ET-4 are also described.

MM-BC-9: CONSERVATION OF FAUNAL RESOURCES

The primary purpose of MM-BC-9 is to compensate for the loss of habitat units for sensitive species within the LAX Airfield Operation Area (AOA), which is outside the scope of this plan. A component of this measure, as it relates to the Los Angeles/El Segundo Dunes (Dunes), is to conduct preconstruction surveys to determine the presence of individuals of sensitive arthropod species, the silvery legless lizard, the San Diego horned lizard, and the burrowing owl. The goal of this mitigation measure is to ensure that sensitive faunal resources will not be affected by the construction or removal of navigational aids in the Dunes. A description of preconstruction survey methods and relocation efforts are described in Section 5.0, *Implementation Plan*.

MM-BC-13: REPLACEMENT OF STATE-DESIGNATED SENSITIVE HABITATS

The goal of MM-BC-13 is to mitigate for the loss of state-designated sensitive habitat within the Dunes as a result of the removal of navigational aids within and adjacent to the northern part of the

HRA (Figure 1-2). Removal of navigational aids and associated service roads under Alternative D of the LAX Master Plan would result in impacts to 1.94 acres of state-designated sensitive habitat within the Dunes. Mitigation for these impacts includes revegetation of all impacted areas and the restoration of Southern Foredune habitat within Subsite 23 to achieve a total mitigation ratio of 2:1. The total acreage for restoration within Subsite 23 associated with this mitigation measure and that of MM-ET-4 is 4.4 acres.

MM-ET-4: EL SEGUNDO BLUE BUTTERFLY CONSERVATION: HABITAT RESTORATION

The mitigation objectives of MM-ET-4 include salvaging and transplanting all coast buckwheat to be removed for navigational aid development within Subsite 23 of the HRA and restoring 3 acres of Southern Foredune habitat within Subsite 23 of the HRA. These activities shall be undertaken three years prior to implementation of proposed navigational aids to ensure that there is no net loss of occupied habitat. The overall goal of the mitigation is to provide habitat for the El Segundo blue butterfly that meets the physiological and ecological requirements of the species. The goal is to ensure that all necessary steps to avoid the flight season of the El Segundo blue butterfly (June 14–September 30) are implemented when undertaking installation of navigational aids and associated service roads proposed under Alternative D of the LAX Master Plan within habitat occupied by the El Segundo blue butterfly.

SECTION 4.0
RESTORATION PLAN

Ecological restoration is usually defined as an attempt to recreate fully functioning historic ecosystems. Ecological restoration may be differentiated from revegetation, which typically has the more limited objective of reestablishing plant cover on disturbed ground. Habitat enhancement refers to a focus on a particular species or set of species for which the area in question functions as habitat. For example, the 1988 to 1994 ecological restoration efforts at the Los Angeles/El Segundo Dunes (Dunes) involved planting a suite of plant species historically present within the Dunes and included the planting of coastal buckwheat shrubs to enhance the area as habitat for the endangered El Segundo blue butterfly. Ecosystem or habitat creation is also an option when true ecological restoration is not considered financially or technically feasible or when other objectives are more important. Mitigation measures MM-BC-13 and MM-ET-4 involve the restoration of habitat historically present at the Dunes, while MM-BC-2 involves revegetation with Lewis' evening primrose to mitigate for the losses associated with the construction of navigational aids.

Restoration efforts undertaken between 1988 and 1994 were based on a species composition and density determined by the initial quantitative sampling of vegetation assemblages, including meadow, backdune, and foredune habitats within the Dunes.[17] Four transects were established and vegetation data was gathered and analyzed. The analysis resulted in the development of a restoration model that was implemented. The same restoration model and nomenclature for subsites have to be used for this restoration plan.[18]

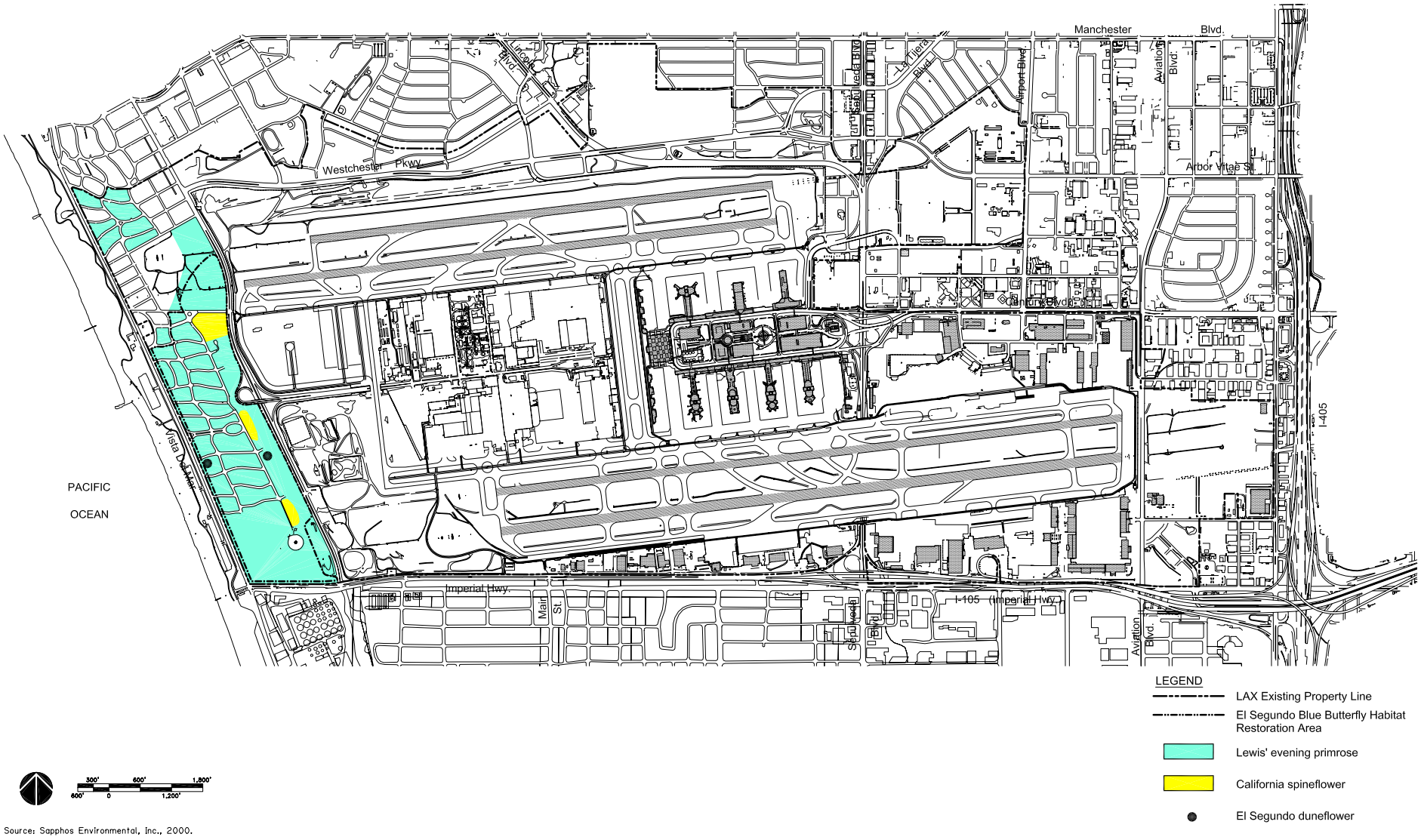
4.1 CONSERVATION OF FLORAL RESOURCES – LEWIS' EVENING PRIMROSE (MM-BC-2)

The areas occupied by Lewis' evening primrose east and west of Pershing Drive are approximately 150 feet apart and most likely represent one inclusive population (Figure 4.1-1, *Location of Sensitive Plant Species*). The area east of Pershing Drive occupied by Lewis' evening primrose is relatively small (300 plants within 2.5 acres) and close to the occupied area within the Dunes (including 9,051 plants within the 200-acre El Segundo Blue Butterfly Habitat Restoration Area (HRA)); therefore, this current configuration does not provide a substantial risk-spreading benefit.

Mitigation for the potential loss of Lewis' evening primrose individuals shall be conducted through the collection of seed east of Pershing Drive and within the HRA followed by the broadcast of seed within Subsite 23. The U.S. Department of Transportation Federal Aviation Administration (FAA), or its designee, shall collect seed from those plants to be removed and properly clean and store the collected seed until used. If possible, seeds shall be collected in multiple years to ensure an adequate seed supply for planting. Collected seed shall be broadcast (distributed) within the 4.3-acre Subsite 23 after the first wetting rain. FAA, or its designee, shall implement a monitoring plan

[17] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

[18] At the beginning of the 1987–1988 research program, the entire 302-acre Dunes property was subdivided into 60 subsites to serve as reference for restoration studies and activities. The subsites were selected on the basis of such factors as soil conditions, plant communities, aerial photographic record, prior butterfly distribution studies, history of environment-modifying activities, and readily available features (e.g., old streets, obvious shifts in soil type, crests, and toes of slope) to enable rapid visual orientation in the field. Individual subsites reveal some biotic and physical variation; they also serve as useful references for description of the Dunes and have proven useful for continuing monitoring and management activities.



Source: Sapphos Environmental, Inc., 2000.

FIGURE 4.1-1
Location of Sensitive Plant Species

to monitor the establishment of individuals of Lewis' evening primrose for a period of not more than five years. Performance criteria shall include the establishment of the same number of plants as the number impacted in the first year following the distribution of seed within the mitigation site. Performance criteria shall also include confirmation of recruitment for two years following the first year that flowering is observed and establishment of individuals throughout the mitigation area within three years following the first year that flowering is observed. Monitoring shall be undertaken in the manner set forth in Section 6.0, *Maintenance and Monitoring Plan,* of this habitat restoration plan. The area will receive monitoring and management for the presence of Lewis' evening primrose individuals equal to or greater than the number of individuals impacted by installation or removal of navigational aids.

4.2 REPLACEMENT OF STATE-DESIGNATED SENSITIVE HABITATS (MM-BC-13)

FAA, or its designee, shall undertake mitigation for the loss of state-designated sensitive habitat within the Dunes, including the HRA. Installation of navigational aids and associated service roads under Alternative D of the Los Angeles International (LAX) Master Plan would result in impacts to 66,675 square feet (1.53 acres) of state-designated sensitive habitat within the Dunes. These 1.53 acres will be replaced at a 2:1 ratio within Subsite 23 of Dunes for a total of 3.06 acres. Additionally, the removal of navigational aids no longer required to assist aircraft approaching from the west has the potential to disturb an estimated 1.4 acres of habitat. These 1.4 acres will be replaced at a 2:1 ratio for a total of 2.92 acres in two locations: 1.4 acres will be undertaken in-situ, and 1.4 acres will be undertaken within Subsite 23. The in-situ restoration of 1.4 acres consists of planting dominant species of both Southern Foredune and Valley Needlegrass Grassland, while restoration of Subsite 23 consists of planting species of Southern Foredune only. The revegetation plan for 1.4 acres of Southern Foredune vegetation type and Valley Needlegrass Grassland within the HRA requires planting specifications and schedules, a weed eradication program, and an irrigation plan, which are provided in Sections 5.0, *Implementation Plan,* of this habitat restoration plan.

4.2.1 In-situ Valley Needlegrass Grassland Restoration

Valley Needlegrass Grassland – Deflation Plain

In-situ restoration efforts will occur within Subsites 47–52 following the removal of existing navigational aids. Subsites 51 and 52 are historically characterized as Valley Needlegrass Grassland and will be revegetated accordingly. This grassland was once part of a larger area referred to as the "Los Angeles Coastal Prairie." The Los Angeles Coastal Prairie is (or was) an instance of Valley Needlegrass Grassland, as classified by Holland.[19] At the Dunes, the grassland plant community was composed of nodding needlegrass (*Nassella* [Stipa] *cernua*) and a number of flowering forbs (herbaceous plants that are not grasslike but are associated with grasses). When Pershing Drive was widened and realigned in 1974, the deflation plain slack area was scraped, and the soil substrate was removed. The area was then hydromulched with a native but inappropriate seed mix that resulted in the transformation of the forb-dominated prairie into one dominated by California buckwheat, iceplant, and Mediterranean grasses. The removal of these species was the focus of previous restoration efforts and continues to be the focus of ongoing maintenance efforts.

[19] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento, CA: California Department of Fish and Game, Non-Game Heritage Program.

Plant Palette

Any areas within Subsites 51 and 52 that have been disturbed due to removal of navigational aids will be revegetated with nodding needlegrass (*Nassella cernua*). Additionally, the following species will be distributed as broadcast seed: Dunes primrose (*Camissonia chieranthifolia*), Lewis' evening primrose (*Camissionia lewisii),* yellow pincushion (*Chaenactis glabriuscula*), slender eriogonum (*Eriogonum gracile*), deerweed (*Lotus scoparius*), California poppy (*Eschscholzia californica*), bedstraw (*Gnaphalium biocolor*), California croton (*Croton californica*), and fescue (*Festuca megalura*).

Propagation

Propagation and planting of nodding needlegrass will be accomplished by the propagation from seed collected on site during late spring/early summer. Seed shall be properly cleaned, dried, and stored until used. In late summer, nodding needlegrass seed will be propagated by a qualified contract grower in 2-inch thimble pots and properly maintained. Seed collection for species to be distributed as broadcast seed will be undertaken during the appropriate time of year, and the collected seed will be properly cleaned and stored until used. If possible, seeds shall be collected in multiple years to ensure an adequate seed supply for broadcast.

Plant Installation

Nodding needlegrass shall be planted at a rate of 1,500 plants per acre (18 inches on center, as previously described in the restoration model for the Dunes).[20] Planting shall take place in the fall or after the first wetting rain. Maintenance of restoration plantings shall consist of adequate irrigation and weed abatement, as described in Section 6.0, *Implementation Plan*.

4.2.2 In-situ Southern Foredune Restoration

Southern Foredune

In-situ restoration efforts will occur within Subsites 23, 47, and 49 following the removal of existing navigational aids. Under MM-ET-4, these subsites will be restored with Southern Foredune vegetation. Of the three communities described on the Dunes, the "pioneer community" is most likely associated with the foredune.[21] The foredune historically supported red sand verbena, pink sand verbena (*Abronia umbellata*), silver beach bur (*Ambrosia chamissonis*), beach morning glory (*Calystegia soldonella*) (no longer present), spectacle pod (*Dithyrea californica* var. *maritime)* (no longer present), and Russian thistle (*Solsola tragus*). Undisturbed areas in the southern-most portion of the Dunes provide the most representative example of this community. As described by Holland, the community is dominated by perennial species with a high proportion of suffrutescent plants (shrubby but not very woody) up to 30 centimeters (~12 inches) tall.[22]

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[20] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

[21] Pierce, W.D. and D. Pool. 1938. "The Fauna and Flora of the El Segundo Sand Dunes." *Bulletin of the Southern California Academy of Science* 37:93-97.

[22] Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. A Non-Game Heritage Program. California Department of Fish and Game. Sacramento.

On undisturbed foredune area, individual plants are usually spaced 2 to 3 feet apart. Mature perennial shrubs, such as coastal buckwheat (*Eriogonum parvifolium*), dunes lupine (*Lupinus chamissonis*), and silver beach bur are usually separated by 2 to 3 feet. The reason for this spacing is not clear but is probably related to water availability and/or underground root growth into a zone where the plants compete for water and/or nutrients.

Plant Palette

All plants within the plant palette (Table 4.2.2-1, *Southern Foredune Plant Palette: In-situ Restoration*) were chosen based on their natural occurrence in southern foredune communities and their establishment success during the 1988–1994 restoration efforts.[23] Table 4.2.2-1 depicts the species to be planted, species density, and species size at the time of planting. The long-term plant density target has been determined based on the average size, growth form, and longevity of individual plants. Initial densities were determined to be adequate to achieve the long-term plant density target. All plants, with the exception of coastal prickly pear, will be planted as container plants.

As a result of coordination efforts undertaken between CCC, FAA, and LAWA, it has been mutually agreed to that in lieu of including coast buckwheat within the plant palette for in-situ restoration of the Southern Foredune plant community, enhancement of the 4.3-acre Subsite 22 within the HRA will be undertaken by planting the appropriate number of coast buckwheat plants sufficient to enhance existing clusters of buckwheat and to establish a new cluster. Subsite 22 has been identified as an appropriate site for the enhancement plantings due to the current low numbers of coast buckwheat individuals (approximately 56 coast buckwheat plants), thus providing opportunities to not only enhance the existing clusters of buckwheat but to establish a new cluster of plants. While Subsite 22 will be monitored concurrently with monitoring efforts at Subsite 23, no success criteria are established for plantings within Subsite 22.

[23] Environmental Science Associates. 1994. "Long Term Management Plan for Los Angeles/El Segundo Dunes." Prepared for: City of Los Angeles Environmental Affairs Department, One World Way West, Los Angeles, CA 90045. Prepared by: Environmental Science Associates, 4221 Wilshire Boulevard, Suite 480 Los Angeles, CA 90010-3512; Sapphos Environmental, Inc., 133 Martin Alley, Pasadena, CA 91105; and Rudolf H.T. Mattoni, Agresearch, Inc., 9620 Heather Road, Beverly Hills, CA 90210.

TABLE 4.2.2-1
SOUTHERN FOREDUNE PLANT PALETTE: IN-SITU RESTORATION

Plant Species	Density (plants per acre)	Size (gallons)
Primary perennial species for foredune revegetation		
Coastal buckwheat* *Eriogonum parvifolium*	TBD	1
Coast goldenbush *Ericameria [Haplopappus] ericoides*	385	1
California encelia *Encelia californica*	146	1
Bladderpod *Isomeris arboreus*	195	1
Narrow-leaved bedstraw *Galium angustifolium*	129	1
Coastal prickly pear *Opuntia littoralis*	125	cuttings
Secondary plant species of the foredune to be introduced as container plants		
Morning glory *Calystegia macrostegia*	158	1
California aster *Corethrogyne filaginifolia*	225	1
Butterweed *Senecio douglasii*	88	1
Saltgrass *Distichlis spicata*	52	1
Lance-leaf dudleya *Dudleya lanceolata*	46	1
California sagebrush *Artemisia californica*	164	1

NOTE:
*Coast buckwheat to be revegetated as a result of the removal of navigational aids outside the HRA shall be planted within the HRA (Subsite 22).

Propagation

The planting palette shall be made up exclusively of native plants that are appropriate to the coastal dune habitat and Southern California coastal region and that are grown from seeds or vegetative materials obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used.

All plants for restoration shall be propagated from seed collected within the Dunes and supplemented by a qualified contract grower, as needed, with local stock. Collection of coast buckwheat seed on the Dunes with no adverse effect on the El Segundo blue butterfly shall take place from September 15 through June 1 of any given year. All plants listed in the plant palette shall have seed collected following the flight season of the El Segundo blue butterfly. The El Segundo blue butterfly flight season is from mid June through early September. Seed shall be cleaned and stored in a cool, dry location until propagation begins in October 2004. Propagation should be conducted at a reputable nursery, allowing four to six months for seedlings to reach a suitable size for out planting.

Plant Installation

Planting of stock shall be in the existing substrate. Prior to plant installation, a qualified habitat restoration specialist shall place colored, pin flags on the enhancement site to mark planting locations of the shrubs. The placement of these flags shall be in concurrence with Appendix A, *Draft Implementation Plan,* and set forth according to Appendix B, *Planting and Irrigation Specifications*. The limits of the restoration site shall also be clearly marked with wooden stakes and delineated using a global positioning system (GPS) unit.

Foredune vegetation stock to be planted shall be healthy, vigorous, well-formed, and free from disease and environmental stress (e.g., windburn). Foredune vegetation stock shall be planted from 1-gallon containers into holes dug to a size twice the width and three times the depth of the container. Plants shall be removed from the container/sleeve, and if necessary, the sides of the root ball shall be scarified to promote root development. Plants shall be placed in the planting holes, as prescribed in Appendix B, so that the crown of the plant is at ground level. Excavated sand shall be used to fill the bottom of each hole to achieve the proper planting level and to backfill the remaining space around the root ball. Immediately after installation, plants shall be deep-soaked with sufficient water to reach the lower roots.

4.3 MITIGATION MEASURE MM-ET-4

MM-ET-4 has two restoration components associated with the conservation of the endangered El Segundo blue butterfly and the species' host plant, coast buckwheat. Subsite 23 of the HRA was selected as the site for implementation of MM-ET-4 due to the low shrub diversity present, as well as low numbers of coastal buckwheat, the foodplant for the El Segundo blue butterfly.

- Coast buckwheat plants are to be salvaged and relocated, along with any larvae on the plant or pupae in the soil below the plant that would be removed to accommodate the replacement navigational aids. These salvaged plants shall be replanted in Subsite 23 combined with previously established MM-BC-13 actions.

- 3.0 acres are to be restored in Subsite 23 to mitigate for the loss of 1.53 acres of state-designated sensitive habitat following the installation of navigational aids within and adjacent to the northern part of the HRA.

4.3.1 Specifications for Coast Buckwheat Salvage and Relocation

Salvage and Transplant

All coast buckwheat to be removed during installation of navigational aids shall be salvaged and transplanted to Subsite 23 within the HRA. Prior to installation of navigational aids, a permitted and qualified biologist shall salvage El Segundo blue butterfly larvae in order to minimize impacts to the butterfly. Salvage and transplantation efforts will take place after the onset of winter rains in January, which coincides with the normal period of dormancy of coast buckwheat. Each plant shall be excavated with its entire root ball such that sand at the base of each plant is disturbed to the least extent possible. Each plant will be transported in a suitable container and planted immediately in Subsite 23.

4.3.2 Southern Foredune Restoration (Subsite 23)

Plant Palette

All plants within the plant palette (Table 4.3.2-1, *Southern Foredune Plant Palette: Subsite 23*) were chosen based on their natural occurrence in Southern Foredune communities and their establishment success during the 1988–1994 restoration efforts.[24] Table 4.3.2-1 depicts the species to be planted, the species density, and the species size at the time of planting. The long-term plant density target has been determined based on the average size, growth form, and longevity of individual plants. Initial densities were determined to be adequate to achieve the long-term plant density target. All plants, with the exception of coastal prickly pear, will be planted as container plants.

[24] Environmental Science Associates. 1994. "Long Term Management Plan for Los Angeles/El Segundo Dunes." Prepared for: City of Los Angeles Environmental Affairs Department, One World Way West, Los Angeles, CA 90045. Prepared by: Environmental Science Associates, 4221 Wilshire Boulevard, Suite 480 Los Angeles, CA 90010-3512; Sapphos Environmental, Inc., 133 Martin Alley, Pasadena, CA 91105; and Rudolf H.T. Mattoni, Agresearch, Inc., 9620 Heather Road, Beverly Hills, CA 90210.

TABLE 4.3.2-1
SOUTHERN FOREDUNE PLANT PALETTE: SUBSITE 23

Plant Species	Density (plants per acre)	Size (gallons)
Primary perennial species for foredune revegetation		
Coastal buckwheat *Eriogonum parvifolium*	200	1
Coast goldenbush *Ericameria [Haplopappus] ericoides*	30	1
California encelia *Encelia californica*	75	1
Bladderpod *Isomeris arboreus*	60	1
Narrow-leaved bedstraw *Galium angustifolium*	75	1
Coastal prickly pear *Opuntia littoralis*	33	cuttings
Secondary plant species of the foredune to be introduced as container plants		
Morning glory *Calystegia macrostegia*	30	1
California aster *Corethrogyne filaginifolia*	150	1
Butterweed *Senecio douglasii*	30	1
Saltgrass *Distichlis spicata*	15	1
Lance-leaf dudleya *Dudleya lanceolata*	150	1
California sagebrush *Artemisia californica*	15	1

Propagation

The planting palette shall be made up exclusively of native plants that are appropriate to the coastal dune habitat and southern California coastal region and that are grown from seeds or vegetative materials obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used.

All plants for restoration shall be propagated from seed collected within the Dunes and supplemented by a qualified contract grower as needed with local stock. Collection of coast buckwheat seed on the Dunes with no adverse effect on the El Segundo blue butterfly shall take place from September 15 through June 1 of any given year. All plants listed in the plant palette shall have seed collected following flight season of the El Segundo blue butterfly. The El Segundo blue butterfly flight season is from mid June through early September. Seed shall be cleaned and stored in a cool, dry location until propagation begins in October 2004. Propagation should be conducted at a reputable nursery, allowing four to six months for seedlings to reach a suitable size for out planting.

Plant Installation

Planting of stock shall be in the existing substrate. Prior to plant installation, a qualified habitat restoration specialist shall place colored, pin flags on the enhancement site to mark planting locations of the shrubs, as described in Appendix A. The placement of these flags shall also be in concurrence with Appendix B. The limits of the restoration site shall also be clearly marked with wooden stakes and delineated using a GPS unit.

Foredune vegetation stock to be planted shall be healthy, vigorous, well-formed, and free from disease and environmental stress (e.g., windburn). Foredune vegetation stock shall be planted from 1-gallon containers into holes dug to a size twice the width and three times the depth of the container. Plants shall be removed from the container/sleeve, and if necessary, the sides of the root ball shall be scarified to promote root development. Plants shall be placed in the planting holes, as prescribed in Appendix B, so that the crown of the plant is at ground level. Excavated sand shall be used to fill the bottom of each hole to achieve the proper planting level and to backfill the remaining space around the root ball. Immediately after installation, plants shall be deep-soaked with sufficient water to reach the lower roots.

4.3.3 Coast Buckwheat Enhancement (Subsite 22)

As a result of coordination efforts undertaken between CCC, FAA, and LAWA, it has been mutually agreed to that in lieu of including coast buckwheat within the plant palette for in-situ restoration of the Southern Foredune plant community, enhancement of the 4.3-acre Subsite 22 within the HRA will be undertaken by planting the appropriate number of coast buckwheat plants sufficient to enhance existing clusters of buckwheat and to establish a new cluster. Subsite 22 has been identified as an appropriate site for the enhancement plantings due to the current low numbers of coast buckwheat individuals (approximately 56 coast buckwheat plants), thus providing opportunities to not only enhance the existing clusters of buckwheat but to establish a new cluster of plants. While Subsite 22 will be monitored concurrently with monitoring efforts at Subsite 23, no success criteria are established for plantings within Subsite 22.

Subsite 22 will be surveyed to identify appropriate areas for the enhancement of existing clusters of coast buckwheat and for the establishment of a new cluster.

SECTION 5.0
IMPLEMENTATION PLAN

This section of this habitat restoration plan describes site preparation, an irrigation plan, planting schedule, and a strategy for weed eradication. The planting plan and irrigation plan is provided in Appendix A. Planting and irrigation specifications are provided in Appendix B. In developing the implementation plan, site preparation techniques most applicable to this restoration/revegetation plan were taken from the Long-Term Habitat Management Plan and provide the basis for the invasive plant removal techniques presented in this section.[25] The planting schedule will reflect the optimal time for plant installation and the recommended irrigation plan.

5.1 SITE PREPARATION: INVASIVE PLANT REMOVAL

During the 1988–1994 restoration efforts, the most cost- and labor-intensive aspects of revegetation were completed. Nonnative plants, primarily iceplant and acacia, were largely removed within the El Segundo Blue Butterfly Habitat Restoration Area (HRA), and the site had been revegetated with plant species that are characteristic of the Los Angeles/El Segundo Dunes (Dunes). It was the intent of the Long-Term Habitat Management Plan to continue a maintenance and monitoring plan in order to support completed efforts. The success of future restoration efforts within the HRA is contingent on the removal of nonnative plants during the site preparation process and during subsequent monitoring periods. During site preparation, should nonnative species be determined to be common (greater that 15-percent cover), a buffer area of 10–15 feet around each restoration polygon will also be weeded.

5.1.1 Iceplant, Acacia, and California Buckwheat

The invasive capacity of the iceplant and acacia species and their capability of rapidly recolonizing the site make continued vigilance in their removal the first priority in vegetation management. Seeds of acacia are present in the soil and will remain viable and continue to germinate and grow for some years. Acacia also expands vegetatively from stumps left in the ground or from roots. Iceplant spreads from an extensive seed banks and expands vegetatively from parts of the plant left in the soil. Although iceplant has been removed manually throughout the 200-acre preserve area and the numbers of both sets of plants have been greatly reduced, small plants continue to regenerate throughout the site; continued removal should be carried out on a routine bases. It is anticipated that regular, intensive eradication efforts will be necessary for a period of at least five years.

California buckwheat (*Eriogonum fasciculatum*) was introduced to the Dunes area through the use of an inappropriate seed mix in hydromulching along Pershing Drive. The subsequent expansion of California buckwheat at the expense of the indigenous coastal buckwheat (*Eriogonum parvifolium*) was one factor contributing to the decline of the El Segundo blue butterfly on site. While an attempt has been made to remove California buckwheat from the Dunes, it still persists as a

[25] Environmental Science Associates. 1994. "Long Term Management Plan for Los Angeles Airport/El Segundo Dunes." Prepared for: City of Los Angeles Environmental Affairs Department, One World Way West, Los Angeles, CA 90045. Prepared by: Environmental Science Associates, 4221 Wilshire Boulevard, Suite 480 Los Angeles, CA 90010-3512; Sapphos Environmental, Inc., 133 Martin Alley, Pasadena, CA 91105; and Rudolf H.T. Mattoni, Agresearch, Inc., 9620 Heather Road, Beverly Hills, CA 90210.

problem, particularly in prairie subsites. As with iceplant and acacia, an annual inspection and program for removal of California buckwheat is required.

Subsite 23 should be inspected to determine where iceplant and acacia need to be removed. Both small and large patches of iceplant should be uprooted and removed from the HRA. Acacia stumps should be treated with herbicide as a follow-up treatment, as necessary (see precautions involving handling of herbicides discussed below). During site preparation and subsequent monitoring, California buckwheat should be identified, cut and daubed with herbicide, and hauled off site along with acacia and iceplant.

5.1.2 Exotic Annual Weeds

Mustard (*Brassica nigra*) and other exotic annual weeds, mostly grasses such as oats (*Avena sp*.), brome (*Bromus sp*.), and barley (*Hordeum sp*.), are present on site. Unlike iceplant or acacia, it is unlikely these species will ever be entirely eradicated from the site, and that should not be a management objective.

In areas within Subsite 23, where exotic annual weeds occur in large numbers and threaten young plants, these annuals should be removed by hand, preferably prior to seed set. Ongoing removal efforts are effective in reducing the recurring seed bank. Some efforts should be made to manage their numbers. In general, as the dune scrub shrubs mature and native vegetation becomes established, problems with mustard and other annual weeds should decline.

5.1.3 Nonnative Trees

Nonnative tree species remaning on site include more than one species of palm, Peruvian pepper trees, and seedlings of *Myoporum*. Nonnative tree species provide habitat for European starlings, a flocking species that constitutes a potential hazard for air strikes. In addition, these nonnative trees are inconsistent with the goal of restoring plant communities that historically occurred at the Dunes.

All nonnative trees (in addition to Acacia) within Subsite 23 should be removed prior to implementation of this habitat restoration plan. Each tree should be surveyed (prior to removal) for nesting birds, which are provided protection pursuant to the federal Migratory Bird Treaty Act. Nesting birds should be removed in the fall (between August and February) when breeding birds are not expected on site. Tree removal is best carried out by trained landscape personnel.

5.1.4 Giant Reed, Castor Bean, and Pampas Grass

While the populations of the nonnative invasive giant reed (*Arundo donax*), castor bean (*Ricinus communis*), and pampas grass (*Cortaderia sellona*) do not appear to be expanding rapidly, giant reed has a tremendous capacity to invade natural vegetation where adequate water is available. Many riparian areas in Southern California have been transformed into giant reed monocultures over the course of a few years. It is likely that giant reed's presence on site is tied to the presence of water through irrigation. However, giant reed is also present on the portion of the Dunes outside of the preserve area where there is no irrigation. Pampas grass seed is dispersed by wind and is most likely to colonize leeward areas where other weedy vegetation may have been removed prior to revegetation and recolonization of native perennials. All three species present a potential problem to vulnerable native communities.

Nonnative invasive perennial pest species such as giant reed, castor bean, and pampas grass should be eradicated using manual and chemical methods. Giant reed is most easily eradicated in early spring when the plants are producing new foliage. The canes should be cut near the ground, the stumps should be painted directly with herbicide, and all cut material should be removed from site with care so as not to leave behind any pieces of stem. Even very tiny pieces are capable of resprouting. Castor bean is also most effectively removed in spring prior to the production of seed pots. Herbicides must be applied under the supervision of an individual with a qualified applicators certificate (QAC). All individuals involved in the application of herbicides must receive safety training and wear the appropriate protective gear. With these requirements, it will be most cost-effective for existing City Landscape Crews. Remnant plant material from giant reed and castor bean is not suitable for use as compost due to the ability of these materials to rapidly recolonize from seed and plant material.

5.2 IMPLEMENTATION

Planting specifications for Valley Needlegrass Grassland and Southern Foredune restoration are detailed in Appendix A and Appendix B.

5.3 SCHEDULE

5.3.1 Valley Needlegrass Grassland

Valley Needlegrass Grassland stock shall be planted at least three years prior to the installation of the navigational aid lighting system. As described above, salvage and transplantation efforts for coastal buckwheat shall take place after the onset of winter rains and prior to April 15, 2005. The planting of stock shall also be undertaken within the same period. Installation of plants during the winter season may potentially reduce the need for supplemental irrigation and facilitate successful establishment.

5.3.2 Coast Buckwheat

All plants for restoration shall be propagated from seed collected within the Dunes and supplemented by a qualified contract grower, as needed, with local stock. Collection of coast buckwheat seed on the Dunes with no adverse effect on the El Segundo blue butterfly shall take place from September 15 through June 1 of any given year. All plants listed in the plant palette shall have seed collected following the flight season of the El Segundo blue butterfly. The El Segundo blue butterfly flight season is from mid June through early September. Seed collection shall begin in September 2004 and may continue each year thereafter, until the appropriate amount of seed is collected to achieve the required planting densities and to meet the performance criteria. Seed shall be cleaned and stored in a cool, dry location until propagation begins in October 2004. Propagation is anticipated to occur from October through December 2004. Propagation should be conducted at a reputable nursery, allowing four to six months for seedlings to reach a suitable size for out planting.

5.3.3 Planting Schedule

Coast buckwheat shall be planted at least three years prior to installation of the navigational aid lighting system. As described above, salvage and transplantation efforts shall take place after the onset of winter rains and prior to April 15, 2005, and planting of coast buckwheat stock shall also be undertaken within the same period.

5.4 IRRIGATION

Given the irregularity of rainfall in Southern California, supplemental irrigation shall be provided for two years to ensure the successful establishment of mitigation plantings. For restoration of the areas affected by installation of navigational aids and removal, water shall be manually applied from a water truck due to the infeasibility of providing a temporary irrigation system to this area (Appendix A and Appendix B).

An existing irrigation system proximal to Subsite 23 shall be used to aid in the establishment of coast buckwheat. A drip irrigation system shall be designed to accommodate the planting of clusters or groups of coast buckwheat plants. Drip irrigation systems (either surface or subsurface systems) allow for the efficient and effective use of water through precise application. Drip irrigation reduces the need to over water, reduces evaporation, and reduces or eliminates runoff. Supplemental irrigation of plant clusters or groupings shall be undertaken during the spring and summer months (April through September), or as determined necessary (for instance, during years of exceptionally low precipitation). Supplemental irrigation shall be administered during the first three years of plant establishment and growth.

5.5 SUCCESS CRITERIA

This section addresses the success criteria of Mitigation Measures MM-BC-2, MM-BC-13, and MM-ET-4, which involve restoration. Mitigation Measures MM-BC-1 and MM-BC-9 address the implementation of best management practices (BMP) and preconstruction surveys for sensitive wildlife and thus lie outside the scope of this section.

5.5.1 Mitigation Measure MM-BC-2

Performance criteria shall include the establishment of the same number of Lewis' evening primrose as the number impacted in the first year following the distribution of seed within the mitigation site. Performance criteria shall also include confirmation of recruitment for two years following the first year that flowering is observed and establishment of individuals throughout the mitigation area within three years following the first year that flowering is observed. Final success criteria, to be determined at the end of the fifth year of monitoring, shall be characterized by the same number of Lewis' evening primrose within the mitigation site as the number impacted by navigational aid development.

5.5.2 Mitigation Measure MM-BC-13

MM-BC-13 involves the restoration of 1.4 acres of Southern Foredune, which is to be combined to the mitigation requirements of MM-ET-4 to achieve 4.4 acres of restoration within Subsite 23. The success criteria for restoration within Subsite 23 are addressed below for MM-ET-4. In addition, those areas impacted by the removal of navigational aids must be restored to Valley Needlegrass Grassland and Southern Foredune communities. The following section addresses the success criteria for each of these habitats.

5.5.3 Valley Needlegrass Grassland

Success criteria to be met include the attainment of at least a 10-percent cover of native grass in the first year, and 20-, 30-, 40-, and 45-percent cover of native grass species over a five-year period, as determined by the point-intercept transect method conducted during the spring, to facilitate the

identification of native annual species. Additional success criteria to be met include the attainment of at least a 20-percent cover of native species[26] during the first year, and 30-, 40-, 50-, and 60-percent cover of native species over a five-year period, and the attainment of a diversity coefficient of 7 at the end of five years, with no more than 15-percent cover in nonnatives and 0-percent cover in nonnative invasive species, as defined by the California Exotic Pest Plant Council. A diversity coefficient of 7 indicates that seven species (from the plant palette of 10 species) and additional native species typical of the habitat shall be present, with at least four native species having greater than 5-percent cover. It is anticipated that volunteer native species typical of the habitat will occupy the restoration polygons. The California Department of Fish and Game (CDFG) has adopted a 10-percent threshold of native grass cover as its criteria for significance of native grasslands.[27] If monitoring discerns any failure in performance goals, remedial plantings shall be undertaken. Habitat restoration shall be conducted by a qualified habitat restoration specialist.

5.5.4 Southern Foredune

Performance criteria to be met include the attainment of 10-, 20-, 30-, 40-, and 45-percent cover of native species, including perennials and annuals typical of the habitat, over a five-year period, as determined by the point-intercept method conducted during the spring, to facilitate the identification of annual species. Additional performance criteria to be met include the attainment of no more than 15-percent cover of nonnative species and 0-percent cover of nonnative invasive species, as defined by the California Exotic Pest Plant Council. In addition, the following model, as prescribed in the Long-Term Management Plan, shall be adhered to with the final value, in conjunction with a 45-percent cover of native species, determining the final success criteria (Table 5.5.4-1, *Southern Foredune Model: Subsite 23*). If monitoring discerns any failure in performance goals, remedial plantings shall be undertaken. Habitat restoration shall be conducted by a qualified habitat restoration specialist. As a result of coordination efforts between CCC, FAA, and LAWA, the coast buckwheat to be planted within Subsite 22 will be monitored and irrigated but will not be subject to success criteria.

[26] Native species will include those derived from the plant palette as well as any other species typical of the community.

[27] Keeley, J.E. 1990. "The California Valley Grassland." *Endangered Plant Communities of Southern California*, Southern California Botanists Special Publication, No. 3, p. 17.

TABLE 5.5.4-1
SOUTHERN FOREDUNE MODEL: SUBSITE 23

Plant Species	Model	Initial	Final
Primary perennial species for foredune revegetation			
Eriogonum parvifolium	130	200	130
Ericameria [Haplopappus] ericoides	20	30	20
Encelia californica	50	75	50
Isomeris arboreus	40	60	40
Galium angustifolium	50	75	50
Opuntia littoralis	22	33	22
Secondary plant species of the foredunes to be introduced as container plants			
Calystegia macrostegia	25	30	25
Corethrogyne filaginifolia	100	150	100
Senecio douglasii	25	30	25
Distichlis spicata	10	15	10
Dudleya lanceolata	25	30	25
Artemisia californica	10	15	10

5.5.5 Mitigation Measure MM-ET-4

Success of the enhancement effort shall be determined through the results of coast buckwheat and vegetation monitoring. Less than ten10 coast buckwheat plants exist in the vicinity of navigational aids scheduled for removal, and have supported the butterfly in two (1998 and 2000) of the seven years of directed surveys.[28] Five coast buckwheat plants were determined to be within 100 feet of the centerline of navigational aids. The two closest plants (2) were approximately 39 feet from the centerline of a single light standard and localizer antenna. Given that the numbers of salvaged coast buckwheat will be relatively low, the coast buckwheat to be planted pursuant to MM-BC-13 will be combined with the salvaged coast buckwheat to achieve the success criteria described below, within Subsite 23. The following success criteria are based on coast buckwheat survival and shall be met by the end of each monitoring year. If a success criterion is not met during a monitoring year, then another year of monitoring shall be added. Remedial action shall be taken to bring the enhancement site into compliance with the success criteria. The success criteria do not have to be met consecutively for five years.

Year 1

- Survival of 160 coast buckwheat per acre
- Exotic species cover not exceeding 15 percent

Year 2

- Survival of 160 coast buckwheat per acre
- Exotic species cover not exceeding 15 percent

[28] Sapphos Environmental, Inc. 2003. Updated Biological Assessment Technical Report for the Federally Endangered El Segundo Blue Butterfly (*Euphilotes battoides allyni*) at Los Angeles International Airport, Los Angeles, California. Prepared for: Los Angeles World Airports, One World Way West, Los Angeles, CA 90009. Prepared by: Sapphos Environmental, Inc., 133 Martin Alley, Pasadena, CA 91105.

Year 3

- Survival of 160 coast buckwheat per acre
- 20-percent increase in cover of coast buckwheat
- 50-percent flowering of coast buckwheat
- Exotic species cover not exceeding 15 percent

Year 4

- Survival of 130 coast buckwheat per acre
- 20-percent increase in cover of coast buckwheat
- 70-percent flowering of coast buckwheat
- Exotic species cover not exceeding 15 percent

Year 5

- Survival of 130 coast buckwheat per acre
- 130 coast buckwheat individuals shall be greater than 2 years of age
- The average coast buckwheat plant shall cover 9 square feet. This determination will be made by measuring 40 per 160 coast buckwheat individuals.
- 90-percent flowering of coast buckwheat
- Exotic species cover not exceeding 15 percent

5.5.6 Southern Foredune

Performance criteria to be met include the attainment of 10-, 20-, 30-, 40-, and 45-percent cover of native species over a five-year period, as determined by the point-intercept method. In addition, the following model, as prescribed in the Long-Term Management Plan, shall be adhered to with the final value, in conjunction with a 45-percent cover of native species determining the final success criteria. Table 5.5.6-1, *Southern Foredune Model: In-Situ Restoration*, describes the model for final success criteria for in-situ restoration of individual species within those areas to be impacted by the removal of navigational aids, and to subsequently receive restoration of southern foredune vegetation.

TABLE 5.5.6-1
SOUTHERN FOREDUNE MODEL: IN-SITU RESTORATION

Plant Species	Model	Initial	Final
Primary perennial species for foredune revegetation			
Ericameria [Haplopappus] ericoides	20	385	20
Encelia californica	50	146	50
Isomeris arboreus	40	195	40
Galium angustifolium	50	129	50
Opuntia littoralis	22	125	22
Secondary plant species of the foredunes to be introduced as container plants			
Calystegia macrostegia	25	158	25
Corethrogyne filaginifolia	100	225	100
Senecio douglasii	25	88	25
Distichlis spicata	10	62	10
Dudleya lanceolata	25	46	25
Artemisia californica	10	164	10

5.6 METHODS OF JUDGING SUCCESS CRITERIA

In order to best judge the success of this habitat restoration plan, success criteria reflect the research conducted by Dr. Rudolph Mattoni, in association with Environmental Science Associates and Sapphos Environmental, Inc.[29,30] The success criteria mirror those of the Long-Term Habitat Management Plan and restoration efforts conducted in the HRA from 1988 to 1994. Model densities in Tables 5.5.4-1 and 5.5.6-1 refer to data derived from surveys conducted in the relatively undisturbed fragments of foredune and backdune communities at the Dunes. Initial densities refer to original planting densities, and final densities are the desired target at completion of restoration.

Those values for coast buckwheat were further derived from values established by the U.S. Fish and Wildlife Service in their non-jeopardy Biological Opinion, issued April 20, 2004, regarding the impacts of Alternative D described in the Supplement to the Draft Environmental Impact Report (EIR) for the LAX Master Plan on the federally endangered Riverside fairy shrimp and El Segundo blue butterfly.[31] Densities for coast buckwheat, as the host plant of the El Segundo blue butterfly, are intended to ensure the conservation of an ecosystem upon which the endangered El Segundo blue butterfly depend and ensure the successful conservation of the species. Those success criteria for MM-ET-4, with respect to coast buckwheat densities by year, reflect the requirements of the

[29] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

[30] Environmental Science Associates. 1994. "Long Term Management Plan for Los Angeles/El Segundo Dunes." Prepared for: City of Los Angeles Environmental Affairs Department, One World Way West, Los Angeles, CA 90045. Prepared by: Environmental Science Associates, 4221 Wilshire Boulevard, Suite 480 Los Angeles, CA 90010-3512; Sapphos Environmental, Inc., 133 Martin Alley, Pasadena, CA 91105; and Rudolf H.T. Mattoni, Agresearch, Inc., 9620 Heather Road, Beverly Hills, CA 90210.

[31] U.S. Fish and Wildlife Service. 2004. *Biological Opinion for Los Angeles International Airport Master Plan, City of Los Angeles, Los Angeles County, California*. Contact: U.S. Fish and Wildlife Service, Ecological Services, Carlsbad Fish and Wildlife Office, 6010 Hidden Valley Road, Carlsbad, CA 92009.

April 20, 2004, Biological Opinion, and reiterated in the El Segundo Blue Butterfly Habitat Enhancement and Monitoring Plan.[32]

Final densities derived from a comparing a census of the restoration site to a fixed standard are hoped to match the model densities, as established in relatively undisturbed sites of the same vegetation type. Maximum allowable differences between the restoration value and the reference value for each success criterion are in all cases null, with the exception of lance-leaf dudleya. Given the strict accordance with the reference sites, initial planting will require augmenting with broadcast seed, which should suffice to establish final densities.

5.7 PROVISIONS FOR FURTHER ACTION

Given the success of the 1988–1994 restoration efforts, it is unlikely the success criteria associated with restoration or habitat enhancement will not be met. It should be noted however that the continued effort to remove exotic, invasive species is of primary importance in maintaining the restoration work to be conducted. Failure to continue the removal of nonnative flora is likely to jeopardize the recolonization of native plant species. Such concern will remain until at least 75 percent of the plant cover consists of native species. However, it is important to note that at some point, as native revegetation plantings mature, recolonize, and become more competitive, removal of exotics will become less critical. In fact, in areas where native vegetation has become well-established, continued weed removal efforts are likely to cause more damage than good. Should monitoring efforts after five years reveal that success criteria are not being met, then the FAA, in cooperation with the CCC and CFWO, will determine the set of additional and/or alternative measures necessary for the restoration project to achieve success. It is in the best interest of the future of the HRA to resume restoration efforts within its own boundaries. However, if the HRA proves incompatible with the goals of this habitat restoration plan, an alternative mitigation site will require choosing, along with the creation of a restoration and monitoring plan similar to this habitat restoration plan.

[32] Sapphos Environmental, Inc. 2004. "El Segundo blue butterfly Habitat Enhancement and Monitoring Plan." Prepared for: Federal Aviation Administration, 15000 Aviation Boulevard, Hawthorne, CA 90261, and Los Angeles World Airports, One World Way, Los Angeles, CA 90045. Prepared by: Sapphos Environmental, Inc., 133 Martin Alley, Pasadena, CA 91105.

SECTION 6.0
MONITORING AND MAINTENANCE PLAN

Responsible Agency: U.S. Department of Transportation, Federal Aviation Administration (FAA)

Reviewing Agencies: California Coastal Commission (CCC)

Monitoring and maintenance of the enhancement site is essential to the long-term success of this mitigation effort. The Monitoring and Maintenance Plan details preconstruction monitoring efforts as well as the long-term management approach. This plan is intended to ensure the successful achievement of the goals and objectives of Mitigation Measures MM-BC-1, MM-BC-2, MM-BC-9, MM-BC-13, and MM-ET-4, as described in Section 3.0, *Project Goals*. Final monitoring for success will occur after at least three years during which no remediation or maintenance activities have occurred, other than weeding.

6.1 PRECONSTRUCTION SURVEY FOR THE CONSERVATION OF FAUNAL RESOURCES

6.1.1 Mitigation Measure MM-BC-9

The primary purpose of MM-BC-9 is to compensate for the loss of habitat units for sensitive species within the Los Angeles International Airport Airfield Operations Area (AOA), which is outside the scope of this plan. A component of this measure, as it relates to the construction of navigational aids in the Los Angeles/El Segundo Dunes (Dunes), is the requirement for preconstruction surveys to determine the presence of individuals of sensitive arthropod species, the silvery legless lizard, the San Diego horned lizard, and the burrowing owl. Species accounts for each of the species to be surveyed for are located in Appendix C, *Background of the Los Angeles/El Segundo Dunes*. Should any sensitive wildlife be observed, they are to be relocated to suitable habitat within the HRA. Relocation efforts should be undertaken by a qualified wildlife biologist.

6.1.2 Sensitive Arthropod Surveys

Within and adjacent to those areas to be impacted by the installation or removal of navigational aids, the vegetation is sparse and largely nonnative. Based on surveys conducted from 1996–1998, it was determined that these areas are unsuitable for the sensitive arthropods. As a preventative measure, all ground-dwelling arthropods will, in all likelihood be trapped (and relocated) according to the methods described below for trapping of the silvery legless lizard and the San Diego horned lizard. In addition, immediately prior to construction activities, all herbaceous and non-herbaceous plants will be shaken to remove to flush out insects prior to grubbing.

6.1.3 Sensitive Reptile Surveys

Pitfall traps will be established three days prior to construction in all areas to be impacted by the installation or removal of navigational aids in order to isolate and relocate the silvery legless lizard, the San Diego horned lizard, and any sensitive arthropods that may be present. Each trap will be comprised of a 5-gallon bucket that is embedded in the ground with the mouth of the bucket leveled with the soil surface. The opening will be covered by a slightly raised lid or stone to keep

out predators and prevent trapped animals from being overheated during the day or drowned during rains.

Each trap shall be censused three times during daytime intervals: early morning, midday, and late afternoon. Active opportunistic searches shall be conducted for the silvery legless lizard and the San Diego horned lizard reptiles over a wider area. These searches shall generally be comprised of walking slowly within and adjacent to all areas impacted by the installation or removal of navigational aids habitats, looking for active reptiles and investigating under logs, rocks or other ground debris for sheltering animals. All trapped animals and arthropods shall receive relocation to a suitable habitat within the HRA by a qualified wildlife biologist.

6.1.4 Burrowing Owl Surveys

Burrowing owl observations have been highly infrequent and isolated instances. There are no known burrows within the Dunes that would support burrowing owls. Prior to the installation or removal of navigational aids in the northern portion of the HRA and areas adjacent to the HRA, a qualified biologist will conduct surveys for burrowing owls. If individuals are identified, they will be flushed from the construction site.

6.2 PRECONSTRUCTION MONITORING

Mitigation Measure MM-BC-1 details the extent and methods to be used for preconstruction monitoring of the navigational aids.

6.2.1 MM-BC-1: Conservation of State-Designated Sensitive Habitat Within and Adjacent to the El Segundo Blue Butterfly Habitat Restoration Area

Prior to the initiation of construction of LAX Master Plan components to be located within or adjacent to the HRA, a preconstruction evaluation shall be conducted to identify and flag specific areas of state-designated sensitive habitats located within 100 feet of construction areas. Subsequent to the preconstruction evaluation, a preconstruction meeting shall be conducted with all construction personnel, including the landscape contractor, grading contractor, and all others conducting operations within the HRA to explain the sensitivity of the areas outside the limits of grading, the need to avoid them, and the potential consequences of failure to comply with the protocols for working on the site. A written set of preconstruction briefing notes shall be prepared and discussed with the construction contractor. The briefing notes shall describe the mitigation requirements established by the permitting agencies.

Construction avoidance measures include erecting a 10-foot-high, tarped, chain-link fence where the construction or staging area is adjacent to state-designated sensitive habitats to reduce the transport of fugitive dust particles related to construction activities. Soil stabilization, watering, or other dust control measures, as feasible and appropriate shall be implemented to reduce fugitive dust emissions during construction activities within 2,000 feet of the HRA, with a goal to reduce fugitive dust emissions by 90 to 95 percent. In addition, to the extent feasible, no grading or stockpiling for construction activities should take place within 100 feet of a state-designated sensitive habitat. Provisions shall be incorporated for the identification of additional construction avoidance measures to be implemented adjacent to state-designated sensitive areas. All construction avoidance measures that address best management practices (BMP) shall be clearly stated within construction bid documents. In addition, FAA shall include a provision in all construction bid documents requiring the presence of a qualified environmental monitor, which

shall be responsible for those activities detailed below. Construction drawings shall indicate vegetated area within the HRA as "Off-Limits Zone."

In addition, MM-BC-1 states that maintenance and management efforts prescribed in El Segundo Dunes Long-Term Habitat Management Plan shall continue to be carried out as prescribed. Since the success of this mitigation effort is largely contingent on the continued removal of nonnative plants, those maintenance and monitoring efforts that were detailed in Section 5.1, *Site Preparation: Invasive Plant Removal,* should follow the same interval as described in Section 6.5, *Coast Buckwheat*.

6.3 CONSTRUCTION MONITORING

Monitoring of construction activities to ensure adherence to the avoidance measures outlined in Mitigation Measure MM-BC-1 is an important part of the mitigation of impacts to sensitive biological resources. A qualified biologist shall be on site during the entire construction phase. Monitoring results will be documented in monitoring notes and summarized in a monitoring report submitted to the CCC and CFWO.

The biological monitor shall ensure that the following guidelines for avoidance are adhered to during construction:

- Staging of equipment and materials will be accomplished outside of occupied habitat areas of the HRA.
- Equipment or vehicles driven and/or operated within the HRA will use existing roadways and paved and/or gravel areas.
- Equipment or vehicles driven and/or operated within native habitat will not leak oils or fuels that, if introduced to the sandy or soil, could be deleterious to living organisms.
- The cleanup of spills of oil or fuel will take place as soon as they are discovered.
- No rubbish will be deposited, and the construction contractor will be in compliance with all litter pollution laws.
- Disturbance or removal of vegetation will not exceed the surveyed and flagged limits of grading.

6.4 LEWIS' EVENING PRIMROSE

A component of Mitigation Measure MM-BC-2 is to implement a monitoring plan to census individuals of Lewis' evening primrose for a period of no more than five years. Monitoring shall be undertaken on a quarterly basis for the first three years following planting, and twice a year thereafter for a total of five years. Monitoring shall include the establishment of an equal number of plants as that impacted in the installation and removal of navigational aids in the HRA in the first year following the distribution of seed in the mitigation site. Monitoring shall also include confirmation of recruitment for two years following the first year that flowering is observed and establishment of individuals throughout the mitigation area within three years following the first year that flowering is observed. Final success criteria, to be determined at the end of the fifth year of monitoring, shall be characterized by the same number of Lewis' evening primrose within the mitigation site as the number impacted by navigational aid development.

6.5 COAST BUCKWHEAT

In order to meet the criteria of Mitigation Measure MM-ET-4, a census of coast buckwheat shall occur to ensure the successful restoration of El Segundo blue butterfly habitat. Since the successful restoration of El Segundo blue butterfly habitat is strictly contingent on the success of coast buckwheat (*Eriogonum parvifolium)* establishment, monitoring is directed at ensuring successful enhancement of Southern Foredune habitat in support of the El Segundo blue butterfly through the attainment of success criteria goals. Monitoring shall be performed by a qualified botanist with appropriate experience in native habitat restoration. The monitoring interval extends over a five-year period following planting of coast buckwheat within Subsite 23 of the Habitat Restoration Area:

- Quarterly monitoring required during the first three years
- Biannual monitoring in the fourth and fifth years

Quarterly and biannual monitoring of coast buckwheat shall include both qualitative and quantitative observations of survival, growth, and flowering. Census counts of coast buckwheat shall include numbers in addition to the number of plants and measurements for the areas of each plant, for the purposes of calculating absolute cover. Observations of El Segundo blue butterfly's use of coast buckwheat shall also be conducted during the flight season of the butterfly. Standard data log sheets shall be established and used throughout the monitoring period. The data sheets shall include a section to record ambient site conditions at the time of monitoring (i.e., date, time, weather, and special condition) and standard data to be collected for each parameter to be monitored. Data collection for some parameters will vary seasonally.

Other vegetation shall be surveyed only once annually using the line-intercept method along permanent vegetation transects. This method shall evaluate vegetative percent cover (total cover as well as cover of individual species), including the cover of coast buckwheat. Vegetation surveys shall be conducted when the dominant vegetation has matured and both early and late season species can be correctly identified. Standard data log sheets shall also be developed for vegetation surveys and used throughout the monitoring period.

A photographic record of the enhancement site shall be kept through the end of the monitoring program. Selection of photographic stations shall provide appropriate views and orientations for a comprehensive assessment of the progress of enhancement efforts. Photographs shall be taken from the same vantage point and in the same direction, and shall reflect material to be discussed in the monitoring reports. All photographs shall be annotated and recorded on standard field data sheets. When percent cover estimates are made of herbaceous vegetation, photographs shall be taken of sampling transects. Photographs for disturbances or special conditions shall be taken as needed.

6.6 MONITORING REPLACEMENT OF STATE-DESIGNATED SENSITIVE HABITATS

As a component of Mitigation Measure MM-BC-13, monitoring for restored Southern Foredune and Valley Needlegrass Grassland will be required for MM-ET-4. Monitoring will occur on a quarterly basis for the first three years following planting, and twice a year thereafter in order to achieve the success criteria detailed in Section 5.6. Monitoring for success will take the form of a census for those species listed in the plant palette. In addition, other vegetation will be surveyed once annually using the line-intercept method to determine percent cover of native species. Sampling shall be conducted with sufficient replication to detect a difference of 10-percent absolute ground cover with a single sample t-test with a statistical power of 90 percent at an alpha of 0.10. The

necessary sample size shall be estimated with a statistical power analysis in the monitoring plan using variance estimates from surveys of reference sites within the Dunes.

6.7 MAINTENANCE PLAN

FAA shall be responsible for all annual operations and maintenance costs required to achieve the success criteria associated with habitat enhancement and monitoring of the enhancement site.

Annual operations and maintenance activities shall include supplemental planting to attain the standards described in the success criteria, and/or to replace those individuals lost as a result of some severe disturbance to the site, installation and maintenance of the irrigation system, trash removal, and weed eradication as described in Section 5.1 of this habitat restoration plan.

SECTION 7.0
REPORTING

7.1 PRECONSTRUCTION MONITORING REPORT

The U.S. Department of Transportation Federal Aviation Administration (FAA) shall submit a preconstruction monitoring report to the executive director of the California Coastal Commission (CCC) upon completion of preconstruction activities for the installation of the navigational aid system within the El Segundo Blue Butterfly Habitat Restoration Area (HRA). These activities include surveys for Lewis' evening primrose (MM-BC-2), sensitive arthropod species, silvery legless lizard, San Diego horned lizard, and the burrowing owl (MM-BC-9). In addition, monitoring efforts pursuant to MM-BC-1 shall be carried out to provide the CCC with an accurate assessment of site conditions prior to construction. This report will include standard data log sheets, including a section to record ambient site conditions at the time of monitoring (i.e., date, time, weather, and special condition). A photographic record of the enhancement sites and Subsite 23 shall be established in the preconstruction monitoring report. Selection of photographic stations shall provide appropriate views and orientations for a comprehensive assessment of the progress of enhancement efforts. Photographs shall be taken from the same vantage point and in the same direction, and shall reflect material to be discussed in the monitoring reports. All photographs shall be annotated and recorded on standard field data sheets. Photographs for disturbances or special conditions shall be taken as needed.

FAA shall also submit a monitoring report to the U.S. Fish and Wildlife Service, Carlsbad Field Office (CFWO), upon completion of nocturnal observations of El Segundo blue butterfly behavior during the first flight period after installation of the navigational aid system.

7.2 POSTCONSTRUCTION REPORT

Within 30 days of planting of foredune vegetation stock, FAA shall be responsible for documenting and reporting the physical and biological "as built" condition of the restoration site. The Initial Conditions Report shall include photographic documentation of site conditions following the initial restoration efforts in addition to a report documenting restoration strategies undertaken and any deviations undertaken not present in this report. The Initial Conditions Report shall include actual planting densities and document whether implementation of the planting design was undertaken according to specifications.

7.3 ANNUAL REPORTING

FAA shall submit annual monitoring reports to the executive director of the CCC by December 1 of each specified monitoring year. If monitoring continues past the five years due to the failure of a success criterion, then a monitoring report shall be filed for that year as well. The report shall discuss the results of monitoring for Mitigation Measures MM-BC-2, MM-BC-13, and MM-ET-4, as they relate to habitat restoration or enhancement. Only the first year annual monitoring report shall address MM-BC-1 and MM-BC-9, since they pertain only to preconstruction efforts. All field notes (standard data collection sheets) and photographs from designated photographic monitoring stations shall be included in the annual report.

SECTION 8.0
REFERENCES

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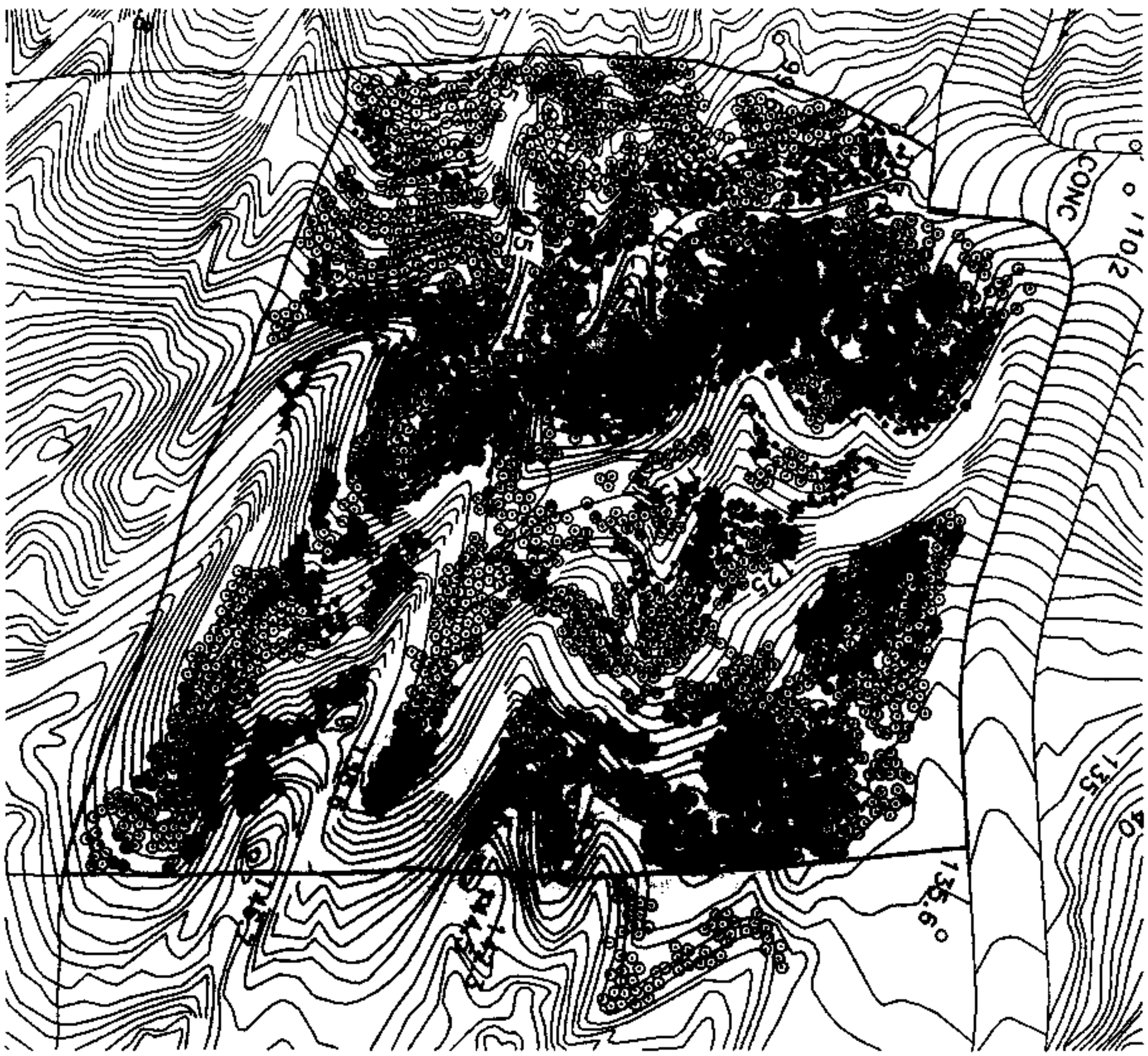
APPENDIX A

DRAFT IMPLEMENTATION PLAN

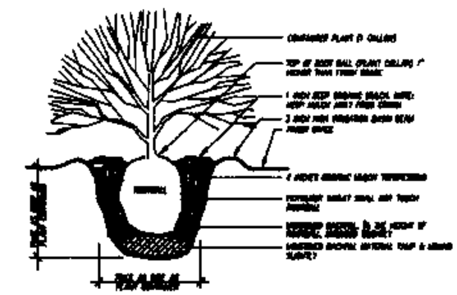


SubSite 23

SUBSITE 23-REVEGETATION PLANT LIST

SYMBOL	BOTANICAL NAME	COMMON NAME	DENSITY	QTY. SUBSITE 23	SIZE
	PRIMARY FOREDUNE PERENNIAL PLANT SPECIES				
⊙	ERIOGONUM PARVIFOLIUM	CALIFORNIA BUCKWHEAT	300	[illegible]	1 GALLON
⊙	ERICAMERIA ERICOIDES	COAST GOLDENBUSH	30	131	1 GALLON
⊙	ENCELIA CALIFORNICA	CALIFORNIA ENCELIA	75	326	1 GALLON
⊛	ISOMERIS ARBOREA	BLADDERPOD	60	260	1 GALLON
⊙	GALIUM ANGUSTIFOLIUM	NARROW-LEAVED BEDSTRAW	75	326	1 GALLON
•	OPUNTIA LITTORALIS	COASTAL PRICKLY PEAR	33	143	CUTTINGS

SYMBOL	BOTANICAL NAME	COMMON NAME	DENSITY	QTY. SUBSITE 23	SIZE
	SECONDARY FOREDUNE PLANT SPECIES				
⊙	CALYSTEGIA MACROSTEGIA	MORNING GLORY	30	130	1 GALLON
⊙	CORETHROGYNE FILAGINIFOLIA	CALIFORNIA ASTER	150	651	1 GALLON
⊙	SENECIO DOUGLASII	BUTTERWEED	30	130	1 GALLON
•	DISTICHLIS SPICATA	SALTGRASS	15	65	1 GALLON
•	DUDLEYA LANCEOLATA	LANCE-LEAF DUDLEYA	150	651	1 GALLON
●	ARTEMISIA CALIFORNICA	CALIFORNIA SAGEBRUSH	15	65	1 GALLON



CONTAINER PLANTING DETAIL

IMPLEMENTATION NOTES

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. [illegible]

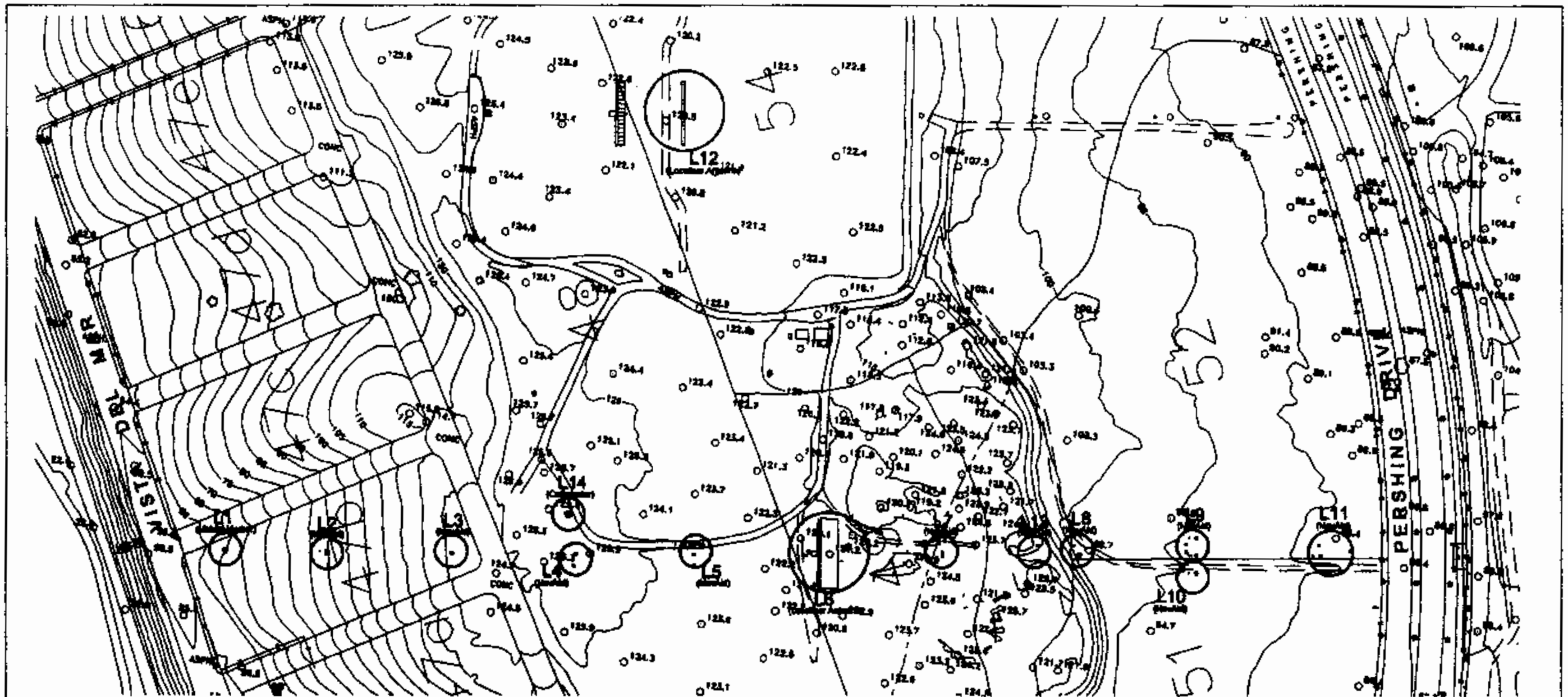
David Volz Design

DUNE RESTORATION
EL SEGUNDO BLUE BUTTERFLY PRESERVE
SUBSITE 23 LOCATION

"PLANTING"

IMPLEMENTAL PLAN
APPENDIX 1

P.1

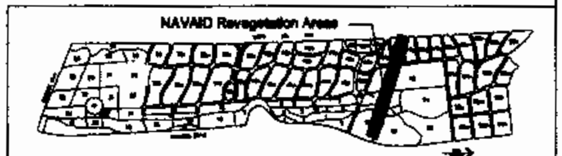


NAVAID REMOVAL AREA REVEGATATION PLANT LIST

BOTANICAL NAME	COMMON NAME	DENSITY	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	SIZE	REMARKS
PRIMARY FOREDUNE PERENNIAL PLANT SPECIES																		
ERICAMERIA ERICOIDES	COAST GOLDENBUSH	300	5	--	2	15	--	100	--	--	--	--	--	200	--	6	1 GALLON	[illegible]
ENCELIA CALIFORNICA	CALIFORNIA ENCELIA	140	2	--	2	10	10	90	2	--	--	--	--	50	--	--	1 GALLON	[illegible]
ISOMERIS ARBOREUS	BLADDERPOD	160	1	5	2	10	1	100	--	--	--	--	--	50	--	4	1 GALLON	[illegible]
GALIUM ANGUSTIFOLIUM	NARROW-LEAVED BEDSTRAW	120	--	--	3	5	--	75	2	--	--	--	--	25	--	--	1 GALLON	[illegible]
OPUNTIA LITTORALIS	COASTAL PRICKLY PEAR	125	--	3	--	3	--	25	--	--	--	--	--	75	--	--	CUTTINGS	[illegible]
SECONDARY FOREDUNE PLANT SPECIES																		
CALYSTEGIA MACROSTEGIA	MORNING GLORY	150	5	--	2	5	--	75	--	--	--	--	--	60	--	--	1 GALLON	[illegible]
CORETHROGYNE FILAGINIFOLIA	CALIFORNIA ASTER	225	--	--	2	5	2	25	10	--	--	--	--	90	--	5	1 GALLON	[illegible]
SENECIO DOUGLASII	BUTTERWEED	80	5	5	3	10	3	30	--	--	--	--	--	--	--	--	1 GALLON	[illegible]
DISTICHLIS SPICATA	SALTGRASS	60	--	--	--	--	--	50	4	--	--	--	--	--	--	--	1 GALLON	[illegible]
DUDLEYA LANCEOLATA	LANCE-LEAF DUDLEYA	48	--	8	--	10	--	25	--	--	--	--	--	--	--	--	1 GALLON	[illegible]
ARTEMISIA CALIFORNICA	CALIFORNIA SAGEBRUSH	184	--	--	--	15	2	25	--	--	--	--	--	150	--	5	1 GALLON	[illegible]
STIPA CERNUA	NODDING FEATHER GRASS		--	--	--	--	--	--	--	250	1300	250	1300	--	250	--	1 GALLON	TRIANGULAR SPACED @ 18" O.C.
TOTAL PLANTS PER AREA:			16	18	16	90	16	600	16	250	1300	250	1300	600	250	16		

IMPLEMENTATION NOTES

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]



Key Map

PREPARED BY:
DVD
David Volz Design

PROJECT: DUNE RESTORATION
EL SEGUNDO BLUE BUTTERFLY PRESERVE
NAVAIDS REVEGETATION AREAS

PREPARED FOR:
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"PLANTING"
IMPLEMENTAL PLAN
APPENDIX 1

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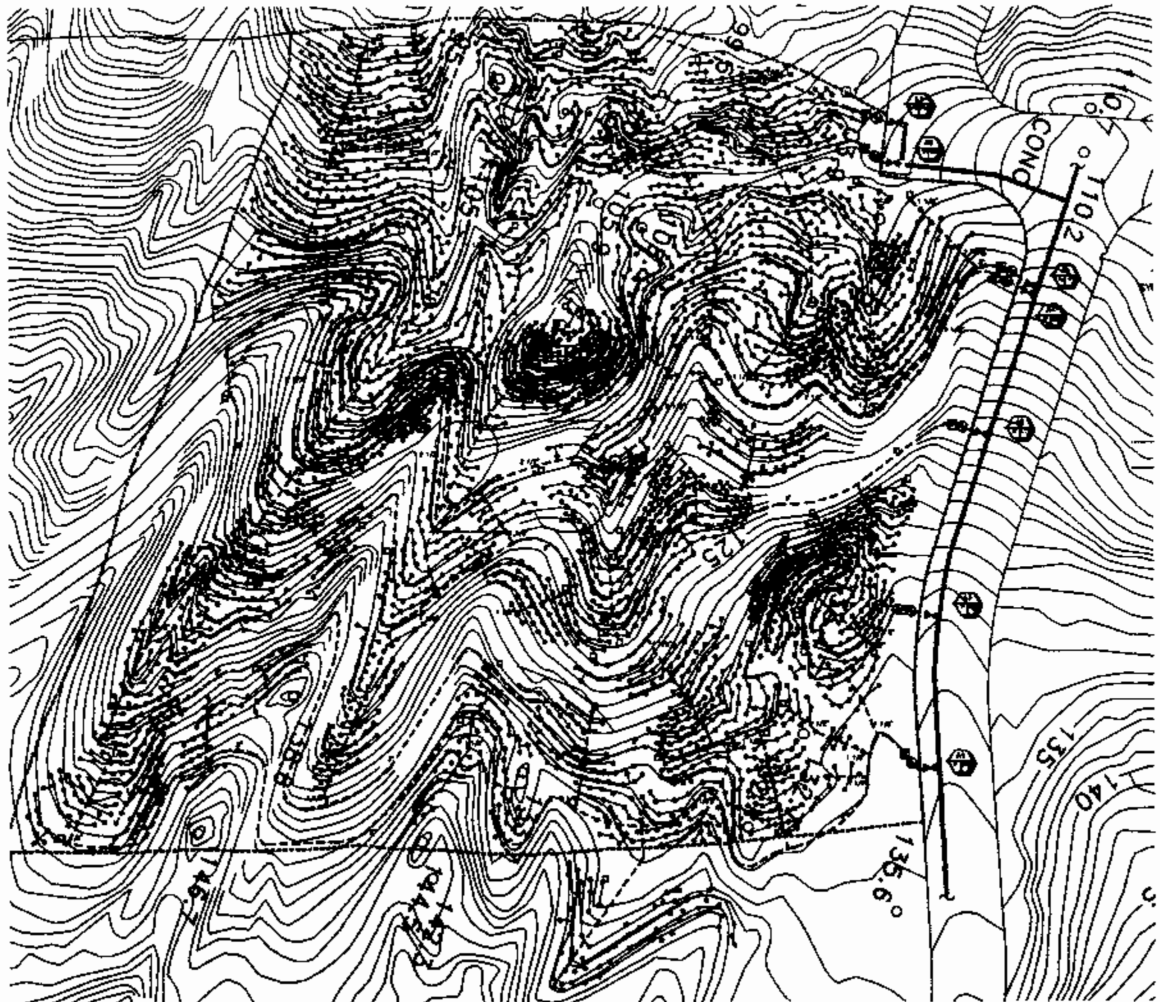
SHEET 2 of 5



IRRIGATION LEGEND

SYMBOL	MANUFACTURER	MODEL NO. / DESCRIPTION
●	RAIN BIRD	PC 05 10-32 WITH PC DIFFUSER CAP; LIGHT BROWN 5 GPH FOR SHRUBS. PLACE IN DISTRIBUTION LINE. ONE PER PLANT, AT BASE OF PLANT
⊛	RAIN BIRD	RAINBIRD PEB-PRS W/EASY RAIN SINGLE-VALVE BATTERY OPERATED CONTROLLER. SIZE PER PLAN
□	NIBCO	MANUAL FLUSH BALL VALVE IN VALVE BOX AT LOWEST END OF EACH SYSTEM
▣	FEBCO	2" ATMOSPHERIC VACUUM BREAKER, DOWNSTEAM OF CONTROL VALVE, 1 1/2" AT VALVE A7
⧓		2" BRASS LINE BALL VALVE - NIBCO
———		EXISTING 2" WATER MAIN LINE (P.O.C.)
———		NEW 2" WATER MAIN LINE, MATCH EXISTING
- - - -		2" SCH 40 PVC LATERAL LINE ON GRADE, BROWNLINE UV RESISTANT USE GALVANIZED TIE-DOWN STAKE AT 10' O.C.
———		XERI-TUBE 700 DISTRIBUTION TUBING ON GRADE W/ 700 SERIES FITTINGS. USE GALVANIZED TIE-DOWN STAKE AT 10' O.C.

VALVE'
GPM'S
VALVE SIZE

IRRIGATION NOTES:

1. THE CONTRACTOR SHALL CONNECT NEW VALVES INTO EXISTING 2" MAINLINE.

2. THE CONTRACTOR SHALL VERIFY THE STATIC PRESSURE, WATER METER SIZE AND LOCATION PRIOR TO THE INSTALLTION OF THE SYSTEM.

3. DISTRIBUTION LINE SHALL BE PLACED ON GRADE AND STABILIZED WITH RAINBIRD GALANIZED TIE-DOWN STAKES AT 10' O.C.

IRRIGATION NOTES

A. ALL DRIP EMITTER HEADS IN SHRUB OR GROUNDCOVER AREAS SHALL BE INSTALLED SO THAT THE DISTRIBUTION LINE IS ON GRADE.

B. ALL PRESSURE LINES SHALL BE TESTED FOR TWO HOURS UNDER HYDROSTATIC PRESSURE OF 100 PSI AND BE PROVEN WATER TIGHT. CONTRACTOR SHALL PROVIDE ALL EQUIPMENT FOR TEST.

C. ALL DISTRIBUTION LINE SHALL BE SET PERPENDICULAR TO FINISH GRADE OF THE AREA TO BE IRRIGATED UNLESS OTHERWISE NOTED ON THE PLANS.

D. THE SPRINKLER SYSTEM IS BASED ON THE MINIMUM OPERATING PRESSURE AND THE MAXIMUM FLOW DEMAND SHOWN ON THE IRRIGATION DRAWINGS AT EACH POINT OF CONNECTION. THE IRRIGATION CONTRACTOR SHALL VERIFY WATER PRESSURE PRIOR TO CONSTRUCTION. REPORT TO THE DISTRICT'S AUTHORIZED REPRESENTATIVE ANY DIFFERENCE BETWEEN THE WATER PRESSURE SHOWN ON THE DRAWINGS AND THE ACTUAL PRESSURE READING AT THE IRRIGATION POINT OF CONNECTION. IN THE EVENT PRESSURE DIFFERENCES ARE NOT REPORTED PRIOR TO START OF CONSTRUCTION, THE IRRIGATION CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ANY REVISIONS NECESSARY.

E. THIS DESIGN IS DIAGRAMMATIC. ALL PIPING, VALVES, ETC SHOWN WITHIN PAVED AREAS ARE FOR DESIGN CLARIFICATION ONLY. INSTALL PIPING AND VALVES IN PLANTING AREAS WHERE POSSIBLE.

F. THE IRRIGATION CONTRACTOR SHALL FLUSH AND ADJUST ALL DISTRIBUTION LINE FOR OPTIMUM PERFORMANCE THIS SHALL INCLUDE SELECTING THE AND THROTTLING THE FLOW CONTROL AT EACH VALVE TO OBTAIN OPTIMUM OPERATING PRESSURE FOR EACH SYSTEM

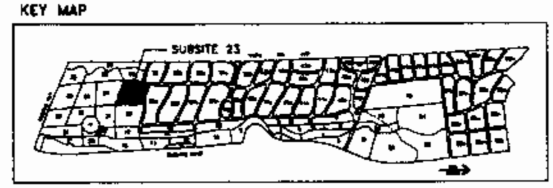
G. DO NOT WILLFULLY INSTALL THE SPRINKLER SYSTEM AS SHOWN ON THE DRAWINGS WHEN IT IS OBVIOUS IN THE FIELD THAT OBSTRUCTIONS, GRADE DIFFERENCES, OR DIFFERENCES IN SITE DIMENSIONS EXIST THAT MIGHT NOT HAVE BEEN FORESEEN AND CONSIDERED IN THE ENGINEERING. THE OWNER'S AUTHORIZED REPRESENTATIVE SHOULD BE INFORMED OF SUCH OBSTRUCTIONS AND DIFFERENCES, BUT IN THE EVENT THAT THIS NOTIFICATION IS NOT PERFORMED, THE IRRIGATION CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ANY REVISIONS NECESSARY

H. INSTALL ALL PIPE MATERIALS AND EQUIPMENT AS SHOWN IN CONSTRUCTION DETAILS. USE TEFLON TAPE OR TEFLON PIPE DOPE ON ALL PVC MALE PIPE THREADS OF ALL SPRINKLER SWING JOINT AND VALVE ASSEMBLIES.

I. IT IS THE RESPONSIBILITY OF THE IRRIGATION CONTRACTOR TO FAMILIARIZE HIMSELF WITH ALL GRADE DIFFERENCES, LOCATION OF WALLS, STRUCTURES EXISTING TREES AND UTILITIES. THE IRRIGATION CONTRACTOR SHALL EXERCISE EXTREME CARE, AND BE RESPONSIBLE FOR ANY DAMAGE IN EXCAVATING AND WORKING NEAR UTILITIES. HE SHALL COORDINATE HIS WORK WITH THE GENERAL CONTRACTOR AND OTHER SUB-CONTRACTORS FOR THE LOCATION OF UTILITIES AND THE INSTALLATION OF PIPE SLEEVES THROUGH WALLS, UNDER ROADWAYS, AND NEAR STRUCTURES.

J. DRAINAGE OF WATER THROUGH SPRINKLER HEAD WILL NOT BE ALLOWED. SOME SPRINKLERS WILL REQUIRE THE INSTALLATION OF AN ANTI-DRAIN VALVE WITHIN THE DISTRIBUTION LINE TO PREVENT DRAINAGE. DURING THE COURSE OF CONSTRUCTION, THE CONTRACTOR SHALL INSTALL AN ANTI-DRAIN AS REQUIRED AT ANY SPRINKLER SHOWING SIGNS OF DRAINING AFTER THE IRRIGATION SYSTEM HAS OPERATED FROM AN ON TO OFF POSITION. INSTALLATION OF ANTI-DRAIN VALVES SHALL BE INCLUDED IN THE BID PRICE WITHOUT ADDITIONAL COST TO THE DISTRICT

KEY MAP



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IRRIGATION PLAN

IMPLEMENTAL PLAN
APPENDIX 1

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SHEET 3 of 6

IRRIGATION PRESSURE CALCULATION–LARGEST VALVE

UNITS	SIZE	TYPE	DESCRIPTION	GPM	UNIT PSI LOSS
1	2"	PRESS.	ATMOSPHERIC VACUUM BREAKER	53.40	1.00
1	2"	BRASS	AUTOMATIC VALVE	53.40	3.10
1	2"	BRASS	GATE VALVE	53.40	2.00
870	2 1/2"	SCH 40	MAINLINE	53.40	[illegible]
35	1 1/2"	SCH 40	LATERAL LINE	10.17	.11
25	3/4"	PE	DISTRIBUTION LINE	.50	1.31
					13.52
MISC		FITTINGS	ALLOWANCE		1.35
STATION: A8			COMPONENT LOSSES:		14.87
STATIC PRESSURE:	54.87 MIN REQ. AT POC		MIN. REQ'D @ HEAD:		30.00
MAX. GPM DEMAND:	53.40		ELEV. LOSS/[illegible]		-4.33
			TOTAL PRESSURE REQ'D:		40.87
			RESIDUAL PRESSURE:		10.00

IRRIGATION PRESSURE CALCULATION–HIGHEST ELEVATION

UNITS	SIZE	TYPE	DESCRIPTION	GPM	UNIT PSI LOSS
1	2"	PRESS.	ATMOSPHERIC VACUUM BREAKER	40.00	1.00
1	2"	BRASS	AUTOMATIC VALVE	40.00	3.10
1	2"	BRASS	GATE VALVE	40.00	2.00
[illegible]	2"	SCH 40	MAINLINE	40.00	12.14
50	1 1/2"	SCH 40	LATERAL LINE	6.35	1.06
10	3/4"	PE	DISTRIBUTION LINE	.40	0.47
					[illegible]
MISC		FITTINGS	ALLOWANCE		2.00
STATION: A1			COMPONENT LOSSES:		[illegible]
STATIC PRESSURE:	[illegible] MIN REQ. AT POC		MIN. REQ'D @ HEAD:		30.00
MAX. GPM DEMAND:	40.00		ELEV. LOSS/[illegible]		-4.33
			TOTAL PRESSURE REQ'D:		[illegible]
			RESIDUAL PRESSURE:		10.00

IRRIGATION PRESSURE CALCULATION–LOWEST ELEVATION

UNITS	SIZE	TYPE	DESCRIPTION	GPM	UNIT PSI LOSS
1	1 1/2"	PRESS.	ATMOSPHERIC VACUUM BREAKER	30.40	1.00
1	1"	BRASS	AUTOMATIC VALVE	30.40	3.10
1	1 1/2"	BRASS	GATE VALVE	30.40	2.00
330	1 1/2"	SCH 40	MAINLINE	30.40	[illegible]
[illegible]	1 1/2"	SCH 40	LATERAL LINE	5.35	[illegible]
11	3/4"	PE	DISTRIBUTION LINE	.77	0.57
					[illegible]
MISC		FITTINGS	ALLOWANCE		1.35
STATION: A7			COMPONENT LOSSES:		13.70
STATIC PRESSURE:	[illegible] MIN REQ. AT POC		MIN. REQ'D @ HEAD:		30.00
MAX. GPM DEMAND:	30.40		ELEV. LOSS/[illegible]		-4.33
			TOTAL PRESSURE REQ'D:		[illegible]
			RESIDUAL PRESSURE:		10.00

PROJECT LANDSCAPE AREA: = 215,870 SQUARE FEET

MAXIMUM WATER BUDGET:
= (ETO) (.80) (AREA) (.62)
= (33.0) (.80) (215,870) (.62)
= 3,530,088.5 (GALLONS/YEAR)

ESTIMATED WATER USE TURF:
= (ETO) (KC) (AREA) (.62) / (IE)
= (33.0) (.80) (0) (.62) / (.70)
= 0 (GALLONS/YEAR)

ESTIMATED WATER USE SHRUBS:
= (ETO) (KC) (AREA) (.62) / (IE)
= (33.0) (.25) (215,870) (.62) / (.70)
= 1,575,931.4 (GALLONS/YEAR)

TOTAL ESTIMATED WATER USE: = 1,575,931.4 (GALLONS/YEAR)
25% RAINFALL: (10) (.25) (.8) (215,870) = - 431,340 (GALLONS/YEAR)
TOTAL = 1,144,591.4 (GALLONS/YEAR)

TOTAL LANDSCAPE AREA
SQ. FT. OF TURF = 0
SQ. FT. OF SHRUB = 215,870
TOTAL AREA = 215,870

GENERAL IRRIGATION NOTES

STATIC PRESSURE
MINIMUM STATIC PRESSURE SHALL BE 58 PSI AT THE POINT OF CONNECTION. SEE PRESSURE CALC'S FOR MINIMUM STATIC AT EACH VALVE. MINIMUM WATER METER SIZE 2". CONTRACTOR SHALL VERIFY PRESSURE READING PRIOR TO STARTING WORK AND REPORT TO LANDSCAPE ARCHITECT IF PRESSURE IS BELOW 48 PSI. IF PRESSURE EXCEEDS 80 PSI CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF A LINE SIZE WILKINS 500 SERIES PRESSURE REDUCING VALVE.

IRRIGATION SYSTEM LAYOUT
DUE TO THE SCALE OF THESE DRAWINGS THE CONTRACTOR SHOULD BE AWARE OF THE POSSIBILITY THAT THE NEED FOR MINOR ADJUSTMENTS TO THE IRRIGATION SYSTEM MAY BE NECESSARY TO PROVIDE PROPER COVERAGE. THESE ADJUSTMENTS COULD INCLUDE NOZZLE CHANGES AND/OR ADDITION OR DELETION OF INDIVIDUAL HEADS TO COMPENSATE FOR CHANGES MADE ON THE SITE. THE CONTRACTOR SHALL LOCATE ALL VALVES, LATERAL LINE AND MAINLINE IN PLANTING AREAS.

SLEEVING (IF AND WHERE NEEDED)
SLEEVES SHALL BE PLACED UNDER ALL DRIVEWAYS AND WALKS WHERE IRRIGATION LATERAL, MAINLINE, AND WIRE WILL CROSS. SLEEVES SHALL BE PVC SCH. 40, MINIMUM BURY 24" DEEP. MINIMUM DISTANCE PAST EDGE OF DRIVEWAY OR CONCRETE WALK SHALL BE 24". WATER AND WIRE SHALL NOT BE PLACED IN THE SAME SLEEVE.

"WATER CONSERVATION CONCEPT STATEMENT"
THE SYSTEM IS DESIGNED TO ACHIEVE CONSERVATION AND EFFICIENCY IN WATER USE BY PROVIDING ANTI-DRAIN VALVES FOR LOW HEAD DRAINAGE, RAIN CHECK INTERRUPT SWITCH TO PREVENT THE SYSTEM FROM ACTIVATING WHEN RAINING, PRESSURE COMPENSATING SCREENS TO PREVENT OVERSPRAY AND REDUCE WATER USAGE IN SMALLER PLANTING AREAS, AND LOW GALLONAGE HEADS TO REDUCE WATER CONSUMPTION.

David Volz Design

PROJECT: DUNE RESTORATION
EL SEGUNDO BLUE BUTTERFLY PRESERVE

IRRIGATION CALCULATIONS

IMPLEMENTAL PLAN
APPENDIX 1

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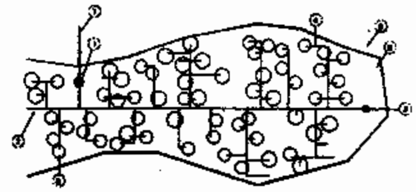
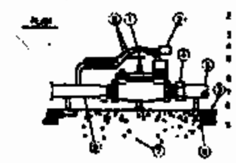


SECTION
SCALE NTS

A TYPICAL PIPE/HEAD LAYOUT



NOTE:
PLACE PVC ON GRADE

SECTION
SCALE NTS

B REMOTE CONTROL VALVE (PLACE UNIT ON GRADE)

NOTE:
PLACE BALL VALVE ON GRADE

SECTION
SCALE NTS

C BALL VALVE (PLACE UNIT ON GRADE)

David Volz Design

DUNE RESTORATION
EL SEGUNDO BLUE BUTTERFLY PRESERVE

IRRIGATION DETAILS

IMPLEMENTAL PLAN
APPENDIX 1

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SHEET 6 of 6

APPENDIX B

PLANTING AND IRRIGATION SPECIFICATIONS

APPENDIX B

PLANTING IMPLEMENTATION

PART 1: GENERAL

1.01 DESCRIPTION

A. The general requirements apply to all Landscaping work operations. Provide labor, materials, tools, transportation and all incidentals necessary to perform work as indicated on the Plans and as herein specified.

B. Related Sections.

1. Section 100: Site Clearing

2. Section 900: Irrigation

C. The Standard Specifications for Public Works Construction, "Greenbook", latest edition, is referenced as if herein contained and the Contractor shall keep a copy at the project site. These Specifications shall supersede conflicts with information given in the "Greenbook", unless otherwise determined by the Owner.

1.02 EXPERIENCE AND PLANTING REQUIREMENTS

A successful restoration project requires a good understanding of native plant communities and the relationship between individual plant types within that community. The Contractor responsible for the installation of plants shall have a minimum of 5 years experience in revegetation or habitat restoration projects and must provide the Owner with a list of three separate projects completed within the past 5 years that demonstrates his/her experience. THE PROJECTS SITES MUST BE SUBMITTED FOR OWNER REVIEW PRIOR TO THE AWARD OF PROJECT.

The oversight of the planting installation must be conducted by the person with the planting restoration experience and must be on site during all planting. The following Contractors have been pre approved and meet the minimum requirements as stated above. Those not listed below must be approved by the Owner.

1. Sonora Botanical
   Contact: Steve Mudge
   Phone: (949) 489-9130

2. Nakae & Associates
   Contact: Kevin Kirschner
   Phone: (949) 786-0405

3. Pacific Restoration Group
   Contact: John Richards
   Phone: (909) 734-9809

1.03 PLANTING LAYOUT

The Contractor shall layout each plant for the review and approval of the Owner's Representative prior to installation. The final placement of the new plant materials shall be done in a manner to conflict with existing dune plantings. Adjustment in the field will be necessary to avoid theses conflicts. The specified plants shall be placed to achieve a natural looking mosaic throughout each of the planting areas. The layout of the plant material shall reflect a natural "established" stand of that particular plant community. The Contractor's personnel with Dune planting installation experience must be on-site at all times to oversee the placement and installation of all plants.

1.04 QUALITY ASSURANCE

A. Comply with all applicable local, state, federal requirements regarding materials, methods of work, and disposal of excess and waste materials.

B. Manufacturer's directions, specifications and detailed drawings will be followed in all cases where articles used furnish directions covering points not delineated on the Plans or Specifications.

C. The work included in this section will be done to the satisfaction of the Owner and the decision by the Owner as to the true construction meaning of the Plans and Specifications will be final.

D. All drop slips for landscape materials (including plants, fertilizers, pesticides, seed mixes) shall be given to the Owner.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install landscape materials when ambient temperatures may drop below 45 degrees F (12 degrees C) or above 95 degrees F (39 degrees C).

C. Do not install landscape materials when wind veloOwner exceeds 30 mph (48 k/hr).

PART 2: PRODUCTS

2.01 REFERENCES

A. ANSI Z60.1 - Nursery Stock.

B. California State Department of Agriculture - Regulations for nursery inspections, rules, and grading.

2.02 PLANT MATERIAL

A. Trees, shrubs, grasses, sedges and bulbs shall be grown by an established nursery having been in the business of growing trees, shrubs, ground cover a minimum of five (5) years.

At the option of the Owner, plants shall be inspected and tagged at the nursery prior to shipment to the planting site.

1. Shrubs: Shrubs shall be of the specified type and size, selected from high quality, well-shaped nursery stock.

2. All plant stock shall be pre-inoculated with endomycorrhizal inoculum *Glomus intraradices.*

B. Plant names indicated or listed in the "Plant Legend" on the Plans, conform to the approved names given in "An Annotated Checklist of Woody Ornamental Plants in California, Oregon, and Washington, Manual 4091", published by the University of California (1979). Except for names not covered therein, the established custom of the nursery is followed.

C. Condition of plants shall be in accordance with the California State Department of Agriculture's regulations for nursery inspections, rules, and grading and shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant disease, insect pests, or their eggs, and shall have healthy normal root systems, well filling their containers, but not to the point of being root bound.

D. Plants shall not be pruned prior to delivery, except as authorized by the Owner. In no case shall trees be topped before delivery.

E. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock, or as specified on the Plans. The minimum acceptable size of all plants, measured before pruning with the branches in normal position, shall conform with measurements, if any, specified on the Plans. Plants larger in size than specified may be used with the approval of the Owner, but the use of larger plants will make no change in contract price.

F. Bare root planting shall be done only with special approval of the Owner.

G. All plant material shall be subject to the inspection and acceptance of the Owner before planting. A representative number of plants as determined by the Owner may be inspected for size and condition of root growth, insects, injuries and defects. Plants not accepted are to be removed from the site immediately and replaced with suitable plants. The Owner reserves the right to reject entire lots of plants represented by defective samples.

2.05 FERTILIZERS, SOIL CONDITIONING MATERIALS AND WATER

A. General.

1. Fertilizing and soil conditioning materials shall comply with the applicable requirements of the State Food and Agricultural Code. All materials shall be packaged first grade, commercial quality products identified as to source, type of material, weight, and manufacturer's guaranteed analysis. Fertilizing and soil

conditioning material shall not contain toxic ingredients or fillers in quantities harmful to human life, animals, or plants.

2. The Contractor shall furnish a Certificate of Compliance stating that the material substantially meets the specifications.

B. Commercial Fertilizer.

Commercial fertilizer shall contain mycorrhizal inoculum , propagules of the vesicular arbuscular mycorrhizal species Glomus intraradices, Glomus aggregatum, Glomus mosseae, combined with other species and/or additional genera including Sclerocyctis, Gigaspora, Scutellospora, Entrophospora and acaulospora. Commercial fertilizer shall be free-flowing material delivered in unopened sacks. Material which becomes caked or otherwise damaged shall not be used

C. Organic Amendment.

1. Humus material shall have an ash content of no less than 8% and no more than 20%.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimho/cm @ 25 degree celeus (ECe less than 10) on a saturated paste extract.
4. Boron content of saturated extract shall be less than 1.0 parts per million.
5. Silicon content (acid-insoluble ash) shall be less than 20%.
6. Calcium carbonate shall not be present if to be applied on alkaine soil.
7. Types of acceptable products are composts. Manure, mushroom composts, straw, alfalfa, peat mosses etc. low in salts. Low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
8. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on redwood of cedar.
9. Sludge-based materials are not acceptable.
10. The compost shall be aerobic without malodorous presence of decomposition products.
11. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen.

D. Water.

Water shall be clean, fresh and free of substances or matter which could inhibit vigorous growth of plants

2.06 NON-SELECTIVE HERBICIDE

Non-selective herbicide for weed abatement shall be Round-Up or approved equal.

2.07 ORGANIC MULCH

A. Mulch shall be "Forest Floor" (0-4")

Available from or equal to:
Aguinaga
7992 Irvine Boulevard
Irvine, CA 92618
(949) 786-9558

"OR"

Approved Equal

B. The mulch shall consist of fibrous, woody bark mixture of varied particle size with the following characteristics:

Percent Passing	Sieve Size
90-100	25.4 mm (1")
80-100	12.7 mm (1/2")
20-60	6.35 mm (1/4")

C. Mulch shall be packaged in bales or bags unless the Owner approves a bulk source in advance of delivery to the site of the work. The Contractor shall submit one sample of three (3) different mulch materials. The Owner, has the right to reject all samples and request additional samples until a suitable mulch material is approved.

B. The Owner has the right to reject all samples and request additional samples until a suitable mulch material is approved.

2.08 PRE-EMERGENCE WEED CONTROL

Pre-emergence herbicide shall be Ron-star 5G to be applied at a rate specified by the manufacturer for ground cover applications.

2.09 SAMPLES

A. Samples of products and materials shall be required by the Owner. Submittals for inspection shall be stored on the site until furnishing of material is complete.

B. Delivery of products and materials may begin upon acceptance of samples or as directed by the Owner.

2.10 PLANT TABLETS

A. Plant tablets shall be Gro-Life by Gro-Power. All natural Mycorrhizal Inoculum

Tablet Size	**7 Grams**					
Container	Pot Liner	1 Gallon	5 Gallon	15 Gallon	24" Box and	36" Box and

Size					Larger	Larger
Application Rates (No. of Tablets)	1	3	n/a	n/a	n/a	n/a

PART 3: EXECUTION

3.01 BACKFILL MIX

Blend the following materials into clean leached soil. Remove debris, rocks and foreign material. Soil clods should not exceed 1 ½ inches in diameter. Excessive gravel should not be present. The following material shall be applied at Rates per Cubic Yard:

Ammonium sulfate	(21-0-0)	1/3 pound
Potassium sulfate	(0-50-0)	1/3 pound
Triple superphosphate	(0-45-0)	¼ pound
Gypsum		2 pounds
Organic amendment		15% by volume

3.02 PLANTING GENERAL

A. All sprinkler/irrigation work shall be inspected and accepted by the Owner, prior to start of any work of this subsection.

B. Location of utility, structures and lines.

1. Prior to excavation for planting or placing of stakes, locate all utilities, electric cables, conduits, irrigation lines, heads, valves and valve control wires, and all utility lines so that proper precautions may be taken not to damage such improvements.

2. In the event of a conflict between utilities and plant locations, promptly notify the Owner, which shall arrange for one or the other to be relocated. Failure to follow this procedure shall place upon the Contractor the responsibility to make, at his own expense, any and all repairs for damages resulting from work.

C. All plants will be inspected by the Owner prior to planting, including plants previously approved at the nursery. The Contractor shall be responsible for the condition of all plants, planted or otherwise, until acceptance.

D. Quantities.

1. Plant materials shall be furnished in the quantities and/or spacing as shown or noted for each location, and shall be of the species, kinds, sizes, etc., as symbolized, and/or described in the Plant Legend, as indicated on the Plans.

2. The Contractor is to verify all sizes and quantities on the Plans. Promptly report any discrepancy to the Owner.

E. Substitution.

1. Any plant material or any development materials specified by trade name or equal, shall be according to these Plans and Specifications.

2. Installation and use of substitute items shall not be made until the Contractor is in receipt of written approval from the Owner. Substitution proposals for plant material must be accompanied by written proof of non-availability within a five hundred mile radius of the project site for material originally specified and proof that material was ordered in a timely matter upon award of contract.

F. Protection and Storage.

1. The Contractor shall regularly water all nursery stock in containers and place them in a cool area protected from sun and drying winds.

2. The Contractor shall not allow plants to dry out before or while being planted. Keep exposed roots moist by means of wet sawdust, peat moss or burlap at all times during planting operations. Do not expose roots to the air except while being placed in the ground. Wilted or diseased plants, whether in place or not, will not be accepted and shall be replaced at the Contractor's expense.

G. The Contractor shall moisten prepared surface immediately prior to installing plant material.

H. The Contractor shall install plant material immediately after delivery to site, within 24 hours after harvesting to prevent deterioration.

I. The Contractor shall water landscaped areas immediately after installation.

J. The Contractor shall verify material quantities from the plan layout.

K. The Contractor shall notify the Owner within 15 days of bid aware in the event of unavailability of plant material.

L. No planting shall be started until irrigation system have been completed and approved by the Owner.

M. The Contractor shall ensure that all excavated plant pits have positive drainage. Plant pits when fully flooded with water shall drain within 8 hours of filling

N. Finish grade of all planting areas to a smooth and even condition with no water pockets of irregularities. Construct a smooth transition from existing to new grade.

3.03 SHRUB PLANTING

A. Planting Holes. Planting holes shall be approximately square for container grown plants, and circular for balled and burlapped plants. The holes shall be twice the width of the plant container or ball, unless otherwise shown on the Plans. The holes shall be one-and-half times the depth of the root ball, or as shown on the Plans. The hole shall be larger, if necessary, to permit handling and planting without injury or breakage of the root ball or root system. Any plant having a broken or cracked root ball before or during planting shall not be planted.

B. Underground Obstructions. In the event that underground construction work or obstructions are encountered in the planting operation, alternate locations for plant material will be selected by the Owner. Operation will be done at no extra cost to the Owner.

C. Planting Procedures.

1. Remove all plants from their containers and set so that, when settled, they bear the same relation to the required grade as they bore to the natural grade before being transplanted. Plant each plant in the center of the pit and backfill with native soil. Hand compact the backfill around the ball or roots. Do not use soil in muddy condition for backfilling. The root ball of the plant shall be 1’ to 2" above the backfill. Do not fill around trunks or stems. Cut off all broken or frayed roots.

   For balled and burlapped plants, all burlap, ropes or wire shall be removed from the top of the root balls.

2. Thoroughly water each plant when the hole is one-half filled.

3. After watering, backfill the remainder of the hole and hand tamp the soil in place until the surface of the backfill is level with the surrounding area and the crown of the plant is at the finished grade of the surrounding area.

4. After backfilling, a basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least six inches (6”) of water. Basins shall be the same size as the container size of each individual plant. The the basins shall be constructed of amended backfill material.

5. Set the plant tablets to be used with each plant on the top of the root ball so the required number of tablets to be used in each hole can be easily verified. Bury tablets upon approval by the Owner.

6. Immediately after planting, apply water to each tree and shrub by means of a hose. Apply water in a moderate stream in the planting hole until the material

about the roots is completely saturated from the bottom of the hole to the top of the ground.

7. Apply water in sufficient quantities and as often as seasonal conditions require to keep the planted areas moist at all times, well below the root system of grass and plants.

8. Basins around shrubs and trees shall be removed at that time directed by the Owner.

D. Pruning. Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to compensate for loss of roots during transplanting, but never to exceed one-third of the branching structure. Upon approval of the Owner, pruning may be done before delivery of plants, but not before plants have been inspected and approved.

3.04 GROUND COVER & GRASS PLANTINGS

A. Soil preparation and fine grading shall be completed prior to ground cover planting.

B. Ground cover shall be planted in moist, but not soggy, soil and spaced as indicated on the Plans.

C. Each plant shall be planted with its proportionate amount of flat soil to minimize root disturbance. Soil moisture shall be such that the soil does not crumble when removing plants.

D. Following planting, ground cover areas shall be regraded to restore smooth finish grade and to ensure proper surface drainage. Hand watering by hose shall begin immediately following planting and mulch shall be spread over the planted areas within eight (8) hours of watering.

E. To prevent plant damage from pedestrian traffic during the initial growing stage, the Contractor shall erect temporary protective fencing to be removed at the end of the maintenance period.

F. The Contractor shall hand water with a watering hose all plants individually and immediately following planting. Apply enough water to saturate soil.

3.05 MULCHING

Apply mulch to a depth of (1 ½ to 2 inches)

3.06 TWO YEAR MAINTENANCE AND PLANT ESTABLISHMENT

A. The “first” year of the maintenance period will begin after the “Date of Acceptance of Installation” for all planting areas. The Contractor shall request in writing from the Owner notification of the date of the start of the maintenance period. At the acceptance of

all planting areas, the Contractor shall request in writing from the Owner notification of the date of the completion of the maintenance period. The maintenance period shall not officially begin or end without written notification from the Owner. The "second year of maintenance shall begin after the completion of the "first" year of maintenance and after written notification form the Owner to begin the "second" year of maintenance.

The "second" year of maintenance shall begin after the completion if the "first" year of maintenance and after written notification from the Owner to begin the "second" year of maintenance.

B. Construction fencing shall remain until after the maintenance period is complete or as directed by the Owner.

C. The Contractor shall maintain all planted areas on a continuous basis as they are completed during the progress of the work and during the establishment and maintenance period, and shall continue to maintain them until final acceptance in accordance with the following.

1. Watering or intense hand watering shall include measures to insure seed germination and vigorous plant growth. Weed, fertilize, spray and apply topdressing as necessary to promote a healthy growing condition. All planted areas shall be kept free of debris and shall be weeded and cultivated at intervals not to exceed ten (10) days. Keep project neat and attractive throughout the maintenance period.

2. Apply herbicides for weed control and/or fungicides for fungal control, as needed or directed by Owner, in accordance with manufacturer's instructions and applicable laws and regulations. Pre-emergent herbicide shall be required in all planting areas. Remedy damage resulting from the use of herbicides.

3. Exterminate rodents and insects as required and in accordance with applicable laws and regulations. Remedy damage from use of insecticides.

4. Plants shall be watered to sufficiently saturate root zone without rotting trees, shrubs, and ground cover.

5. Repair or replace any damaged item caused by vehicles, vandals, bicycles, or foot traffic during the maintenance period.

6. Hand Watering: Hand watering will be require at all NAVAIDS revegetation sites.

7. Any damaged or dead plant material shall be replaced with like and kind on a bi-monthly basis throughout the maintenance period.

D. Maintenance period shall be extended if plant material is not in a healthy growing condition. When all maintenance work has been completed to the satisfaction of Owner, the Owner will issue the Contractor a written notice of completion of maintenance.

3.07 INSPECTION

A. All inspections herein specified shall be made by the Owner. The Contractor shall request inspection at least forty-eight (48) hours in advance of the time the inspection is required. Requested inspections, subsequently canceled without twenty-four (24) hours notice, will be billed to the Contractor.

B. Inspection will be required for, and not necessarily limited to, the following parts of the work.

1. Prior to digging planting pits for shrubs.

2. Prior to final placement of plant materials.

3. During backfilling of plant pits with native backfill.

4. Monthly inspections during the maintenance period.

5. Final inspection at the end of the maintenance period.

PART 4: MEASUREMENT AND PAYMENT

4.01 PLANTING IMPLEMENTATION

A. The basis of measurement shall be installed in place, healthy, shrubs, and ground cover per each item as counted and/or otherwise determined by the Owner.

B. Payment shall be made at the unit prices bid in the proposal for 1 Gallon- Shrubs and Cuttings.

4.03 MULCHING

A. The basis of measurement shall be installed in-place mulch as calculated and/or otherwise determined by the Owner.

B. Payment shall be made at the lump sum contract price in the proposal for Wood Mulch.

4.04 SOIL PREPARATION

A. The basis of measurement shall be installed in place, soil preparation and/or otherwise determined by the Owner.

B. Payment shall be made at the lump sum contract price soil preparation & fine grade.

4.05 PRE-EMERGENCE WEED CONTROL

A. The basis of measurement shall be the application of pre-emergence weed control as determined by the Owner.

B. Pre-Emergence weed control will be considered as included in other items of work and no additional payment will be made therefor.

4.06 FIRST YEAR OF MAINTENANCE

A. The basis of measurement shall be comprehensive maintenance as herein described and as determined by the Owner.

B. Payment shall be made at the lump sum contract price for “First” Year Maintenance.

4.07 “SECOND” YEAR OF MAINTENANCE

A. The basis of measurement shall be comprehensive maintenance as herein described and as determined by the Owner.

B. Payment shall be made at the lump sum contract price for “Second” Year of Maintenance.

END OF SECTION

APPENDIX B

IRRIGATION IMPLEMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.

B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

C. Related Sections.

1. Section 100: Site Clearing

2. Section 800: Landscaping

D. The latest edition of the State of California Department of Transportation Standard Specifications and the Standard Specifications for Public Works Construction, latest edition, are referenced as if herein contained and the Contractor shall keep a copy at the project site. These Specifications shall supersede conflicts with information given in the, standard specifications unless otherwise determined by the Owner. Irrigation installation and materials shall conform to Owner of Tracy's Parks and Parkways Design Manual, latest edition.

1.02 CONSTRUCTION DRAWINGS

A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Owner shall have final authority for clarification.

C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in Owning. Such obstructions or differences should be brought to the attention of the Owner as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.03 QUALITY ASSURANCE

A. Provide at least one English speaking person who shall be present at all times during execution of all phases of work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnishes directions covering points not shown in the drawings and specifications.

C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.

E. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

1.04 SUBMITTALS

A. Materials List:

1. After award of contract and before any irrigation system materials are delivered to the job site, submit to the Owner a complete list of all irrigation systems, materials, or processes proposed to be furnished and installed as part of this contract.

2. Show manufacturer's name and catalog number for each item, furnish six sets of complete catalog cuts and technical data, furnish the manufacturer's recommendations as to the method of installation.

3. No substitutions will be allowed without prior written acceptance by the Owner. Any requests for substitutions must be made within 30 days after award of contract.

4. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

B. Substitutions:

If the Irrigation Contractor wishes to substitute any equipment or materials for equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Owner for approval.

1. Provide a written statement indicating the reason for making the substitution.

2. Provide catalog cut sheets, technical data, and performance information for each substitute item.

3. Provide in writing the difference in installed price if the item is accepted.

1.05 EXISTING CONDITIONS

A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water and electrical supply, connection to the irrigation system.

B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Owner authorized representative prior to beginning construction.

C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between the such obstacles and the proposed work, the Contractor shall promptly notify the Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.

D. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost, all damage resulting from his operations or negligence.

E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans.

F. Do not install irrigation as shown on the drawings when it is obvious in the field that obstructions, grade differences of differences in site dimensions exist that might hasve been forseen and considered in the Ownering. The Owner should be notified (in writing) of such obstructions and differences. In the event that the notification is not given, the Contractor assumes full responsibility for all necessary changes.

G. Irrigation system is based on the minimum operating pressure and maximum flow demand shown on plans. The Contractor shall verify water pressure at point of connection prior to start of irrigation installation. Notify Owner if water pressure shown on plans and actual site reading differ. In the event pressure differences are not reported in writing, Contractor assumes full responsibility for all necessary changes.

H. Field adjustments may be required to provide optimum operating efficiency. Contractor shall be responsible for adjusting system for optimum performance.

1.06 INSPECTIONS

A. All lines shall not be covered over until accepted by the Owner. The Contractor shall be solely responsible for notifying the, Owner, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.

B. Inspections will be required for the following at a minimum:

1. System layout

2. Pressure test irrigation main line (3 hours at 125 PSI)

3. Coverage test of irrigation system

4. Final inspection prior to start of maintenance period

5. Final acceptance

C. Site observations and testing will not commence without the record drawings as prepared by the Irrigation Contractor. Record drawings shall be complete and up to date for each site visit.

D. Work that fails testing and is not accepted will be re-tested. Hourly rates and expenses of the Owner for re-inspection or re-testing will be paid by the Irrigation Contractor at no additional expense to Owner.

1.07 STORAGE AND HANDLING

A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Owner and at no additional cost to the Owner.

B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.08 Cleanup and Disposal

A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals minimum daily or when ordered to do so by the Owner.

B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.09 Turnover Items

A. Drawings of Record:

1. Record accurately on one set of contract drawings all changes in the work constituting departures from the original contract drawings.

2. The changes and dimensions shall be recorded in a legible and workmanlike manner to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Owner.
3. Dimensions from/to permanent points of reference such as buildings, sidewalks, curbs, etc. shall be shown. Data on record drawings shall be recorded on a day to day basis as the project is being installed. All lettering on drawings shall be minimum 1/8 inch in size.

4. Show locations and depths of the following items:

    a. Point of connection (including water P.O.C., master control valves, quick couplers, etc.)

    b. Routing of sprinkler pressure lines (dimensions shown at a maximum of 100 feet along routing)

    c. Isolation valves

    d. Automatic remote control valves

    e. Quick coupling valves

    f. Routing of control wires

    g. Irrigation controllers

    h. Related equipment (as may be directed)

    i. Quick Link equipment

5. Maintain record drawings on site at all times. Upon completion of work, transfer all as-built information and dimensions to Owner's original mylar set.

B. Controller Charts:

1. Record drawings as "Drawings of Record" must be approved by the Owner before charts are prepared.

2. Provide two "updated" controller charts for the controller that controls the new irrigation for Area III. The chart shall show the area covered by the particular controller and the irrigation zone of each remote control valve and or Quick-Link equipment.

3. The chart is to be a reduced copy of the actual "Drawings of Record". In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.

4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Owner authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.

2. Each complete, bound manual shall include the following information:

a. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.

b. Operating and maintenance instructions for all equipment.

c. Spare parts lists and related manufacturer information for all equipment.

d. Irrigation schedules.

D. Equipment:

Supply as a part of this contract the following items:

a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.

b. Two (2) 30-inch sprinkler keys for manual operation of control valves.

c. Two (2) keys for each automatic controller.

d. One (1) valve box cover key or wrench.

e. Four (4) extra sprinkler heads of each size and type.

E. Turn over drawings, charts, manuals and extra equipment to the Owner at time of final walk-through inspection as part of final pre-maintenance acceptance.

1.10 COMPLETION

A. At the time of the pre-maintenance period inspection, the Owner, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Owner.

B. The Owner Owner shall have final authority on all portions of the work.

C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.

D. The Contractor without any additional expense to the Owner shall repair any settling of trenches, which may occur during the one-year period following acceptance, to the Owner's satisfaction. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 Guarantee

A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.

B. Should any problem with the irrigation system be discovered within the guarantee period, the Contractor at no additional expense to Owner shall correct it within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitute an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the owner by the Contractor, all at no additional cost to the Owner.

C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the owner. We shall make such repairs or replacements within 10 calendar days following written notification by the owner. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from owner, we authorize the owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:
PROJECT LOCATION:

CONTRACTOR NAME:
ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - MATERIALS

2.01 Summary

Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Owner standards will be rejected and shall be removed from the site at no expense to the Owner.

2.02 Pipe

A. Pressure supply lines 2 1/2 inches in diameter and up to 4 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.

B. Pressure supply lines 2 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC conforming to ASTM D1785.

C. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be Schedule 40 solvent weld PVC conforming to ASTM D1785.

2.03 Plastic Pipe and Fittings

A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.

B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2241 or ASTM D1785.

C. All solvent weld PVC fittings shall be standard weight Schedule 40 and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2466.

D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.

E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.

F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

2.04 Backflow Prevention Units

A. The blackflow prevention unit shall be a reduced pressure type vacuum breaker of the size, manufacturer and model number as indicated on the drawings.

B. Install a new stainless steel backflow prevention enclosure. The backflow enclosure shall be of the manufacturer, size, and type indicated on the drawings**.**

2.05 Valves

A. Ball Valves

1. Ball valves shall be of the manufacturer, size, and type indicated on the drawings.

2. Ball valves shall be constructed of a bronze body, ball and stem, full port with a malleable iron hand lever. Ball valves shall have threaded connections.

3. All ball valves shall have a minimum working pressure of not less than 150 psi and shall conform to AWWA standards.

B. Quick Coupler Valves:

1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.

2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 PSI without leakage. Valves shall have 1" female threads opening at base, with two-piece body. Valves to be operated only with a coupler key designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.

C. Automatic Remote Control Valves and Master Control Valve.

1. Automatic remote control valves and master control valve shall be of the manufacturer, size, and type indicated on the drawings.

2. Automatic remote control valves shall be electrically operated, spring loaded, self cleaning, puckless diaphram activated normally closed type valve. Master valve working with flow sensor shall be normally open.

3. Valve solenoid shall be corrosion-proof and constructed of stainless steel molded in epoxy to form one integral unit, and shall be 24 volt A.C.

D. Flow Meter: Flow meter shall be as shown on the Plans and conform to manufacturing specifications.

2.06 Valve Boxes

A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.

B. The valve box cover shall be green in color and secured with a hidden latch mechanism or bolts.

C. The cover and box shall be capable of sustaining a load of 1,500 pounds.

D. Valve box extensions shall be by the same manufacturer as the valve box.

E. Automatic control valve boxes shall be 14"x19"x12" rectangular size. Valve box covers shall be marked "RCV" with the valve identification number "heat branded" onto the cover in 2 inch high letters / numbers.

F. Gate and quick coupler valve boxes shall be 14” x 19” size. Valve box covers shall be marked with either "GV" or "QCV" "heat branded" onto the cover in 2 inch high letters. Upgrade quick coupler value boxes in lawn areas to sustain loads of 1500lbs.

2.07 Automatic Controller

A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.

B. Stainless steel controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.

2.08 Electrical

A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.

B. All electrical work shall conform to local codes and ordinances.

C. Flow sensor (Bermad) cable shall be 14 gauge. Install 5 control wires from controllers to flow sensors.

2.09 Low Voltage Control Wiring

A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.

B. Connections shall be Spears DS400 Drisplice connectors.

C. Ground wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).

2.10 Irrigation Heads

A. Irrigation heads shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.

B. Irrigation heads shall be used as indicated on the drawings.

PART 3 - EXECUTION

3.01 Site Conditions

A. Inspections:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner.

2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:

1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.

2. The Owner shall accept final grades before work on this section will be allowed to begin.

D. Field Measurements:

1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.

2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.

3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:

1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to Owner.

F. Layout:

1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.

2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:

1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to the Owner.

H. Electrical Service:

1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.

2. Contractor shall connect existing 120V electrical service as necessary to the irrigation controllers..

3.02 Trenching

A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
B. Provide minimum cover of 18 inches on pressure supply lines.

C. Provide minimum cover of 18 inches for control wires.

D. Provide minimum cover of 12 inches for non-pressure lines.

E. Pipes installed in a common trench shall have a 6-inch minimum space between pipes.

3.03 Backfilling

A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inch in diameter.

B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to 90% relative compaction and shall conform to adjacent grades.

C. Jetting or flooding in lieu of tamping is not allowed.

D. Under no circumstances shall truck wheels be used to compact backfill.

E. Provide sand backfill a minimum of 6 inches over and under all piping under paved areas.

3.04 Piping

A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.

B. Cutting or breaking of existing pavement is not permitted.

C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.

D. Remove all dented and damaged pipe sections.

E. All lines shall have a minimum clearance of 6 inches from each other and 12 inches from lines of other trades.

F. Parallel lines shall not be installed directly over each other.

G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.

I. Centerload all plastic pipe prior to pressure testing.

J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.

K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope an all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic female adapters.

3.05 Existing Controller

A. Existing Controllers and wiring to be protected.

B. The Irrigation Contractor shall be responsible for necessary wiring within the existing controller to accommodate the Quick-Link equipment.

C. The irrigation system shall be programmed to operate during the periods of minimal use of the design/planting area

3.06 Control Wiring

A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.

B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.

C. All connections shall be of an approved type and shall occur in a valve box. Provide a 36" inch service loop at each connection.

D. An expansion loop of 36" inches shall be provided at each wire connection and/or directional change, and one of 36 inches shall be provided at each remote control valve.

E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.07 Valves

A. Automatic control valves, quick coupler, and ball valves are to be installed in the approximate locations indicated on the drawings.

B. Valves shall be installed in shrub areas whenever possible.

C. Install all valves as indicated in the detail drawings.

D. Valves to be installed in valve boxes shall be installed one valve per box.

3.08 Valve Boxes

A. Valve boxes shall be installed in shrub areas whenever possible.

B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 1 inch above finish grade in ground cover areas.

3.09 Irrigation Heads

A. Irrigation heads shall be installed as indicated on the drawings.

B. Spacing of heads shall not exceed maximum indicated on the drawings.

C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

3.10 Miscellaneous Equipment

A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.

B. Quick coupler valves shall be set approximately 12 inches from walks, curbs, header boards, or paved areas where applicable.

3.11 Flushing the System

A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.

B. Irrigation heads shall be installed after flushing the system has been completed.

3.12 Adjusting the System

A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.

B. If it is determined by the Owner that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.

C. The entire system shall be operating properly before any planting operations commence.

D. Automatic control valves are to be adjusted so that the irrigation heads and drip tubing operate at the pressure recommended by the manufacturer.

3.13 Testing and Observation

A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Owner.

B. The Contractor shall be solely responsible for notifying the Owner, a minimum of 48 hours in advance, where and when the work is ready for testing.

C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Owner.

D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Owner. This test shall be accepted by the Owner and accomplished before starting any planting.

E. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

3.14 Maintenance

During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings. The

contractor will prune plants if determined necessary by the Owner Owner to provide 100 % coverage.

3.15 Completion Cleaning

Clean-up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed, and any damage sustained on the work of others shall be repaired to original conditions.

3.16 Irrigation System Design and Water Supply:

The irrigation system designed is based upon a minimum available static water pressure of 75 p.s.i at a flow rate 38 g.p.m. Individual stations are designed to this minimum p.s.i.

The system is also designed to withstand a maximum pressure of 120 p.s.i. Contractor shall verify the existing working water pressure at the water supply location shown on the drawings prior to starting construction. The Contractor shall notify the Owner in writing of any discrepancies noted. Failure to provide such written notification shall result in the Contractor being required to provide modifications to the irrigation system as necessary to achieve a fully operational systems providing 100% coverage, at no additional charge to the Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.01 IRRIGATION

A. The basis of measurement shall be installed in place, fully operational landscape irrigation system as herein described and as determined by the Owner.

B. Payment will be made at the Lump Sum Contract Price for irrigation systems.

END OF SECTION

APPENDIX C
BACKGROUND OF THE LOS ANGELES/EL SEGUNDO DUNES

BACKGROUND OF THE LOS ANGELES/EL SEGUNDO DUNES

1.0 HISTORICAL BACKGROUND OF CALIFORNIA COASTAL SAND DUNES

The following section is adapted from Mattoni.[1] Coastal sand dunes represent a vanishing habitat in California. Statewide, coastal dunes have been reduced to less than 25 percent of the area they originally occupied. The three largest coastal dunes systems in the state, both historic and current, are located in central California: the 28,000-acre San Francisco dunes system has been almost entirely eliminated by urbanization; and the Monterey and Santa Maria systems, 84,000 and 104,000 acres, respectively, are about 40 percent intact, with evident disturbances to the remaining areas.

Mainland Southern California harbored 12 discrete dunes systems south of Point Conception, totaling about 5,100 acres. Less than 1,000 acres, or 19 percent, are still recognizable as sand dunes. The Los Angeles/El Segundo Dunes (Dunes) were the largest dunes system in Southern California, originally encompassing 2,900 acres. Remnants are now limited to the following four sites:

- The Dunes parcel is the largest remnant, encompassing 277 acres of actual dunes, of which 43 acres are relatively undisturbed and 137 acres are in the final stages of clearing and revegetation.

- The Los Angeles Department of Water and Power ("Hyperion") right-of-way, south of the Dunes parcel, encompasses about 55 acres of relatively disturbed backdune and dune crest habitat of potential high habitat value.

- The Chevron El Segundo Blue Butterfly Preserve, south of Hyperion, encompasses 1.6 acres devoted largely to the maintenance of the butterfly's food plant.

- Sand Dunes Park in Manhattan Beach, further south, encompasses 4 acres of disturbed habitat, with some retained habitat values.

Two other nearby sites are important biological extensions of the Dunes habitat for purposes of conservation. Although they have not been recently connected, they share many of the same species:

- Ballona Wetland-Playa del Rey, north of the Airport parcel, contains a 2.5 to 5 acre highly degraded backdune; and

- Malaga Cove to the south consists of 1.5 acres of rapidly degrading pre-Flandrian sandstone bluff, with some free sand cover, facing the ocean. Some native plants support a population of the El Segundo blue butterfly (ESB).

[1] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

Biological relationships also exist between the dunes systems of Southern California and three dunes systems in northern Baja California. Those systems share a number of plant and animal species. However, of the three dunes systems in Baja California—Ensenada, Rosarita, and Descondido—only Ensenada's 1,000-acre dune habitat remains and is in serious jeopardy from population expansion. Also biologically related to the Dunes is a series of 11 dunes systems on the Channel Islands that total 3,500 acres. Although they are now largely protected by governmental agencies, their habitats have suffered severe losses from past overgrazing by cattle, feral sheep, goats, and swine.

The remaining undisturbed fragments of the Dunes, together with areas under restoration, constitute the richest remaining site representing Southern California sand dunes communities. The Preserve area, therefore, has an irreplaceable function as a refugium for sand-obligate plant species. The Dunes constitute the sole significant reservoir for carrying theses species into the future.

2.0 GEOLOGY OF THE LOS ANGELES/EL SEGUNDO SAND DUNES COMPLEX

The geologic history of the Dunes has been described by Cooper.[2] For the most part, the Dunes are of recent geologic origin. The Dunes complex has two major components: pre-Flandrian relict "sand hills" and active Flandrian dunes shown as foredune and backdune ("Flandrian" and "pre-Flandrian" are geologic terms that refer to the time of formation). The older pre-Flandrian dunes form a base of cemented sands (sandstones) of varying hardness beneath the newer dunes and extend far inland from them. The active dunes are perched atop the pre-Flandrian formation and are thereby separated from the strand by a 10- to 15-foot bluff. The active dunes provide substrate supporting a sclerophyllous (having stiff, leathery leaves) scrub community unique to dunes, and the older pre-Flandrian dunes, where exposed or near the surface, have physiochemical properties that present distinctive adaptive requirements for plants and animals and therefore support a different biota.

The pre-Flandrian sand formations were deposited when sea level was about the same as today. Sea levels dropped during the last glaciation, which reached its maxima 18,000 years ago, and then rose again from their low during the glaciation to approximately present levels. The Flandrian dunes were formed during the last 4,000–6,000 years as the sea level was rising. The formation of sand dunes is well described by Cooper, both in general terms and in regards to the specific case of the Dunes.[3]

Prior to settlement and modification of the area, active Flandrian formations at the Dunes extended about 9 miles along the coast and reached an average of about 0.5 mile inland. To the north, the Dunes were limited by the Playa del Rey bluffs. At the foot of the bluffs, a Dunes segment bordered both sides of Ballona Creek and extended north as low hummocks into what is today Ocean Park. The large deflation plain of the pre-Flandrian dunes and the Torrance plain formed the boundaries of the Dunes to the east. The southern boundary of the Dunes was in the vicinity of the Palos Verdes terraces in Redondo Beach.

The deflation plain to the east of the backdune is the weathered remnant of the pre-Flandrian formations. It consists of loosely consolidated (incipient) sandstone covered to variable depths with Aeolian (wind-transported) sand. Within the deflation plain, areas referred to as dune slack areas, where the land was eroded down to or near the water table, were found in isolated locations both

[2] Cooper, W.S. 1967. "Coastal Dunes of California." Geological Society of America Memoir, 104:1-131.

[3] Cooper, W.S. 1967. "Coastal Dunes of California." Geological Society of America Memoir, 104:1-131.

within the Dunes and on the lee side. A series of these depressions, either coinciding with the water table or underlain by undrained impermeable substrate that allowed spring rain water to briefly pool before evaporating, were found over the whole of the pre-Flandrian formation. These depressions formed a series of vernal pools, with a few permanent marshes. Excepting a few relict marshes, for example Madrona Marsh, these wetland habitats have disappeared from the Dunes site and vicinity as a result of both land disturbance and likely alterations in the water table.[4]

2.1 Recent (19th and 20th Century) Land Use History

The Dunes and adjacent deflation plan were undisturbed until 1890. In the first decade of the 1900s, the City of Redondo Beach and community of Venice were developed, the former separating the main dunes from south Redondo Beach and the Malaga Cove extensions and the latter destroying all the dunes north of the mouth of Ballona Creek.

Construction of the Chevron refinery in 1911 divided the remaining dunes into two large fragments. The southern fragment was gradually converted to residential housing starting in the late 1940s. The residential area on the northern fragment—the Dunes—was subdivided, with the installation of streets and utilities, beginning in 1928, but construction was delayed until after World War II. Indeed, until the end of World War II the northern dunes and coastal plain were virtually pristine. Within a few years, residences blanketed the southern half of the Dunes. Substantial amounts of sand were removed for construction of the Hyperion Wastewater Treatment and Scattergood generating plants in the 1940s and 1950s. These alterations, along with continued development of housing on the present Dunes, reduced the northern undisturbed fragment to about 100 dispersed acres of actual dunes by 1960.

The next major causes of disturbance arose from the expansion of the former Mines Field into the Los Angeles International Airport (LAX). The Federal Aviation Administration (FAA) installed radar equipment—Very high Omni Range (VOR) Navigation Beacon—on a 5-acre site at the southern end of the Dunes in 1950. Large quantities of sand were reconfigured to elevate the facility.

With increasing air traffic necessitating construction of the north runway and prompting the need for greater safety considerations and with the onset of jet age noise, residential living conditions adjacent to the airport became increasingly difficult. Residents elected to have their land acquired by the City of Los Angeles as a noise and safety buffer zone. Between 1966 and 1972, some 822 residences were purchased and cleared from nearly 200 acres. About 70 percent of the backdune area was also excavated and recontoured in order to realign Pershing Drive in 1975; the entire 302-acre area was fenced as an airport security measure. The recontoured backdunes were stabilized by hydromulch containing seeds of plants that were "native" to California but were composed mistakenly of coastal sage scrub species rather than the coastal dune scrub plant community. One of the coastal sage scrub species introduced was the common California buckwheat (*Eriogonum fasciculatum*). California buckwheat vigorously expanded on the dunes, out-competing the dunes native, coastal buckwheat (*Eriogonum parvifolium*). The reduction in the number of local dunes buckwheat had dire consequences for the endangered ESB, which is dependent on coastal buckwheat for virtually all life cycle functions. The ESB was listed as an endangered species in 1976, under the federal Endangered Species Act.

[4] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

During the same general time period, a 12-acre portion of the foredune south and west of the VOR was disturbed by sand mining operations, and a nearby area was used as a spoils site for excess soil. Sand was also removed and relocated to widen Dockweiler beach. The lee area prairie between the backdune and Pershing Drive was completely scraped, iceplant was introduced to stabilize cut slopes, and portions were also oiled for soil stabilization. From the late 1960s through the late 1970s, undisturbed acreage at the Dunes was reduced to a total of 40 acres, which served as a refugia and the sole source of local populations for subsequent colonizations.

The Los Angeles coastal prairie, which historically was found on the deflation plain to the lee of the Dunes, has been completely destroyed. The community associated with this prairie (valley needlegrass grassland in the Holland [1986] classification) was dominated by the perennial *Nassella* [*Stipa*], with a rich mix of herbaceous flowering plants. The valley needlegrass grassland community is now almost completely absent due to extensive grading and paving and the invasion of exotic annual grasses. Similarly, the vernal pool communities mentioned above are also gone.

Today, less than 10 percent of the historic sand dunes survive as open space, and only 15 percent of this is represented by habitat that can be characterized as partially to wholly undisturbed in comparison with historical conditions.

2.2 Soils And Hydrology

With the exception of soils in the extreme northeast corner that were once farmed (Subsites 53, 55, and 56), the soils throughout the Dunes have sand content greater than 97 percent and reveal no significant difference in soil texture in either surface or subsurface samples. However, underlying sandstone is exposed near or at the surface in several areas, revealing the uneven nature of pre-Flandrian deposits. For example, grading for construction of the previous residential development exposed hard sandstones in the foredune areas close to the bluffs. Sandstone substrates may channel and/or block subsurface water flows, but this has not been studied on the dunes.

The Dunes are also fairly homogenous in soil fertility chemistry, showing no significant differences among subsites.[5] The sands are high in sodium content, and conversely, low in the major fertility components—nitrogen, phosphorous, and potassium. The Dunes flora must be capable of dealing with these conditions, which are normally suboptimum for plant growth.

Limited assays in 1987–1988 did not reveal unexpected concentrations of heavy metals and hydrocarbon in surface or subsurface sand layers. However, because the concentration range of boron between a plant's "essential" requirement and toxicity is narrow (1–5 parts per million [ppm] in most cases) and borates are increasingly used in jet fuels, boron from this source could become a significant factor in toxifying the dunes ecosystem.[6]

The sole source of natural water for the Dunes is direct precipitation and local runoff. Average annual rainfall at LAX is less than 14 inches. Runoff is briefly retained at the surface only in areas where the weathered, cemented sand remnants of the pre-Flandrian dunes are exposed or near the

[5] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

[6] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

surface. Therefore, the toe of the backdune slope, where the sand substrate of the dunes meets the relatively impermeable sandstone layer, serves as a moisture trap, and the slack area itself has the theoretical capability of retaining water in small depressions. Mattoni discusses the inherent difficulties with reestablishing vernal pools that have been subjected to disturbance. Little is known about the original character of these features. Mattoni postulates that changes in hydrology, particularly the lowering of groundwater table, may have contributed to their loss.[7]

2.3 Dunes Landforms and Communities

Present Configuration of Dune Landforms

The physical environment of the 302-acre Dunes complex forms a dynamic interface zone between the high-energy processes of the open ocean and the protected inland areas of the coastal plain that are outside the direct influence of ocean water, salt spray, and sand. Historically, the plant communities formed a continuum in response to topography and proximity to the ocean, beginning with the beach (strand), bordered by a bluff, foredune, and backdune, and then forming a transition into plant communities typical of the coastal plain. At the Dunes, human activities and site modifications have altered these components without eliminating their essential physical and biological relationships.

The Dunes site now contains no native beach or bluff communities. Four main landforms or aspects are present, each associated with a distinct plant community. These landforms include the following estimated acreages: 222 acres of both pristine and disturbed (restored) foredune covering the majority of the western land area; 29 acres of pristine and disturbed (restored) backdune slope generally paralleling the eastern boundary; 26 acres of deflation plain, largely disturbed, in several easterly locations; and 25 acres of highly disturbed soil type that was heavily farmed in the northeast corner (this area now lies outside the Preserve). Only 43 acres of the total 277 acres of actual Dunes complex are undisturbed; about 25 acres are covered by roads and buildings.

The beach is defined as that expanse of sandy substrate between the mean tide line and the beginning of the foredune. The beach is formed typically by the farthest inland reach of storm waves. In areas where sand is available and winds are present, active shifting accumulations of sand may form. Historically, at the Dunes, a narrow 100- to 150-foot-wide strand extended from the mean tide line to the base of a 10- to 15-foot bluff formed by wave erosion of an older deposit of weakly consolidated sand. The natural vegetation of the strand and bluff was largely removed and the foredune "relocated" about 150 feet eastward of its historically seaward border by the artificial widening of Dockweiler Beach, construction of Vista del Mar Boulevard, and placement of extensive parking lots on top of the bluff.

Notwithstanding its eastward relocation, the foredune continues to be perched on top of the pre-Flandrian dunes, extending from the remaining bluff just above the beach to the point of drop-off that forms the backdune. The foredune is a single gradual slope, rising to a maximum of over 70 meters (215 feet) with an average width of 800 meters (~2460 feet). The foredune is subject to the most severe physical stress within the dunes system: exposed to intense afternoon sun, unprotected from prevailing westerly winds, and exposed to some salt spray as well. Temperature extremes are greater over any 24-hour period than in any other part of the Dunes complex. The substrate is fine-

[7] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

grained sand, accepting local microenvironments with accumulated organic debris from plant growth on the north- and east-facing slopes formed by small depressions and gullies on the foredune.

Toward the southern end of the foredune near the VOR are three large "blowouts"—areas of barren sand where plant growth is limited by sand actively transported by prevailing westerly winds east. The blowouts cut across five relatively undisturbed study subsites (Subsites 22, 23, 24, 29, and 31) and fit the popular visual conception of sand dunes as areas of constantly shifting sand. These particular blowouts have persisted almost unchanged, except for some modification by sand mining, since the earliest aerial views.

Roughly 75 percent of the foredune developed as residences was later cleared of homes and some infrastructure and has now undergone restoration (i.e., rubble and alien plants have been removed and the area has been revegetated with plants native to Southern California coastal dunes). A narrow edge of the foredune bordering the backdune (Subsites 5, 6, 14, 17, and 50) was never developed; these subsites retain relatively pristine conditions. Within the formerly developed areas of the foredune, Subsite 39 is notable in that about 50 percent of the subsite was covered by native land species when restoration of surrounding subsites began.

The backdune was formed as wind-transported sand was deposited at the dune crest because of the decrease in wind velocity at this point. The backdune slope is steep. Because it is steep, the slope is also unstable. Sand falls easily, except where stabilized by dense plant growth. The backdune faces east and receives morning sun, but is shaded by 3:00 p.m., even in summer. Fog also tends to hang over the backdune, so humidity is generally higher than on the foredune. Likewise, the backdune is in the lee of the prevailing, drying westerly winds, although it does receive the brunt of annual fall Santa Ana winds. Thus, the backdune experiences less thermal stress and generally less wind-drying than the foredune; it is cooler and more humid.

Environmental variation is provided where the backdune slope exposure changes from predominately eastward to southerly and northerly aspects. The toe of the backdune slope, where the sand substrate of the dunes meets the relatively impermeable sandstone layer, serves as a trap, for both moisture and nutrients. Microenvironmental patches, such as this area and the topographic "pockets" of organic material within the foredune sand substrate, are an important factor in creating community diversity, particularly for small organizes such as insects and small annual plants.

Historically, the area behind the Dunes intergraded with the coastal plain, while narrow construction of the term "dune ecosystem" would apply only to the dunes proper, the influence of sand extended substantially inland from the actual Dunes complex. The deflation plain (slack area) may have originally covered as much as 30 square miles.[8] Dune ecosystems are not strictly closed with sharply demarcated boundaries. Some proportions of species either range into or inhabit adjacent territory, resulting in an extra rich biota at the interface ("edge") of the dune and its inland neighbor communities. Thus dunes community biology is enhanced by surrounding habitats and by the interfaces between them and the dunes.[9]

[8] Cooper, W.S. 1967. "Coastal Dunes of California." Geological Society of America Memoir, 104:1-131.

[9] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

The many undrained impermeable depressions shown in historic maps over the whole formation are known to have supported vernal pools and the distinctive vegetation associated with these water features. Most of the historic deflation area has been either eliminated in development or physically and biologically transformed. The small remaining area has been graded, and none of the historic vernal pools exist any longer.

2.4 Vegetation of Los Angeles/El Segundo Dunes

Plant Communities

The vegetation of coastal sand dunes in Southern California is not well known or understood, as much of the dunes were destroyed or heavily impacted before scientific investigations could take place. The native vegetation of the Dunes is not found anywhere else in the County of Los Angeles and is uncommon throughout Southern California.[10] By fortuitous circumstance, the Dunes were investigated by Pierce et al. in 1938 and 1939. Other pertinent early studies include Couch (1914), who surveyed dune vegetation at Manhattan Beach, and Johnson (1973), who described the vegetation of dunes at Ensenada, Mexico, about 160 miles south of the California/Mexico border.[11] The following description of the historic plant communities at Dunes is based on these past historic investigations.

Beach

The available information on the beach vegetation of Southern California is compiled in Barbour and Johnson.[12] Unfortunately, much of the early data collected by Couch for coastal areas of California does not clearly differentiate between beach and dune vegetation. Pierce and Pool found saltbush (*Atriplex leucophylla*) as occasionally occurring in the beach community.[13] Vegetation is normally limited to the upper edge of the high water line. With the construction of Vista Del Mar Boulevard and the development of Dockweiler Beach, this community is no longer present at the Dunes.

Foredune

Of the three communities described on the Dunes by Pierce and Pool (1938), the "pioneer community" is most likely associated with the foredune. The foredune supported red sand verbena, pink sand verbena (*Abronia umbellata*), silver beach bur (*Ambrosia chamissonis* ssp. *bipinnatisecta*), beach morning glory (*Calystegia soldonella*), spectacle pod (*Dithyrea californica* var. *maritima*, and Russian thistle (*Solsola tragus*). Undisturbed areas near the VOR (Subsites 22 and 23) that contain these species provide the most representative example of this community, classifies as "southern foredune." As described by Holland, the community is dominated by

[10] England and Nelson. 1976. Los Angeles County Significant Ecological Areas Study. Prepared for: County of Los Angeles Department of Regional Planning, 320 West Temple Street, Los Angeles, CA 90012. Prepared by: England and Nelson Environmental Consultants, P.O. Box 1026, Riverside, CA 92502.

[11] Barbour, M.G. and A.F. Johnson. 1988. "Beach and dune." In *Terrestrial Vegetation of California*. California Native Plant Society. Special Publication No. 9.

[12] Barbour, M.G. and A.F. Johnson. 1988. "Beach and dune." In *Terrestrial Vegetation of California*. California Native Plant Society. Special Publication No. 9.

[13] Pierce, W.D. and D. Pool. 1938. "The Fauna and Flora of the El Segundo Sand Dunes." *Bulletin of the Southern California Academy of Science,* 37:93-97.

perennial species with a high proportion of suffrutescent plants, which are shrubby but not very woody and up to 30 centimeters (~12 inches) tall.[14]

On undisturbed foredune area, individual plants are usually spaced 2 to 3 feet apart. Mature perennial shrubs, such as coastal buckwheat, dune bush lupine (*Lupinus chamissonis*), and silver beach bur are usually separated by about this distance. The reason for this spacing is not clear but is probably related to water availability and/or underground root growth into a zone where the plants compete for water and/or nutrients.

Backdune

On more or less stabilized rides, flats, and backdune slopes, a denser vegetation referred to as "southern dune scrub" (California Natural Diversity Database [CNDDB] Element Code 21330) can be found.[15] Southern dune scrub consists of a dense coastal scrub community of scattered shrubs, subshrubs, and herbs, generally less than 3 feet tall. This community typically develops considerable cover. The plant diversity of the backdune is higher than that of the foredune, with the richest biota of the entire dune complex occurring along the toe of the backdune slope. The microenvironment discussed above serves as an ecotone, creating an "edge effect" between the sand substrate of the dunes and the relatively impermeable sandstone layer of the deflation plain.

The semi-established dune community described at the Dunes by Pierce and Pool included species such as mock heather (*Ericameria* [Happlopappus] *ericoides*) and dune bush lupine, described as dominant components of dune vegetation as far north as the Monterey Peninsula.[16] In addition, Pierce and Pool described an established and distinctive dune shrub community characterized by bladderpod (*Isomeris arborea*) and lemonadeberry (*Rhus integrifolia*), with an herbaceous component including the following native and introduced species: sea fig (*Mesembryanthemum chilense*), Hottedtot fig (*M. edule*), common ice ant (*M. crystallinum*), Parish's bristlescale (*Atriplex parishii*), lamb's quarters (*Chenopodium album*), coast sand bur (*Cenchrus [*pauciflorus] *incertus*), wishbone bush (*Mirabilis laevis*), black nightshade (*Solanum nigrum*), and coast prickly pear (*Opuntia littoralis*).[17] Two plants, hedge-leaved horkelia (*Horkelia cuneatus*) and hairy goldenaster (*Heterotheca sessiflora* ssp. *fastigiata* [as *Chrysopsis villosis*]), were noted as occurring only at the backdunes–slack interface. These latter two plants are limited to the same situation today.

[14] Holland, R. F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento: California Department of Fish and Game.

[15] California Department of Fish and Game. 2004. *Rarefind: A Database Application for the Use of the California Department of Fish and Game's Natural Diversity Database*. Sacramento: California Department of Fish and Game.

[16] Pierce, W.D. and D. Pool. 1938. "The Fauna and Flora of the El Segundo Sand Dunes." *Bulletin of the Southern California Academy of Science,* 37:93-97.

[17] Pierce, W.D. and D. Pool. 1938. "The Fauna and Flora of the El Segundo Sand Dunes." *Bulletin of the Southern California Academy of Science,* 37:93-97.

Valley Needlegrass Grassland – Deflation Plain

The deflation plain to the east of the dunes supported an area of grasslands and vernal pools. Such deflation areas are commonly found behind coastal dune systems, and where eroded down to or near the water table, commonly support vernal pools.[18] The grasslands of the Dunes were part of a larger area, the Los Angeles coastal prairie. The Los Angeles coastal prairie is (or was) an instance of valley needlegrass grassland and classified by Holland.[19] At the Dunes, the grassland plant community was composed of nodding needlegrass (*Nassella* [Stipa] *cernua*) and a number of flowering forbs (herbaceous plants that are not grasslike but are associated with grasses). A photograph of the area in 1938 shows a predominance of forbs over grasses. valley needlegrass grasslands are most commonly associated with heavier soils, not sandy substrates. Barry lists some 195 soil series on which these grasslands are found.[20] The grassland at the Dunes was probably transitional to the grasslands found further inland on non-sandy substrates.

When Pershing Drive was widened and realigned, the deflation plain slack area was scraped, and the soil substrate was removed. The area was then hydromulched with a native but inappropriate seed mix that resulted in the transformation from a forb-dominated prairie to one dominated by California buckwheat, iceplant, and Mediterranean grasses. Much of the iceplant and buckwheat have been removed as a part of the restoration efforts, but the latter species is persistent.

Vernal Pools

Historically, vernal pools and the associated unique plant community occurred within the deflation plain, and at least one occurred on the southerly foredune. Vernal pools in the vicinity of the Dunes are known to have supported a number of indicator species such as California Orcutt grass (*Orcuttia californica*), ground pink (*Linanthus dianthiflourus*), purple owl's clover (*Castilleja exserta* [*Orthocarpus purpurascens*]), and California plantain (*Plantago erecta*), and others. Currently, there are no vernal pools within the Dunes.

Flora of the Dunes

In 1994, some 160 species of plants were known to occur on the Dunes. These plants species are arrayed across the Dunes in the plant communities discussed above. The contemporary flora of the Dunes is complex due to its long history of human influence. Species have been lost due to human disturbance and destruction of habitat. Many invasive weedy species have found their way into the Dunes. Several alleged "native" species from other plant communities were introduced with standard hydromulching. In addition, former residents deliberately introduced some species in association with residential landscaping.

What is known of the original species composition is largely limited to plant collections made by Pierce and his colleagues.[21] While the dunes were relatively undisturbed at that time, it is likely that some changes had already occurred. A number of European-introduced annual species were

[18] Barbour, M.G. and A.F. Johnson. 1988. "Beach and dune." In *Terrestrial Vegetation of California*. California Native Plant Society. Special Publication No. 9.

[19] Holland, R. F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Sacramento: California Department of Fish and Game.

[20] Barry, W.J. 1972. *The Central Valley Prairie*. Sacramento: California Department of Parks and Recreation.

[21] Pierce, W.D. 1938/1940. Unpublished Notes on the El Segundo Sand Dunes Study. 5 volumes. Los Angeles: Natural History Museum of Los Angeles County.

already present, and some native species were likely already extirpated. The prairie communities had been the most altered, and to a lesser extent, at the beach and lower foredune, the introduced landscape species had their greatest impact. Small areas of foredune and backdune were relatively untouched and thus provided useful information of naturally occurring species composition.

At the time of plant surveys in 1988, some 24 plant taxa recorded by Pierce, 50 years prior, were absent.[22] A number of the extirpated species were associated with the Dunes habitats—beach, valley needlegrass grassland, and vernal pools—that had been most disturbed by human activities. The changes to the beach discussed above effectively removed habitat for a suite of beach-adapted species. Likewise, the activities associated with the construction of Pershing Drive had a heavy impact on the prairie and vernal pools of the deflation plain behind the dunes. The loss here included a suite of species associated with the vernal pools habitat as well as some associated with the prairie itself.

The removal of houses from the site in 1979 and wide-spread physical disturbance of native soils provided opportunities for nonnative plants and animals to invade otherwise integrated natural communities. Therefore, iceplant and acacia expanded quickly. Surveys conducted in 1987 showed that two iceplant species (*Carpobrotus edulis* and *C. aequilaterus*) covered approximately 35 percent of the site, which resulted in a proportionate displacement of native plants. Similarly, two species of acacia (*Acacia cyclops* and *A. retinoides*) expanded. From 1979 to 1987, acacia increased from less than 40 individuals to 671.[23] Portions of the former residential area came to be dominated by acacia and iceplant. The physical structure of the prairie and vernal pool wetland was disrupted, and the plant community was converted to a nonnative scrub. The removal of the acacia and iceplant has been a major component of the restoration activities to date. The numbers of both genera have been greatly reduced; however, they are still present on site and reproducing. Continued vigilance in their removal will be required to ensure that iceplant and acacia do not yet reclaim the site.

An extensive effort has been made to reintroduce most of the extirpated plant species with mixed results. Some plant introductions have been very successful. Less successful reintroductions may have been due to insufficient information about species propagation requirements for germination and establishment. Directed research on the germination requirements of these species at a botanical garden, academic institution, or nursery specializing in native plants would be appropriate. Reintroduction of species associated with habitats that are no longer present, such as beach and vernal pools, is difficult if not impossible.

2.5 Sensitive Species Addressed in the Mitigation Measures

This section addresses the specific species that are addressed in Mitigation Measures MM-BC-2, MM-BC-9, and MM-ET-4.

[22] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

[23] Mattoni, R.H.T. 1990. "Species Diversity and Habitat Evaluation Across the El Segundo Sand Dunes at LAX." Prepared by: Mattoni, R.H.T., Agresearch, Inc. Prepared for: The Board of Airport Commissioners, One World Way West, Los Angeles, CA 90009.

El Segundo Blue Butterfly (ESB)

Species Description

The ESB is one of five subspecies of the square-spotted blue butterfly (*Euphilotes battoides*) and is endemic to Southern California. The ESB is distinguished from the other four subspecies by a combination of underside black spot size, amount of orange on the wings, wingspread, foodplant, and other characters.[24] The adults have a wingspan of 0.75 to 1.25 inches. The wings of the males are a bright blue color with an orange border on the rear of the upper hindwings. The females are a dull brown color with an orange border on the upper distal surface of the hindwings.[25]

Habitat Requirements

Distribution of the ESB is dependent on adequate habitat and occurrence of its foodplant, the coast buckwheat. Furthermore, the ESB appears to be limited to habitats with high sand content. These sites historically consisted of the Dunes, where the key indicator of primary, undisturbed habitat is the coast buckwheat. The biological communities of sand dunes are adapted to continuously moving sand and extreme aridity. ESB are present within extant and restored southern foredune and southern dune scrub habitats within the Habitat Restoration Area of the Dunes. The Dunes population represents more than 90 percent of the known population of this species. The Dunes are the largest fragment of ESB habitat and are also the closest approximation to a prehistoric dune ecosystem composition.[26] More research is necessary to determine those factors necessary in determining ESB endemism to the Dunes.

Life History

The ESB, as with all species of the genus *Euphilotes,* spends virtually its entire life cycle in intimate association with the flowerheads of a specific species of buckwheat. In this case, the coast buckwheat is where virtually all stages of the ESB's life cycle occur.[27] The ESB undergoes four major phases, or instars, of maturation (complete metamorphosis): egg, larvae, pupae, and adult. The life span of the ESB is about one year; however, some pupae will remain in diapause for two years or more. Adults usually fly from mid-June to mid-August, although the exact timing is weather dependent. The onset of flight is closely synchronized with the flowering of coast buckwheat. In addition, by late August, the larvae generally pupate underground, which coincides with the senescence of the coast buckwheat flowerhead. Thus, significant arrays of population regulating mechanisms operate within the flowerhead environment.

Upon emerging from their pupae, adults fly directly to flowering heads of the coast buckwheat. Upon arrival at the flowerheads, females begin mating with males that are moving constantly from flowerhead to flowerhead. Immediately after mating, the females begin laying eggs that hatch in

[24] Mattoni, R.H.T. 1992. "The Endangered El Segundo Blue Butterfly." *Journal of Research Lepidoptera*, *29*: 277–304.

[25] U.S. Fish and Wildlife Service. 20 April 2004. *Biological Opinion for Los Angeles International Airport Master Plan, City of Los Angeles, Los Angeles, County, California*. Prepared for: U.S. Department of Transportation, Federal Aviation Administration, P.O. Box 92007, Los Angeles, CA 90009.

[26] Mattoni, R.H.T. 1992. "The Endangered El Segundo Blue Butterfly." *Journal of Research Lepidoptera*, *29*: 277–304.

[27] Mattoni, R.H.T. 1992. "The Endangered El Segundo Blue Butterfly." *Journal of Research Lepidoptera*, *29*: 277–304.

three to five days, and larvae will undergo four instars prior to pupation in 18 to 25 days.[28] ESB are described as sedentary, but formal and informal mark/recapture studies indicate that adult dispersal can occur infrequently. Each larva will require two to three flowerheads during its development.

ESB larvae have a symbiotic relationship with ants. During the third instar, ESB larvae develop an eversible tube and glands that secrete a fluid that attracts ants, usually *Iridiomyrmex humilis* or *Conomyrmex* sp., which may protect them from parasitoids and small predators. By late August or September, the ESB pupate when inflorescences become senescent, and the pupae winter either underground or within the leaf litter.[29]

Little is known about the predators of the ESB. It is assumed that crab and lynx spiders capture mature ESB. Braconid wasps and tachinid flies parasitize ESB eggs on flowerheads in the dunes.[30]

Population Dynamics

ESB population densities have decreased dramatically due to urban development on the Dunes, which were undisturbed until the late 1880s, when the cities from Redondo Beach to Venice were established.[31]

Numbers of ESB have been monitored since the City of Los Angeles initiated active management of the Habitat Restoration Area in 1995 and are reported in Table 2.5-1, *El Segundo Blue Butterfly Population Figures*.

[28] U.S. Fish and Wildlife Service. 20 April 2004. *Biological Opinion for Los Angeles International Airport Master Plan, City of Los Angeles, Los Angeles, County, California*. Prepared for: U.S. Department of Transportation, Federal Aviation Administration, P.O. Box 92007, Los Angeles, CA 90009.

[29] U.S. Fish and Wildlife Service. 20 April 2004. *Biological Opinion for Los Angeles International Airport Master Plan, City of Los Angeles, Los Angeles, County, California*. Prepared for: U.S. Department of Transportation, Federal Aviation Administration, P.O. Box 92007, Los Angeles, CA 90009.

[30] Arnold, R.A. 1986. "Habitat Enhancement Techniques for the El Segundo Blue Butterfly: An Urban Endangered Species." In *Integrating Man and Nature*, in the *Metropolitan Environment, Proceeding of a National Symposium on Urban Wildlife*. Edited by L. W. Adams and D.L. Leedy. Columbia, MD: National Institute for Urban Wildlands.

[31] U.S. Fish and Wildlife Service. 1998. *Recovery Plan for the El Segundo Blue Butterfly (*Euphilotes abttoides allyni*)*. Portland, OR: U.S. Fish and Wildlife Service.

TABLE 2.5-1
EL SEGUNDO BLUE BUTTERFLY POPULATION FIGURES

Year	Acreage	Block	Historic Transect	Estimated Population
1995	200	Not performed	1,240	Not performed
1996	200	2,063	1,455	7,092 to 31,000
1997	200	723	126	Not performed
1998	200	4,069	2,129	16,978 to 87,000
1999	200	2,125	1,741	9,867 to 39,000
2000	200	2,933	2,104	18,000 to 69,500
2001	200	4,736	2,652	24,134 to 79,109
2002	200	2,750	1,236	17,789 to 54,002
2003	200	5,803	2,688	34,737 to 109,814

NOTES:
[1] Block counts are peak numbers taken during one week of the butterfly's flight season (June 1 through September 30).
[2] Historic transects represent numbers of butterflies observed along specific transect lines crossing the ESB Habitat Restoration Area during the entire flight season.
[3] Prior to 1996, only historic transect counts were performed. Block counts began during the 1996 flight season.

Peak numbers of 5,803 individuals were recorded as a result of block counts conducted in 2003. The total population estimate, which was extrapolated from the 2003 block counts, ranged from 34,737 to 109,814 ESB.[32] The Dunes are divided into 87 subsites for the purpose of maintenance and monitoring activities. During 2003, ESB were observed within 50 of the 87 subsites.[33] Previous counts in 1999 rendered estimates of total population ranging from 9,867 to 39,000.[34] Counts in 2000 showed that the butterfly population increased significantly when compared to 1999. Similarly, counts of ESB in 2001 rendered an increased estimate of the total population, ranging from 24,134 to 79,109 individuals since 2000. Counts in 2002 rendered estimates of the total population ranging from 17,789 to 54,002, with a peak number of 2,750 individuals recorded as a result of block counts conducted in that year.[35] Population fluctuations of this magnitude are not unusual among insects, especially those that have a single generation per year. Indeed, several forest pest moths that are routinely monitored can exhibit a 10-fold increase in population numbers within a few generations or may decline just as rapidly.[36] Factors such as seasonal weather conditions, increased parasitism and predation, a higher incidence of disease, or a decline in foodplant numbers (or flowerhead numbers in the case of the ESB) may individually or collectively affect population numbers.

[32] Arnold, R.A. 2003. *Report of the El Segundo Blue Monitoring Activities in 2003 at the Los Angeles International Airport*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

[33] Los Angeles World Airports. 25 November 1998. Memorandum for the Record to Maurice Laham from Andrew Huang: Estimate of the 1998 LAX El Segundo Blue Butterfly Population.

[34] Arnold, R.A. 1983. "Ecological Studies of Six Endangered Butterflies (*Lepidoptera:Lycaenidae*); Island Biogeography, Patch Dynamics, and the Design of Habitat Preserves." *Entomology*, *99*: 153.

[35] Arnold, R.A. 2003. *Report of the El Segundo Blue Monitoring Activities in 2003 at the Los Angeles International Airport*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

[36] Varley, G.C., G.R. Gradwell, and M.P. Hassell. 1974. *Insect Population Ecology*. Berkeley, CA: University of California Press.

Status and Distribution

ESB are currently found exclusively within the Dunes. The Dunes complex historically covered an area of about 4.5 square miles, stretching from the mouth of Ballona Creek south to the Palos Verdes Peninsula. The Dunes were bordered on the west by the Pacific Ocean and continue inland approximately 0.5 mile. Museum specimens of ESB were collected in El Segundo, Redondo Beach, Manhattan Beach, and on the Palos Verdes Peninsula.[37] Recently, ESB have been found at the Ballona Wetlands, Dunes, Chevron Butterfly Preserve, and Malaga Cove. Each of these areas represents a recovery unit within the ESB Recovery Plan.[38]

The Ballona recovery unit is the northern-most unit and extends south to Westchester Boulevard. It contains two sites with suitable habitat for ESB. The Ballona Wetlands have a degraded dune with 7 acres of degraded habitat. A small portion of the 7 acres was planted with native vegetation and coastal buckwheat plants, but was later altered by a lagoon restoration project. Another privately owned 6-acre site in the Ballona Wetlands is where one male was observed in 1987.[39]

The LAX recovery unit is the largest remaining undeveloped coastal sand dune system in Southern California.[40] It also contains what is believed to be the largest remaining population of ESB. Population estimates for ESB vary greatly from year to year, and there is disagreement regarding the survey methods employed to estimate the ESB population. The 2002 survey at the Dunes estimated the population to be between 52,000 and 54,000 ESB.[41] The 2003 population estimate was between 105,000 and 109,000.[42] It is quite possible that the current population estimate model used by LAX has significantly overestimated the size of the ESB population.[43] The 2002 survey also noted that the coast buckwheat population is declining and showed that the current rate of recruitment would not be sufficient to replace the growing number of senescent plants. The size of the population and the status of the Dunes as a preserve for ESB and other coastal dune–dependent species make this recovery unit the cornerstone for the survival and recovery of ESB.[44]

The El Segundo recovery unit is immediately south of the Dunes unit. The unit contains 1.6 acres owned and managed by the Chevron Corporation. The estimated number of ESB and host plants in 2002 was between 9,500 and 9,900 ESB and 907 coast buckwheat host plants.[45] The population

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[37] Donahue, J.P. 1975. *A Report on the 24 Species of California Butterflies Being Considered for Placement on the Federal Lists of Endangered or Threatened Species*. (Unpublished report.) Los Angeles: Natural History Museum of Los Angeles County.

[38] U.S. Fish and Wildlife Service. 1998. *Recovery Plan for the El Segundo Blue Butterfly (*Euphilotes abttoides allyni*)*. Portland, OR: U.S. Fish and Wildlife Service.

[39] Mattoni, R.H.T. 1992. "The Endangered El Segundo Blue Butterfly." *Journal of Research Lepidoptera*, *29*: 277–304.

[40] U.S. Fish and Wildlife Service. 1998. *Recovery Plan for the El Segundo Blue Butterfly (*Euphilotes abttoides allyni*)*. Portland, OR: U.S. Fish and Wildlife Service.

[41] Arnold, R.A. 2002. *Report of the El Segundo Blue Monitoring Activities in 2002 at the Los Angeles International Airport*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

[42] Arnold, R.A. 2003. *Report of the El Segundo Blue Monitoring Activities in 2003 at the Los Angeles International Airport*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

[43] Longcore, T. and C. Rich. 2001. *Review of Biological Resources Analysis in LAX Master Plan Draft Environmental Impact Statement/Environmental Impact Report*.

[44] U.S. Fish and Wildlife Service. 1998. *Recovery Plan for the El Segundo Blue Butterfly (*Euphilotes abttoides allyni*)*. Portland, OR: U.S. Fish and Wildlife Service.

[45] Arnold, R.A. 2002. *Report of the El Segundo Blue Monitoring Activities in 2002 at the Chevron Butterfly Preserve*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

estimates for ESB on the Chevron El Segundo Blue Butterfly Preserve use the same method as the Dunes and may overestimate the number of butterflies on the site. The host plant population had declined 23 percent from the previous year.[46] There is also a 30-acre site east of the Hyperion sewage treatment plant that lies between the Dunes and the Chevron site. There was one butterfly observed on this site in the 1980s.[47] The Hyperion site may serve as a movement corridor between the Dunes and the Chevron site.

The Torrance recovery unit is the southernmost unit, extending south to the Palos Verdes Peninsula. There are several scattered areas along the beach bluffs that support coast buckwheat and ESB. These areas are scattered and located primarily on private property. A Safe Harbors Agreement has been implemented for this recovery unit. The agreement, administered by the Urban Wildlands Group, allows private landowners to carry out some low-impact shoreline development while maintaining and improving ESB habitat.[48]

California Silvery Legless Lizard

Distribution

The California silvery legless lizard *(Anniella pulchra pulchra)* is a federal Species of Concern and a state Species of Special Concern. This species is known to occur in the coastal ranges from San Francisco to northwest Baja California, Mexico, including the floor of the San Joaquin Valley, the west slope of the southern Sierra, the Tehachapi Mountains, and the mountains of Southern California below 6,000 feet in elevation.[49,50]

The CNDDB lists 14 occurrences of this species throughout the California; all are presumed extant. Occurrences of this species are recorded in the following counties: Contra Costa, Merced, Madera, San Benito, Fresno, San Luis Obispo, San Bernardino, Santa Barbara, Los Angeles, Riverside, and San Diego.[51] The three closest occurrences include Leona Valley, along Elizabeth Lake Pine Canyon Road within the County of Los Angeles in 1995 (Ritter Ridge quadrangle); 4.4 miles west of Lancaster within the County of Los Angeles in 1988 (Lancaster West quadrangle); and approximately 4 miles south-southwest of Lancaster within the County of Los Angeles in 1988 (Lancaster West quadrangle).

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[46] Arnold, R.A. 2002. *Report of the El Segundo Blue Monitoring Activities in 2002 at the Chevron Butterfly Preserve*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

[47] Mattoni, R.H.T. 1992. "The Endangered El Segundo Blue Butterfly." *Journal of Research Lepidoptera, 29*: 277–304.

[48] U.S. Fish and Wildlife Service. 20 April 2004. *Biological Opinion for Los Angeles International Airport Master Plan, City of Los Angeles, Los Angeles, County, California*. Prepared for: U.S. Department of Transportation, Federal Aviation Administration, P.O. Box 92007, Los Angeles, CA 90009.

[49] California Department of Fish and Game. 2001. *Rarefind 2: California Natural Diversity Database*. Sacramento: State of California Resource Agency.

[50] California Department of Fish and Game. 1998. *California's Wildlife, Volume I: Amphibians and Reptiles*. Sacramento: California Department of Fish and Game.

[51] California Department of Fish and Game. 2001. *Rarefind 2: California Natural Diversity Database*. Sacramento: State of California Resource Agency.

Description

This species silvery, beige, or gray above, with a dark middorsal line. It has a yellow ventral side with thin lengthwise lines between the scale rows and very shiny skin. The species is approximately 10.9 to 17.5 centimeters in length. [52]

Habitat Association

It can be found along the Pacific slope of the coastal mountains, inhabiting areas with sandy or loose, loamy soils under the sparse vegetation of beaches, riparian, oak woodland, coastal sage scrub, chaparral, and alluvial fans of the coastal scrub;[53] It requires sandy soil with leaf litter.

Space Use

Presently, there is no data on the size of the species home range. There is also no evidence for territorial defense or predictable seasonal movements.[54] It forages in the leaf litter during the day, and it may forage on the surface at dusk or at night.[55]

Reproduction

Little is known about the reproduction of the species. It is known that it is live-bearing, mating occurs in the late spring or early summer, and they have 1 to 4 young born between September and November.[56]

Food Habits

This species eats insect larvae, small adult insects, and spiders, and they usually forage at the base of shrubs or other vegetation on the surface or in the leaf litter.[57]

Factors Affecting Distribution

The California silvery legless lizard is primarily threatened by habitat loss and fragmentation occurring in conjunction with urban and agricultural development. Development, flood control measures, habitat isolation, mining, and livestock grazing threaten eight of the known occurrences.

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[52] Stebbins, R.C. 1985. *A Field Guide to Western Reptiles and Amphibians*. Boston: Houghton Mifflin Company.

[53] California Department of Fish and Game. 2001. *Rarefind 2: California Natural Diversity Database*. Sacramento: State of California Resource Agency.

[54] California Department of Fish and Game. 1998. *California's Wildlife, Volume I: Amphibians and Reptiles*. Sacramento: California Department of Fish and Game.

[55] Stebbins, R.C. 1985. *A Field Guide to Western Reptiles and Amphibians*. Boston: Houghton Mifflin Company.

[56] Stebbins, R.C. 1985. *A Field Guide to Western Reptiles and Amphibians*. Boston: Houghton Mifflin Company.

[57] California Department of Fish and Game. 1988. *California's Wildlife, Volume I: Amphibians and Reptiles*. Sacramento: California Department of Fish and Game.

San Diego Horned Lizard

Distribution

The San Diego horned lizard (*Phrynosoma coronatum blainvillii*) is both a federal and state Species of Special Concern.[58] It was historically distributed from the Transverse Range in the Counties of Kern, Santa Barbara, Ventura and Los Angeles southward throughout the peninsular ranges of Southern California to Baja California, Mexico, as far south as San Vicente. In California, this taxon ranges from the transverse ranges to the Mexican border, west of the deserts; however, it occurs at scattered sites along the extreme western desert slope of the peninsular ranges.[59] There is also an isolated population in Siskiyou County.[60]

The CNDDB lists 455 known occurrences of the San Diego horned lizard throughout the State of California, all of which are presumed extant, with the exception of the following: three occurrences in San Bernardino County are extirpated; three occurrences in Riverside County are extirpated; four occurrences in the County of Los Angeles are extirpated, and seven occurrences are listed as possibly extirpated; and two occurrences in San Diego County that are listed as possibly extirpated.[61] The nearest known occurrence to the Specific Plan Area includes a sighting at Topanga Canyon, 2.5 miles southwest of Woodland Hills in 1986 (Calabasas quadrangle), which is approximately 5 to 8 miles south of the Specific Plan Area; a sighting 1 mile west of Woodland Hills and north of Highway 101 in 1954 (Calabasas quadrangle), which is approximately 5 to 8 miles east of the Specific Plan Area; and a sighting in Stunt Ranch, 4 miles south of Calabasas in the Santa Monica Mountains in 1953 (Malibu Beach quadrangle), which is approximately 7 to 10 miles south of the Specific Plan Area. Other occurrences of this taxon are distributed throughout the Counties of Kern, San Bernardino, Los Angeles, Orange, Riverside and San Diego.

Description

The San Diego horned lizard is a member of the family Iguanidae. It is a large, dorsoventrally flattened lizard with five backwardly projecting head spines (four large, lateral, sometimes curved, and one moderate-sized median). The lizard has a large shelf above each eye, terminating a backwardly projecting, spine-like, scale (postrictal); large, convex, smooth scales on the forehead (frontals); and two parallel rows of pointed scales, fringing each side of the body.[62] The ground color above is yellowish or reddish gray, usually darker laterally. The head is more or less uniform without dark marks, yellowish or slate-colored, distinctly lighting on snout. The larger spines are often reddish. There are no distinct bands on the legs. The ventral surfaces are white or cream, usually mottled to a varying degree with dark brown. Ventral surfaces of limbs and tail are unmarked. All others of this genus, with the exception of the closely related California horned lizard, either have very short horns on the head, the tympanum hidden, a single series of peripheral

[58] California Department of Fish and Game. 2001. *RareFind 2: A Database Application for the Use of the California Department of Fish and Game's Natural Diversity Database*. Sacramento: California Department of Fish and Game.

[59] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

[60] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). November 1990. *California Statewide Wildlife Habitat Relationship Systems. Volume I: Amphibians and Reptiles*. Sacramento: State of California Resources Agency.

[61] California Department of Fish and Game. 2001. *RareFind 2: A Database Application for the Use of the California Department of Fish and Game's Natural Diversity Database*. Sacramento: California Department of Fish and Game.

[62] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

spines (or none), keeled ventrals, or only a single longitudinal row of enlarged throat scales on each. Any of these characteristics will separate them from the San Diego horned lizard.[63]

Habitat Association

The San Diego horned lizard is terrestrial and found in valleys, mesas, and foothills. They are found in a wide variety of habitats, including coastal sage, annual grassland, chaparral, oak woodland, riparian woodland, valley-foothill hardwood, coniferous forests, pine-cypress, and juniper habitats. In the foothill and mountain habitats covered with dense brush or other vegetation, San Diego horned lizards are largely restricted to areas with pockets of open microhabitat, a habitat structure that can be created by natural events such as fire and floods or human created disturbances such as livestock grazing, fire breaks, and roads.[64] They are chiefly found below 2,000 feet in Northern California and 3,000 feet in Southern California.[65]

Space Use

The San Diego horned lizard is diurnal and most activity occurs during the middle of the day in the spring and fall but is restricted to morning and late afternoon during mid-summer. Nocturnal activity may occur during particularly warm periods. Fall and winter are inactive periods in most areas.[66] They emerge from hibernation in late March and are surface active mostly during April through July, after which time most adults aestivate. They then reappear again briefly in August, disappearing into overwintering sites from late August through early October, with the variation depending on elevation and perhaps local conditions.[67] Pronounced seasonal movement or migration has not been reported. Habitat requirements, such as sites for courtship and display, egg-laying, and hibernation, are apparently found within the normal area of activity.

The San Diego horned lizard displays a distinctive sequence with regards to its daily diurnal activity. Frequently, just before sunrise, they emerge from their burial sites in the substrate and later move into a position where the first rays of the sun will allow them to bask. As temperatures warm, they thermoregulate by either shifting the orientation of their bodies relative to the sun or moving in and out of the shade. By late morning, body temperatures are elevated enough to allow the horned lizards to feed or engage in territorial and sexual behavior. During the warmest part of the day, the San Diego horned lizard covers itself with loose soil. In the later afternoon, individuals reemerge from the substrate and resume full activities. The sequence of morning behavior is repeated in reversed order prior to when individuals rebury themselves in the substrate for the night.

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[63] Smith, H.M. 1946. *Handbook of Lizards / Lizards of the United States and Canada*. Ithaca, NY, and London: Comstock Publishing Associates, A Division of Cornell University Press.

[64] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

[65] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). November 1990. *California Statewide Wildlife Habitat Relationship Systems. Volume I: Amphibians and Reptiles*. Sacramento: State of California Resources Agency.

[66] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). November 1990. *California Statewide Wildlife Habitat Relationship Systems. Volume I: Amphibians and Reptiles*. Sacramento: State of California Resources Agency.

[67] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

The San Diego horned lizard relies on camouflage for protection and often hesitates to move at the approach of a predator. Leopard snakes, sidewinders, striped whipsnakes and other snakes, loggerhead shrikes, and hawks have all been reported as predators of horned lizards.[68]

Reproduction

The reproductive season for the San Diego horned lizard varies from year to year and geographically depending on local conditions.[69] Males and females require two to three years to reach the minimum size for sexual maturity.[70] The coast horned lizard, of which the San Diego horned lizard is a subspecies, is apparently unique among lizards in using a belly-to-belly position during copulation.[71] It has been suggested that in mating the male turns the female over on her back. As with many lizards, the male bites and holds the skin at one side of the female's neck.[72]

They are oviparous and lay one clutch of 6 to 17 eggs each year from May through early July. No data exists suggesting that this taxon can produce more than one clutch per year. Incubation requires approximately two months and hatchlings first appear in late July and early August.[73]

Food Habits

Horned lizards forage on the ground in open areas, usually between shrubs and often near ant nests. San Diego horned lizards have an insectivorous diet that consists mostly of native harvester ants (*Pogonmyrmex* spp.). Ants can make up over 90 percent of the diet items of the San Diego horned lizard, but the diet of this taxon may vary considerably with locality, since it is an opportunistic feeder that will eat other insects, especially termites, beetles, flies, wasps, and grasshoppers when they are abundant.[74]

[68] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). November 1990. *California Statewide Wildlife Habitat Relationship Systems. Volume I: Amphibians and Reptiles*. Sacramento: State of California Resources Agency.

[69] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). November 1990. *California Statewide Wildlife Habitat Relationship Systems. Volume I: Amphibians and Reptiles*. Sacramento: State of California Resources Agency.

[70] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

[71] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). November 1990. *California Statewide Wildlife Habitat Relationship Systems. Volume I: Amphibians and Reptiles*. Sacramento: State of California Resources Agency.

[72] Smith, H.M. 1946. *Handbook of Lizards / Lizards of the United States and Canada*. Ithaca, NY, and London: Comstock Publishing Associates, A Division of Cornell University Press.

[73] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

[74] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

Factors Affecting Distribution

The relatively specialized diet and habitat requirements, a high degree of site fidelity, and a defensive behavior based on crypsis make the San Diego horned lizard vulnerable. This taxon was heavily exploited for the curio trade at the turn of the century and later by biological supply companies and the pet trade before commercial collecting was banned in 1981. These factors, coupled with extensive habitat loss from agriculture and urbanization, have been the main reasons cited for the decline of this taxon.[75] General loss of habitat is another major factor affecting distribution. Habitat loss can be attributed to development and recreational use such as camping and off-road vehicle use.[76]

Perhaps the most insidious threat to the San Diego horned lizard is the progressive elimination of its food base by exotic ants that have invaded upland habitats. Argentine ants build nests in disturbed soils and expand into adjacent areas, eliminating native ant colonies as development continues.

Lewis' Evening Primrose

Distribution

Lewis' evening primrose (*Camissonia lewisii*) is a small annual with a California Native Plant Society (CNPS) listing of "3," which means it is rare and more information on the plant is needed. Lewis' evening primrose is found in the Counties of San Diego, Orange, and Los Angeles, and in Baja California, Mexico, from 0 to 1,300 feet in elevation. Lewis' evening primrose is believed to be severely declining in Southern California and likely throughout its range.[77] The genus is notoriously difficult to differentiate, since the species can superficially mimic the relatively common *Camissonia bistorta* or *Camissonia micrantha;* therefore, some of the reported inland locales may represent misidentifications.[78]

Reiser provides the greatest description of locations of the Lewis' evening primrose in and around San Diego County, including the coastal strand at Border Field, Spooner's Mesa in the Tijuana Hills, the western edge of Otay Mesa, and a hillside abutting the Penasquitos Lagoon.[79] Herbarium species have been reported to come from Balboa Park, Otay Lakes Road, Silver Strand, San Luis Rey, Crown Point, the south end of San Diego Bay, and near Old Town. Within the County of Los Angeles, the species has been reported at Point Dume (in the Santa Monica Mountains) and the Dunes.

Description

Lewis' evening primrose is a member of the evening primrose family. The small stature of the plant and sandy or clay microhabitat near the beach are typical of this species. Lewis' evening primrose

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[75] Jennings, M.R. and M.P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Prepared for: California Department of Fish and Game, Island Fisheries Division, 1701 Nimbus Road, Rancho Cordova, CA 95701.

[76] California Department of Fish and Game. 2001. *RareFind 2: A Database Application for the Use of the California Department of Fish and Game's Natural Diversity Database*. Sacramento: California Department of Fish and Game.

[77] California Native Plant Society. 2004. Inventory of Rare and Endangered Plants. Available at: http://www.cnps.org/inventory.

[78] Reiser, C.H. 1994. Rare Plants of San Diego County. Available at: http://sandiego.sierraclub.org/rareplants/.

[79] Reiser, C.H. 1994. Rare Plants of San Diego County. Available at: http://sandiego.sierraclub.org/rareplants/.

is a small plant with simple leaves that are low to the ground in a rosette pattern. The Lewis' evening primrose has yellow fading to red petals fused with the sepals from 1.5 to 4 millimeters, with 1 to 2 dots near the base of the sepal.[80]

Habitat Association

This small annual grows in sandy or clay substrates near the beach, typically on beach bluffs. However, this small plant has been reported in numerous coastal habitat types, particularly coastal scrub and coastal dunes, and valley/foothill grasslands. The coastal habitat types typically consist of species such as California sagebrush (*Artemisia californica*), sages (*Salvia mellifera, Salvia leucophylla, Salvia apiana*), California buckwheat (*Eriogonum fasciculatum*), dune buckwheat (*Eriogonum latifolium*), chamise (*Adenstoma fasciculatum*), coast goldenbush (*Isocoma menziesii*), coyote brush (*Baccharis pilularis*), and lemonade berry (*Rhus integrifolia*). The grassland habitats now typically include many nonnative annual species such as ripgut (*Bromus diandrus*), foxtail chess (*Bromus madritensis*), wild oats (*Avena fatua*), and Italian rye grass (*Lolium multiflorium*), in addition to the native perennial needle grasses such as Foothill needlegrass (*Nassella lepida*), nodding needlegrass (*Nassella cernua*), and purple needlegrass (*Nassella puchra*).[81]

Reproduction

The Lewis' evening primrose has been observed to flower from early spring through early summer and is self propagating. The dull brownish quadrangular seed capsule is 0.7 to 0.8 millimeters in size.[82] Additional life history information is required of this rare species.

Factors Affecting Distribution

This species is extremely rare and maybe approaching extirpation in the U.S. Some of the reported locales for San Diego County are now within the boundaries of the urbanized coastal cities where they are likely extirpated. More information is required to identify specific factors affecting distribution.

Burrowing Owl

Distribution

The burrowing owl is both a federal and state Species of Concern. They are found from southern Canada to southern South America. The burrowing owl is resident largely throughout the southern U.S., with several populations inhabiting the gulf coast of Louisiana and the Florida panhandle.[83] In Southern California, burrowing owls are common in the Imperial Valley, rather common in agricultural areas within the Colorado River district, and generally scarce and decreasing elsewhere.[84] Along coastal Southern California, the burrowing owl distribution is greatly reduced and localized.

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[80] Hickman, J.C., ed. 1993. *The Jepson Manual: Higher Plants of California.* Berkeley, CA: University of California Press.

[81] Sawyer, J.O., and T. Keeler-Wolf. 1995. *A Manual of California Vegetation*. Sacramento: California Native Plant Society.

[82] California Native Plant Society. 2004. Inventory of Rare and Endangered Plants. Available at: http://www.cnps.org/inventory.

[83] Johnsgard, P.A. 1988. *North American Owls*. Washington, DC: Smithsonian Institute Press.

[84] Garrett, K. and J. Dunn. 1981. *Birds of Southern California: Status and Distribution*. Los Angeles: The Artesian Press.

A query of the CNDDB returned no records for burrowing owl in the Calabasas quadrangle. However, the CNDDB lists 395 occurrences of this species within the State of California, including both those that are extant and extirpated. Occurrences of this species occur in the Counties of Lassen, Tehama, Glenn, Butte, Colusa, Sutter, Placer, Sonoma, Napa, Yolo, Marin, Solano, Sacramento, Contra Costa, San Joaquin, Alameda, Stanislaus, Santa Cruz, Santa Clara, Merced, Madera, Fresno, Inyo, Monterey, Kings, Tulare, San Luis Obispo, Kern, San Bernardino, Ventura, Los Angeles, Orange, Riverside, San Diego, and Imperial. The CNDDB did return records in quadrangles adjacent to the Calabasas quadrangle, focused in the Counties of Ventura and Los Angeles. The three closest occurrences to the Specific Plan Area are upper Dry Canyon, 2 miles north of Simi Valley and approximately 10 miles northwest of the Specific Plan Area (Santa Susana quadrangle) in 1990; Playa del Rey near Culver Boulevard and Jefferson Boulevard, approximately 25 miles southeast of the Specific Plan Area (Venice quadrangle), in 1981; and the south side of Anaverde Valley, 2 miles west of the Avenue S Interchange on Highway 14 in Palmdale and approximately 35 miles northeast of the Specific Plan Area (Ritter Ridge quadrangle), in 1999.

Description

Burrowing owls are small- to medium-sized raptors that are characterized by their use of burrows for nesting. Adults are between 7.5 to 10 inches in length and weigh approximately 5 ounces. They have relatively long legs, a distinct yellow iris, brown plumage with buffy white spots on the back, and a white underside with brown barring.[85]

Habitat Association

Burrowing owls prefer dry, open, treeless shortgrass plains, often in areas with little or no vegetation, which are often associated with burrowing mammals and rodents. Burrowing owls can also be found on golf courses, at airports, in cemeteries, in vacant lots in residential areas, and along shoulders of roadways.[86]

Space Use

Typically, burrowing owls occupy abandoned squirrel or rodent burrows and enlarge them by kicking backward with their feet and digging with their bills.[87] Burrowing owls typically have a nesting burrow and several alternate burrows used for cover and predator protection. They also often line their nest burrow entrances with dried cow or horse manure, which is believed to mask their scent. Burrowing owls are active during the day and night. Typically, this species perches in open sunlight in the mornings then retreats to shade or a burrow during hot afternoons.[88]

Reproduction

Breeding usually begins during March or April in California, and during this time, burrowing owls can be observed foraging and roosting near their burrows. Males begin displaying in front of the

[85] Sibley, D.A. 2000. *National Audubon Society: The Sibley Guide to Birds.* New York: Alfred A. Knopf, Inc.

[86] Small, A. 1994. *California Birds: Their Status and Distribution*. Vista, CA: Ibis.

[87] Small, A. 1994. *California Birds: Their Status and Distribution*. Vista, CA: Ibis.

[88] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). 1990. *California's Wildlife, Volume II: Birds*. Sacramento: State of California Resources Agency.

nest burrow to attract a female. Clutch size averages from five to six eggs, perhaps greater in the north. Females incubate exclusively for approximately 28 to 29 days. Males bring food to the entrance of the burrow where the female takes the food and feeds the young. The male rarely enters the nesting burrow. Young emerge from the nest burrow after approximately two weeks, fly by approximately four weeks, and begin dispersing in late August and September.[89]

Food Habits

Burrowing owls primarily feed on insects such as grasshoppers, small mammals, rodents, reptiles, other small birds, and carrion. This species generally hunts from a perch and hovers, dives, and hops after the prey.[90]

Factors Affecting Distribution

They occur primarily in agricultural and grassland areas of interior and coastal valleys and in fewer numbers on bluffs along the immediate coast, but they are resident on the Channel Islands. Burrowing owls from more northern areas occasionally migrate into southern and coastal regions of Southern California during the winter. Preliminary data from the Los Angeles County Breeding Bird Atlas indicate records of several breeding pairs of burrowing owls in the Antelope Valley, but no breeding has been documented on the coastal slope of the County of Los Angeles for records between 1995 and 1997.

[89] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). 1990. *California's Wildlife, Volume II: Birds*. Sacramento: State of California Resources Agency.

[90] Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). 1990. *California's Wildlife, Volume II: Birds*. Sacramento: State of California Resources Agency.

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Arnold, R.A. 2002. *Report of the El Segundo Blue Monitoring Activities in 2002 at the Chevron Butterfly Preserve*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

Arnold, R.A. 2003. *Report of the El Segundo Blue Monitoring Activities in 2003 at the Los Angeles International Airport*. Contact: Entomological Consulting Services, LTD., 104 Mountain View Court, Pleasant Hill, CA 94523-2188.

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