Habitat Restoration Plan for the

Abalone Cove Ecological Reserve in the Palos Verdes Nature Preserve




JUNE 2013

PREPARED FOR

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Prepared for:

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1.0 INTRODUCTION

This Habitat Restoration Plan (HRP) was prepared for the Abalone Cove Ecological Reserve (Abalone Cove ER) within the Palos Verdes Nature Preserve (PVNP) located in the City of Rancho Palos Verdes, California (Figures 1 and 2). The Abalone Cove ER is one of ten ecological reserves within the approximately 1,400-acre PVNP. The PVNP is owned by the City of Rancho Palos Verdes and managed by the Palos Verdes Peninsula Land Conservancy (PVPLC).

The PVPLC obtained joint grant funding from the National Fish and Wildlife Foundation and the Santa Monica Bay Restoration Foundation to implement this HRP at the Abalone Cove ER.

This HRP discusses implementing restoration of approximately 4 acres of coastal sage scrub, mixed coastal scrub and coastal bluff scrub in a disturbed area of the Abalone Cove ER currently dominated by non-native plant species. The HRP addresses restoration design, planting recommendations, installation procedures, maintenance requirements, monitoring methodology, and performance standards.

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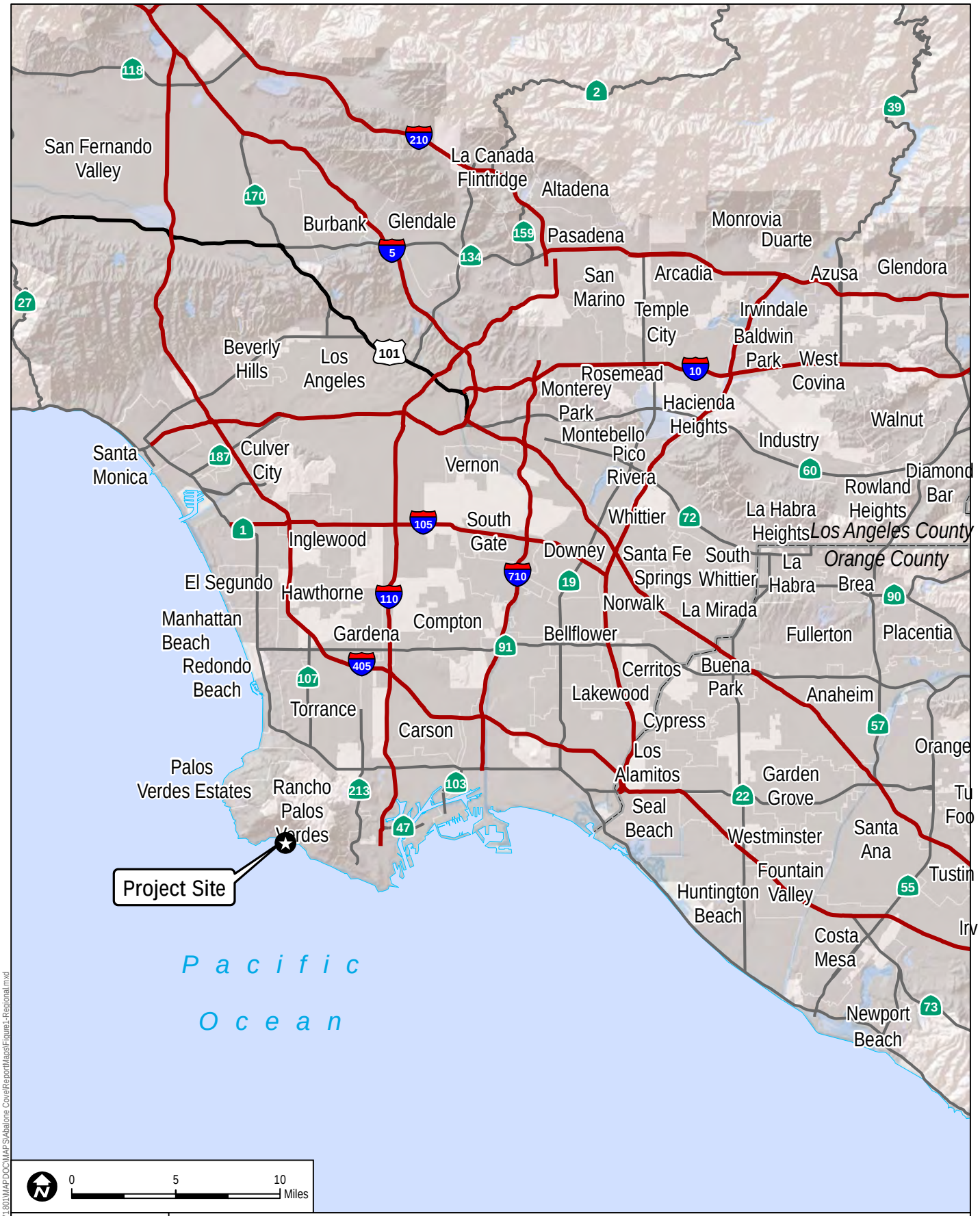

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FIGURE 1

Regional Map

Habitat Restoration Plan for the Abalone Cove Ecological Reserve in the Palos Verdes Nature Preserve

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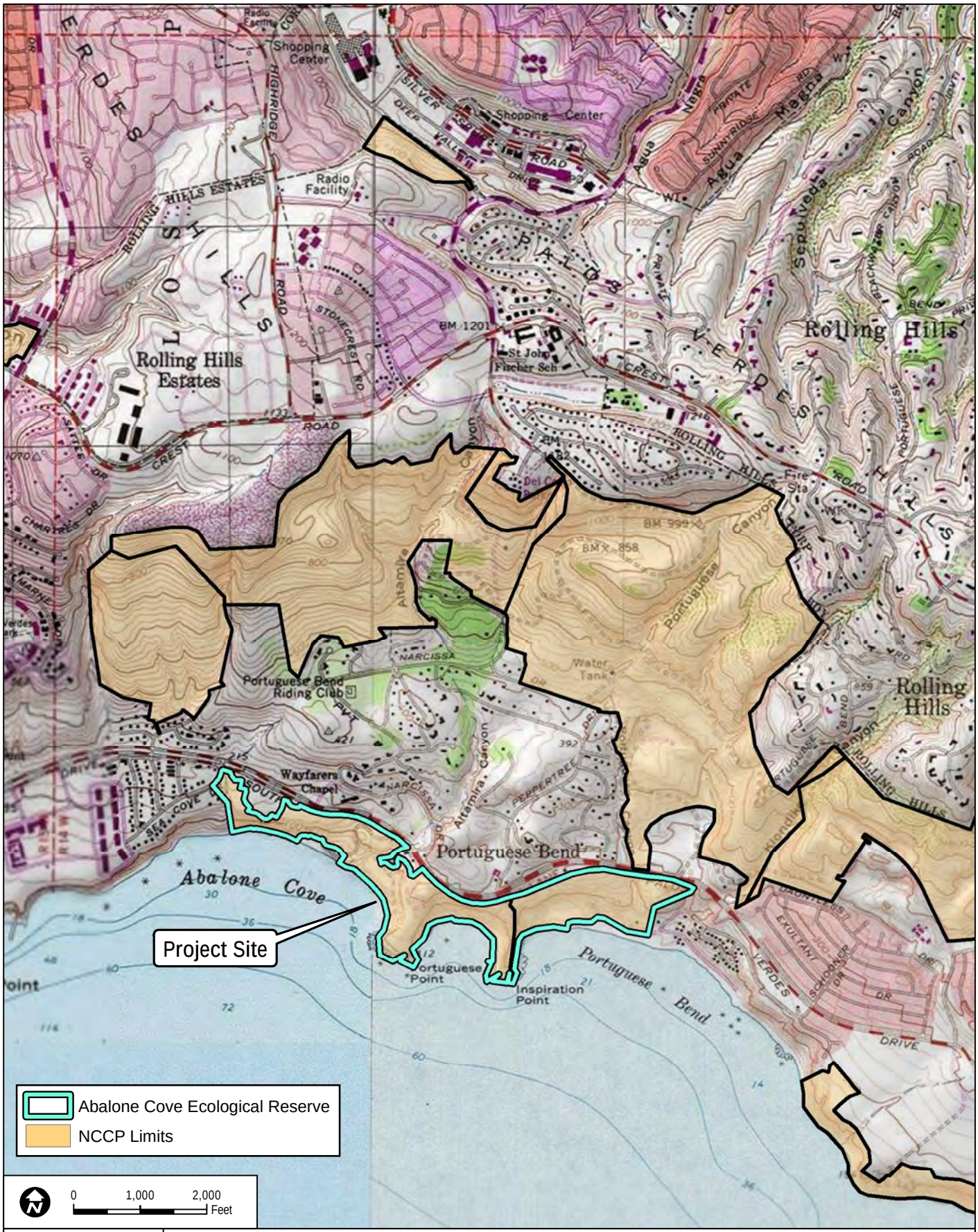

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SOURCE: USGS 7.5-Minute Redondo Beach, San Pedro Series Quadrangles.

FIGURE 2
Vicinity Map

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Habitat Restoration Plan for the Abalone Cove Ecological Reserve in the Palos Verdes Nature Preserve

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2.0 EXISTING CONDITIONS

2.1 Site Description

The Abalone Cove ER is located on the southern portion of the Palos Verdes Peninsula. The entire Abalone Cove ER is approximately 64 acres and is located along the shoreline of the peninsula. There are two promontories, Portuguese and Inspiration Points, which bound the cove within the Abalone Cove ER. The proposed restoration areas are located just upslope and west of Portuguese Point.

2.2 Vegetation Communities

Plant communities and land covers within the Abalone Cove ER are typical of plant communities found in this region, exhibiting some level of prior disturbance, but containing elements of the native plant communities. Vegetation mapping of the reserve was prepared by PVPLC and the California Native Plant Society (CNPS) (PVPLC and CNPS 2010). According to the vegetation mapping conducted by PVPLC and CNPS, the proposed restoration areas consist of California coastal scrub (Restoration Area 1), iceplant/orchard (Restoration Area 2), and urban (Restoration Area 3) (Figure 3). The existing vegetation communities present at each of the proposed restoration areas are described further below.

Restoration Area 1: While the PVPLC and CNPS mapping shows this area as California coastal scrub, it is composed almost entirely of non-native plant species, including predominantly non-native annual grasses, black mustard (*Brassica nigra*) and sourclover (*Melilotus indica*) (Figure 4; Photos 1 and 2). A few native lemonadeberry (*Rhus intergrifolia*), coyote brush (*Baccharis pilularis*), and California brittlebush (*Encelia californica*) shrubs are present, but the area is substantially disturbed. There are some existing access roads leading to utilities within the area, as well as a trail that is located along the upper edge of the coastal bluff.

Restoration Area 2: This area was mapped by PVPLC and CNPS as Vancouverian Coastal Dune and Bluff because of the presence of hottentot fig (*Carpobrotus edulis*). While hottentot fig occurs at this location, the predominant species is red-flowered iceplant (*Malephora crocea*). In addition to hottentot fig and red-flowered iceplant, the area also supports several olive trees (*Olea europaea*) that were planted in rows, and non-native annual grasses, black mustard and a few remnant native shrubs (Figure 4; Photos 3 and 4).

Restoration Area 3: This area was mapped by PVPLC and CNPS as Urban, which includes areas that support exotic trees, shrubs and herbs (PVPLC and CNPS 2010). The area supports a stand of exotic pine trees (*Pinus* sp.). The understory is a mix of native and non-native species. Commonly occurring native species include toyon (*Heteromeles arbutifolia*), lemonadeberry,

California sagebrush (*Artemisia californica*) and coastal buckwheat *(Eriogonum cinereum)*. Predominant non-native species include scorpion vetch (*Coronilla valentina*), black mustard, coastal wattle (*Acacia cyclops*), myoporum (*Myoporum laetum*) and non-native annual grasses (Figure 4; Photos 5 and 6).

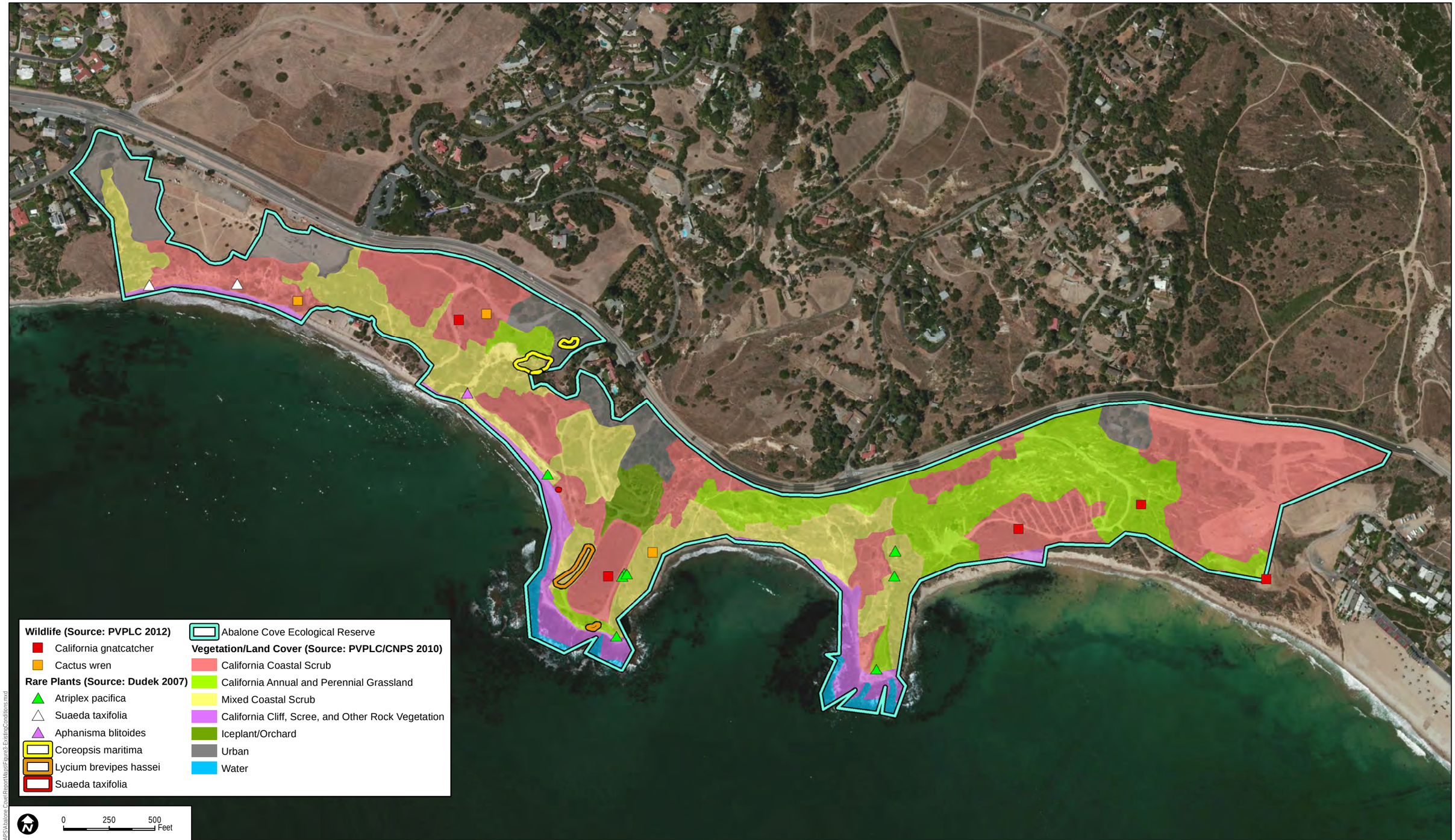
2.3 Geology and Soils

The Palos Verdes Peninsula is primarily an old marine terrace with relatively steep eroded canyons which drain southwesterly into the Pacific Ocean. The underlying geologic material consists of marine sedimentary and basaltic rocks. The area is seismically active, with active Palos Verdes and San Pedro fault zones that have caused the peninsula to uplift relative to the adjacent Los Angeles Basin and the offshore bedrock.

According to the Report and General Soil Map for Los Angeles County (USDA 1969), the soils within the Abalone Cove ER are composed of the Altamont-Diablo association (30–50% slopes). Soils of the Altamont-Diablo association occur on gently sloping to rolling foothills throughout the Los Angeles basin as far north as Point Dume. The Altamont-Diablo association is comprised of approximately 60% Altamont soils and 30% Diablo soils. Diablo soils are described to be 22–52 inches deep, are well drained, and have slow subsoil permeability. Altamont soils are described to be 24–36 inches deep, are well drained, and have slow subsoil permeability. They have dark brown, neutral, clay surface layers about 12 inches thick underlain by a brown, calcareous clay subsoil.

Site specific soil samples were collected from the proposed restoration areas. The soil samples were combined to create a composite sample representative of the general soil conditions on site. The composite sample was submitted to Wallace Laboratories for analysis of standard soil constituents, agricultural suitability, texture, and cation exchange capacity. Based on the results of the analysis, the soils are loam, with a fair infiltration rate and low/fair organic matter (Appendix A). The soils on site are slightly alkaline (pH = 7.79) and the salinity is high (ECe = 4.42). Sodium and chloride are very high, with 1,488 and 1,442 parts per million (ppm), respectively. Problems with plant growth and saline soils begin at 150 ppm and higher. The sodium adsorption ratio (SAR) is high at 13.8 (increasing problems start at 3). Additionally, major nutrients (nitrogen and phosphorus) are low.

Due to the soil chemistry described above, particularly with regard to saline soils, seed germination will be low or non-existent for many species, and container plants may struggle to become established and grow healthfully without amendments and supplemental watering. This HRP takes into consideration the soil chemistry issues in the proposed restoration approach, with a greater emphasis on establishing container plants, and less emphasis on establishing species from seeds.



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SOURCE: Palos Verdes Peninsula Land Conservancy, 2013; Bing Maps

FIGURE 3

Existing Conditions

Habitat Restoration Plan for the Abalone Cove Ecological Reserve in the Palos Verdes Nature Preserve

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Photo 1. Representative view of Restoration Area 1.

Photo 2. Invasive weeds at Restoration Area 1 (black mustard, clover and brome grasses predominate)

Photo 3. Representative view of Restoration Area 2.

Photo 4. Invasive weeds at Restoration Area 2 (iceplant, mustard and brome grasses predominate)

Photo 5. Representative view of Restoration Area 3.

Photo 6. Invasive weeds at Restoration Area 3 (scorpion vetch, mustard and brome grasses predominate)

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2.4 Special-Status Species

No special-status wildlife species have been documented within the specific areas identified for restoration in the HRP. However, coastal California gnatcatcher (*Polioptila californica californica*) (CAGN) has been observed in the past north of Restoration Area 1 and to the south of Restoration Area 2 (PVPLC 2012). Additionally, cactus wren (*Campylorhynchus brunneicapillus*) (CAWR) has been observed southeast of Restoration Area 2 and northwest of Restoration Area 1 (PVPLC 2012) (Figure 3).

Similarly, no special-status plant species have been documented within the specific areas identified for restoration in the HRP. However, five special-status plant species have been documented nearby, including aphanisma (*Aphanisma blitoides*), south coast saltscale (*Atriplex pacifica*), woolly sea-blite (*Suaeda taxifolia*), sea dahlia (*Coreopsis maritima*), and Santa Catalina Island desert-thorn (*Lycium brevipes* var. *hassei*) (Dudek and PVPLC 2007; CNPS 2013). In addition to special-status plant species, the host plant (coastal buckwheat) for the federally listed, endangered, El Segundo blue butterfly (*Euphilotes battoides allyni*) is known to occur in the vicinity of the proposed restoration areas. El Segundo blue butterfly has not been observed at the Abalone Cove ER.

2.5 Non-Native Invasive Species

Non-native species are abundant within the areas identified for restoration, and compose the majority of the existing vegetative cover. Controlling non-native species during the plant establishment phase will present a significant challenge, and should be prioritized as the most critical aspect of the maintenance program. The most predominant non-native species include black mustard, ripgut brome (*Bromus diandrus*), scorpion vetch, red-flowered iceplant, hottentot fig, and sourclover. These species, as well as additional non-native species observed on site, are provided in Table 1 with their associated rating in the California Invasive Plant Council's (Cal-IPC) Inventory of Invasive Plant Species (2013).

Table 1
Non-Native Plant Species and Associated Cal-IPC Ratings

High
Bromus madritensis ssp. *madritensis*—compact brome
Carpobrotus edulis—hottentot fig
Foeniculum vulgare—fennel
Moderate
Atriplex semibaccata—Australian saltbush
Avena barbata—slender oat
Bromus diandrus—ripgut brome
Centaurea melitensis—Maltese star-thistle
Glebionis coronaria—crowndaisy
Hordeum murinum—mouse barley
Mesembryanthemum crystallinum—common iceplant
Myoporum laetum—myoporum
Pennisetum setaceum—crimson fountaingrass
Euphorbia terracina—Geraldton carnation weed
Limited
Bromus hordeaceus—soft brome
Erodium cicutarium—redstem stork's bill
Marrubium vulgare—horehound
Olea europaea—olive
Ricinus communis—castorbean
Salsola tragus—prickly Russian thistle
Schinus terebinthifolius—Brazilian peppertree
None
**Acacia cyclops*—coastal wattle
Chenopodium murale—nettleleaf goosefoot
**Coronilla valentina* ssp. *glauca*—scorpion vetch
Malva parviflora—cheeseweed mallow
**Melilotus indicus*—annual yellow sweetclover
Nerium oleander—oleander
Pelargonium sp. — geranium
***Pinus* sp.—pine
Sonchus oleraceus—common sowthistle
**Tropaeolum majus*—nasturtium

*Note that while there are several species on the list that do not have a Cal-IPC rating for the state of California, that some of these species can be locally invasive. Species with an asterisk are considered to be moderately invasive within the region and should be aggressively controlled.
**Note that pine trees taller than 5 feet will be left in place and not removed. Seedlings and young saplings less than 5 feet tall will be removed.

3.0 RESTORATION PROGRAM

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed in order to re-establish or enhance biological functions and services. This HRP outlines the restoration implementation strategy for upland habitat at the Abalone Cove ER and proposes to provide for the restoration of approximately 2.0 acres of coastal sage scrub, 0.5 acre of coastal bluff scrub, and 2.0 acres of mixed coastal scrub habitat.

3.1 Restoration Site Goals and Objectives

The fragmented habitat existing in the proposed restoration locations limits wildlife use and provides opportunity for the further spread and establishment of invasive weed species. The planting of native coastal sage scrub, coastal bluff scrub, and mixed coastal scrub will provide contiguous native habitat that includes a mosaic of shrub cover that is resistant to the invasion of invasive weed species and provides increased nesting, cover and foraging opportunities for wildlife. In particular, the overarching goal of the restoration program is to provide habitat for coastal California gnatcatcher.

The habitat restoration program will focus on the creation of habitat for covered species with the objective of increasing the overall habitat carrying capacity for the target species populations. Coastal scrub restoration is intended to provide improved foraging habitat for resident and migrating wildlife species, and potential nesting and foraging habitat for target species such as the coastal California gnatcatcher, southern California rufous-crowned sparrow, Pacific pocket mouse, and other sensitive wildlife species. Achievement of the performance standards described herein would create suitable habitat for these species. However, occupation of the site by these species is not a requirement for successful project completion.

In addition to these broad goals, the following site-specific objectives for the Abalone Cove ER restoration site have been incorporated into this HRP in the interest of minimizing adverse impacts to biological resources:

- Avoid additional or unplanned disturbance to existing native habitats during implementation of the project construction and long-term maintenance activities;
- Prevent any impacts to sensitive plant or wildlife species during implementation of the project construction and long-term maintenance activities;
- Control non-native invasive weed species considered to be highly or moderately invasive on the Cal-IPC Invasive Plant Inventory (2013);

- Utilize erosion control measures in the form of "Best Management Practices" (BMPs) on the site as conditions necessitate;
- Reintroduce special-status plant species as components of the planting plans where feasible and as appropriate.

3.2 Habitats to be Established

The habitat restoration program consists of site preparation (primarily non-native plant species removal), native planting/seeding, supplemental watering, maintenance, and monitoring. Proposed planting for the target habitat types will focus primarily on the installation of container plants to achieve the project goals. A native seed mix will also be applied as a supplemental measure to increase cover and diversity.

Habitat Restoration Areas 1 and 2 are almost entirely composed of non-native species. Restoration Area 1 is dominated by black mustard, sourclover and ripgut brome (Figure 4, Photos 1 and 2), and Restoration Area 2 is dominated by iceplant (hottentot fig and red-flowered iceplant), black mustard, olive and ripgut brome (Figure 4, Photos 3 and 4). Restoration area 3 is disturbed mixed coastal scrub dominated by toyon, laurel sumac and lemonadeberry, with a significant presence of non-native species, including scorpion vetch, pine trees, myoporum, black mustard and brome grasses.

Coastal sage scrub habitat and coastal bluff scrub habitat are planned for Habitat Restoration Area 1. The coastal bluff scrub is planned for the area right along the edge of the coastal bluffs, and coastal sage scrub is planned for the remainder of the area (Figure 5). Coastal sage scrub is also planned for Restoration Area 2. Mixed coastal scrub is planned for Restoration Area 3. Each specific habitat type to be restored is described below. It is expected that all planting shall be installed to mimic the natural distribution and vegetation mosaic of adjacent healthy habitats.

3.2.1 Coastal Sage Scrub

The restoration strategy for coastal sage scrub habitat on the Abalone Cove ER restoration sites includes reintroducing regionally appropriate native coastal sage scrub species that are currently present in adjacent native habitats. The plant palette includes a container plant and seed mix composition (Table 2) that has been designed to replicate the native composition of a healthy coastal sage scrub plant community similar to existing coastal sage scrub habitat present on the Abalone Cove ER site, and with the specific intent to provide habitat suitable for occupation by coastal California gnatcatcher. The planting palette has been designed to contain a composition of shrub species that are dominant in coastal sage scrub habitat occupied by coastal California gnatcatcher (Atwood et al. 1994). On the Palos Verdes Peninsula, the primary coastal sage scrub dominants include California sagebrush, California brittlebush, and coastal buckwheat, with coast goldenbush, common deerweed, lemonadeberry, California buckwheat, sages, bladderpod, coast prickly-pear, and wishbone bush as common constituents.

Table 2
Proposed Coastal Sage Scrub Planting Palette (Approximately 2 Acres)

Botanical Name	Common Name	Container Size	Spacing (on center)	Group Size	Quantity (per acre)
Container Plants					
Acmispon glaber (= Lotus scoparius)	Common Deerweed	D40	4	3	109
Artemisia californica	California sagebrush	D40	5	5	470
Astragalus trichopodus var. *lonchus*	Ocean locoweed	D40	2	7	54
Baccharis pilularis	Coyote brush	D40	6	3	24
Cylindropuntia prolifera	Coastal cholla	1-gallon	5	5	38
Dudleya laceolata	Lanceleaf liveforever	D40	2	3	22
Elymus (=Leymus) condensatus	Giant wildrye	D40	5	3	26
Encelia californica	California brittlebush	D40	4	5	354
Eriogonum cinereum	Coastal buckwheat	D40	5	5	105
Eriogonum fasciculatum	California buckwheat	D40	5	5	261
Eriophyllum confertifolium	Golden yarrow	D40	2	3	109
Isocoma menziessii	Coast goldenbush	D40	4	3	163
Malacothrix saxatilis	Cliff desert dandelion	D40	2	3	54
Mirabilis laevis var. *crassifolia*	Wishbone bush	D40	3	5	145
Opuntia oricola	Chaparral prickly-pear	1-gallon or pads	6	3	25
Peritoma (=Isomeris) arborea	Bladderpod	D40	5	5	52
Rhus integrifolia	Lemonadeberry	D40	12	1	15
Salvia leucophylla	Purple sage	D40	5	5	87
Salvia mellifera	Black sage	D40	5	3	52
				Total Container Plants	**2,165**
Seed Mix					
Botanical Name	*Common Name*	*Pure Live Seed*	*Lbs. Per Acre*		
Eschscholzia californica var. *maritima*	California poppy	85	1		
Pseudognaphalium (=Gnaphalium) californicum	California everlasting	2	0.5		
Corethrogyne (=Lessingia) filaginifolia	Common sandaster	3	2		
Lupinus bicolor	Miniature lupine	90	2		
Lupinus succulentus	Arroyo lupine	90	3		
Melica imperfecta	Smallflower melicgrass	70	1		
Stipa (=Nassella) lepida	Foothill needlegrass	65	2		
Stipa (=Nassella) pulchra	Purple needle-grass	75	4		
		Total Lbs. Per Acre	**15.5**		

3.2.2 Coastal Bluff Scrub

The restoration strategy for coastal bluff scrub habitat is comparable to that described for coastal sage scrub in 4.2.1, except that the composition of species was modified to include the addition of coastal bluff species such as seacliff buckwheat, bright green dudleya, California saltbush, California boxthorn and Santa Catalina Island boxthorn (Table 3). Additionally, the bluffs currently support Aphanisma and south coast saltscale, which will be incorporated into the planting palette as available.

Table 3
Proposed Coastal Bluff Scrub Planting Palette (0.5 Acre)

Botanical Name	Common Name	Container Size	Spacing (on center)	Group Size	Quantity (per acre)
Container Plants					
Acmispon glaber (=Lotus scoparius)	Common deerweed	D40	4	3	163
**Aphanisma blitoides*	Aphanisma	D40	1	5	as available
Artemisia californica	California sagebrush	D40	5	5	436
**Atriplex pacifica*	south coast saltscale	D40	2	5	as available
Cylindropuntia prolifera	Coastal cholla	1-gallon	5	5	122
Dudleya virens	Bright green dudleya	D40	2	3	54
Encelia californica	California brittlebush	D40	5	3	174
Eriogonum parvifolium	Seacliff buckwheat	D40	5	5	348
Eriophyllum confertifolium	Golden yarrow	D40	3	3	48
Lycium brevipes	Santa Catalina Island desert-thorn	D40	5	3	23
Lycium californicum	California boxthorn	D40	5	5	21
Mirabilis laevis var. *crassifolia*	Wishbone bush	D40	3	5	145
Opuntia littoralis	Coast prickly-pear	1-gallon or pads	5	5	157
Peritoma (=Isomeris) arborea	Bladderpod	D40	5	5	192
			Total Container Plants		**1,944**
Seed Mix					
Botanical Name	*Common Name*	*Pure Live Seed*	*Lbs. Per Acre*		
**Aphanisma blitoides*	Aphanisma	TBD	TBD		
**Atriplex pacifica*	south coast saltscale	TBD	TBD		
Corethrogyne (=Lessingia) filaginifolia	Common sandaster	3	2		
Eschscholzia californica var. *maritima*	California poppy	85	1		
Lasthenia californica	Common goldfields	50	1		
Layia platyglossa	Tidy tips	60	0.5		
Lupinus bicolor	Miniature lupine	90	2		
Lupinus succulentus	Arroyo lupine	90	3		
Stipa (=Nassella) lepida	Foothill needle-grass	65	2		
		Total Lbs. Per Acre	**11.5**		

*Aphanisma and south coast saltscale are rare plant species that may be introduced to the coastal bluff scrub if seed or plants are available.
TBD = To be determined

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SOURCE: Palos Verdes Peninsula Land Conservancy, 2013; Bing Maps

FIGURE 5

Restoration Areas

Habitat Restoration Plan for the Abalone Cove Ecological Reserve in the Palos Verdes Nature Preserve

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3.2.3 Mixed Coastal Scrub

The restoration strategy for the Mixed Coastal Scrub habitat on the Abalone Cove ER includes removing the non-native species (with the exception of the pine trees taller than 5 feet) and planting with mixed coastal scrub species. The shadier conditions created by the presence of the pine trees, and the northwestern aspect at this location, create conditions that are suitable for species that prefer more mesic conditions, such as toyon, lemonadeberry, laurel sumac and blue elderberry, which have been included in the planting palette (Table 4). Additionally, the area appears to be suitable to support sea dahlia, which will be incorporated into the planting palette as available.

Table 4
Proposed Mixed Coastal Scrub Planting Palette (Approximately 2.0 Acres)

Botanical Name	Common Name	Container Size	Spacing (on center)	Group Size	Quantity (per acre)
Container Plants					
Acmispon glaber (=Lotus scoparius)	Common deerweed	D40	4	3	54
Artemisia californica	California sagebrush	D40	5	3	87
Baccharis pilularis	Coyote brush	D40	6	3	24
**Coreopsis maritima*	Sea dahlia	D40	2	5	as available
Elymus (=Leymus) condensatus	Giant wildrye	D40	4	1	82
Eriogonum cinereum	Coastal buckwheat	D40	5	3	35
Eriophyllum confertifolium	Golden yarrow	D40	2	3	54
Heteromeles arbutifolia	Toyon	D40	10	1	65
Mirabilis laevis var. *crassifolia*	Wishbone bush	D40	8	1	24
Malosma laurina	Laurel sumac	D40	10	1	34
Marah macrocarpa	Wild cucumber	D40	12	1	4
Rhus integrifolia	Lemonadeberry	D40	15	1	61
Sambucus nigra	Blue elderberry	D40	3	3	23
Verbena lasiostachys	Western vervain	D40	4	3	97
			Total Container Plants		**644**
Seed Mix					
Botanical Name	*Common Name*	*Pure Live Seed*		*Lbs. Per Acre*	
**Coreopsis maritima*	Sea dahlia	TBD		TBD	
Eschscholzia californica var. *maritima*	California poppy	85		1	
Lessingia filaginifolia	California-aster	3		2	
Lupinus bicolor	Miniature lupine	90		2	
Lupinus succulentus	Arroyo lupine	90		3	
Melica imperfecta	Coast melic grass	70		2	
Stipa (=Nassella) lepida	Foothill needlegrass	65		4	
Nemophila menziesii	Baby blue-eyes	75		0.5	
Pseudognaphalium californicum	California everlasting	1		0.5	
		Total Lbs. Per Acre		**15.0**	

*Sea dahlia is a rare plant species that may be introduced to the mixed coastal scrub if seed or plants are available.
TBD = To be determined

3.3 Revegetation Materials

Plant materials for the restoration planting areas will include container stock and seed of coastal scrub species, as indicated in the plant palettes provided in Tables 2-4. As much as feasible, the container plant materials will be grown at the PVPLC nursery from native seed collected on the Palos Verdes Peninsula. The nursery will grow the plants in D40 Deepots. Additionally, for the seed mixes, PVPLC will collect available seed from the peninsula for application at the restoration site. If some species cannot be grown as container stock at the PVPLC nursery, or local seed is not available for collection, the planting palettes may be adjusted, or another source may be used for acquiring locally sourced plant materials.

Standard planting procedures will be employed for installing container stock. Planting holes shall be approximately twice the width of the rootball, and as deep. If dry soil conditions exist at the time of plant installation, planting holes will be filled with water and allowed to drain immediately prior to planting. A fertilizer packet with controlled-release fertilizer (e.g., Best Paks 20-10-5) will be placed in the bottom of each hole prior to planting.

In order to aid plant establishment at the unirrigated restoration site, an acrylamide copolymer gel (e.g., Terra-Sorb Hydrogel) may be used to improve water holding capacity and moisture retention surrounding the root ball. According to the product specifications, the product is non-toxic, and the potassium-based polymers break down into fertilizer after about five years (Gardner's Supply Company 2013). The application rate will follow product recommendations at approximately 0.5 ounce per container plant. No other amendments or fertilizers are proposed for the backfill soil.

DriWater may also be used to aid plant establishment. DriWater is a time released natural cellulose gum gel that retains moisture that is slowly released into the soil when the gel is broken down by naturally occurring enzymes. The moisture released from the DriWater gel becomes available for uptake by developing plant roots. DriWater can be applied in cardboard cartons or in plastic tubes with gel packs. DriWater can be costly to utilize on large scale restoration projects, and therefore would only be used in special cases where supplemental watering along with the addition of acrylamide copolymer gel was insufficient to promote plant establishment.

3.4 Target Functions and Values

The primary functional goal of the restored coastal sage scrub, coastal bluff scrub, and mixed coastal scrub habitat is to restore vegetation that contains a diversity of native coastal scrub plant species and that provides habitat value for sensitive wildlife species, particularly for coastal California gnatcatcher. A secondary consideration is to create contiguous and intact habitat which resists the re-establishment of invasive plant species.

3.5 Time Lapse

The length of time to develop high quality habitat depends on a variety of factors including weather, soil conditions, herbivory, weed competition and maintenance quality. Under optimal conditions, coastal sage scrub may take approximately three years from the installation of seed and container plants to develop the appropriate structure to provide the functions and values needed for habitation of wildlife, including suitable nesting habitat for California gnatcatcher and other coastal scrub species. In an unirrigated setting, and with drought conditions, scrub development may take longer than three years to mature enough to be suitable for nesting. As a hedge against drought, the addition of supplemental watering would increase plant survival, improve establishment, and hasten habitat development.

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4.0 IMPLEMENTATION PLAN

4.1 Rationale for Expecting Success

The identified locations for restoration on the Abalone Cove ER are directly adjacent to viable and self-sustaining target habitats, indicating appropriate environmental conditions to support the intended upland habitats. This HRP includes a provision for supplemental watering to promote establishment and survival of native species included in the plant palette. The HRP also includes a 3-year maintenance plan, wherein invasive non-native weeds within the restoration site will be controlled to aid native plant establishment. Additionally, native plant materials will be grown or collected from sources from the Palos Verdes Peninsula, thus preserving genetic integrity and increasing the potential for long-term success.

4.2 Preliminary Schedule

Appropriate timing of planting and seeding will minimize the need for supplemental watering and will increase the survival rate of the installed plants. For unirrigated restoration sites, the best survival rates are achieved when container plants and seed are installed at the onset of the rainy season or soon thereafter (November through February). Planting and seeding at the site should be timed to take advantage of seasonal rainfall patterns and most appropriate growing season temperatures (see Charts 1-2 and Table 5).

Table 5
Preliminary Restoration Project Schedule

Task	Date
Site clearing	Spring and Summer 2013
Invasive weed species control and grow-kill cycles	Spring and Summer 2013
Installation of supplemental watering system*	Summer 2013
Planting container stock	Fall and Early Winter 2013
Seed application	Fall and Early Winter 2014
Monitoring and maintenance	To begin upon successful installation of container plants

*Supplemental watering system may not be installed if supplemental watering is to be conducted using a watering truck.

Chart 1
Average Monthly Precipitation for the Portuguese Bend Nature Preserve

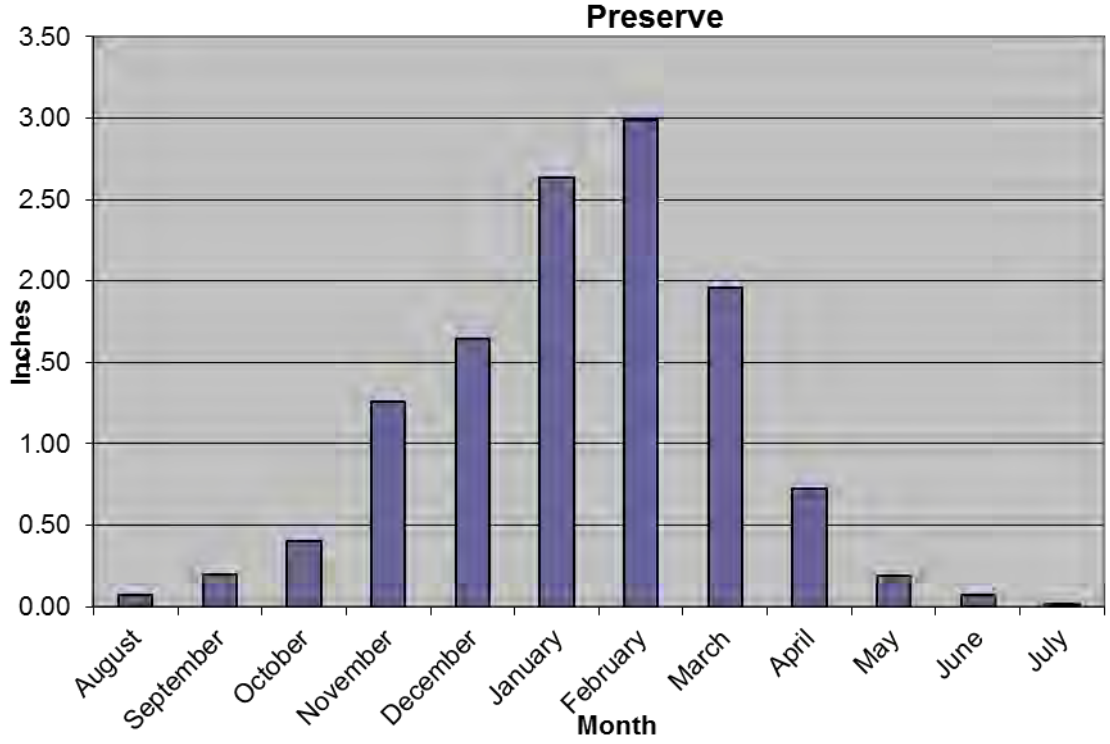
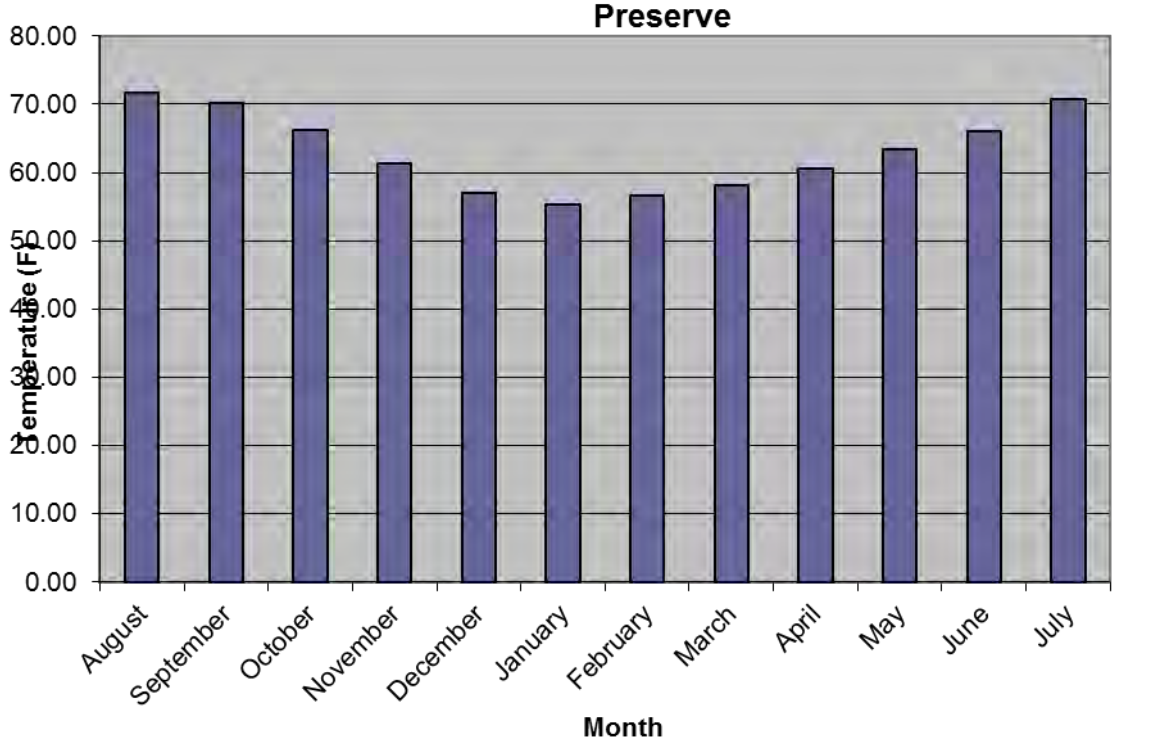


Chart 2
Average Monthly Temperatures for the Portuguese Bend Nature Preserve



4.2.1 Site Preparation

The PVPLC will be responsible for site preparation which includes invasive weed species control and soil preparation in the restoration areas. Clearing of weeds is planned to be performed during the migratory bird nesting season (February 15–September 15). Prior to clearing vegetation, a nesting bird survey should be conducted by a qualified wildlife biologist within 72 hours prior to vegetation removal in accordance with the Migratory Bird Treaty Act (16 U.S.G. 703-712).

During site preparation, all invasive weed species, particularly black mustard, ripgut brome, scorpion vetch, hottentot fig, and sourclover should be controlled within the restoration areas. Invasive species control should also include exotic trees and shrubs such as Brazilian pepper, coastal wattle, olive, myoporum, and castor bean. Invasive weeds should be killed and removed from the restoration areas as part of the site preparation activities. The one exception is that red-flowered iceplant should be treated with herbicide, but left in place to provide erosion control and weed suppression on the steeper portion of Restoration Area 2.

The initial weed control effort will involve a combination of chemical and mechanical treatment. Prior to the installation of native plant materials, "grow and kill" weed removal treatments should be conducted by allowing non-native seedling emergence in the fall and early winter. When weeds have begun to grow, a foliar application of an appropriate systemic herbicide should be applied to kill target weeds. If adequate rainfall has occurred during this period, another cycle should be repeated. The restoration ecologist will provide weed control recommendations to the restoration contractor that are specific to the target weed species identified for control. Any use of herbicides shall be in accordance with label instructions, following the recommendations of a licensed Pest Control Advisor, and any application shall be applied under the direction of a state-certified Qualified Applicator.

4.2.2 Supplemental Watering System

The planned method of providing supplemental watering at the proposed restoration areas is with a watering truck. However, a temporary watering system may be installed to provide localized access for supplemental watering of container plants during the establishment period. The supplemental watering system would consist of a mainline with hose bibs at the three restoration locations for connecting irrigation hose for manual watering. A supplemental watering system would need to get approved by the City to ensure that it is in compliance with the City's coastal setback zone and Landslide Moratorium Area restrictions. The supplemental watering system would only be used until the plants are established such that they can survive on their own from seasonal rainfall. It is expected that the system would be abandoned and removed after two to

three years of use, depending upon the level of plant establishment achieved by that time. Watering on site will gradually be decreased prior to the system being abandoned in order to allow the plants to become acclimated to the site's natural conditions.

There are some existing pipes and old water lines located in the vicinity of the proposed restoration site. If the PVPLC can get approval to use these old lines, they may be modified for use at the restoration sites. Alternatively, the PVPLC may establish temporary on-grade mainlines leading from a nearby water source (hydrant or other point of connection) to the restoration areas. The supplemental watering system would be installed as an above-ground system, so that irrigation equipment may be removed once the system has been decommissioned, and the site has become established. The supplemental watering system would be designed and installed by the PVPLC maintenance staff.

4.2.3 Erosion Control

Where needed, erosion control measures, such as the installation of sandbags, fiber rolls, silt fencing, and/or erosion-control matting may be necessary to control erosion until target vegetation establishes. At a minimum, silt fencing should be installed at the toe of slopes that are unvegetated after removing non-native species. As a component of the overall erosion control measures for the restoration areas, the red-flowered iceplant should temporarily remain in place to provide erosion control on the steeper slope area of Restoration Area 2. The iceplant should be killed prior to planting, but even though the plants are dead, they should retain enough structure and coverage to provide effective erosion control for at least the first year.

No erosion control devices should be used that contain seed from non-native plants. The need and location of erosion control will be determined in the field by the project's restoration ecologist.

5.0 MAINTENANCE PLAN

The purpose of the maintenance plan is to provide guidelines for long-term maintenance of the restoration site during the establishment period. Maintenance activities will occur at the direction of the project's restoration ecologist on an as-needed basis. The maintenance period will begin after the installation of the container plants. Maintenance will be necessary until the habitats are fully established, which is estimated will take three years.

Because the goal of this project is to establish a natural system that can support itself with little or no maintenance, the primary focus of the maintenance plan is concentrated in the first few seasons of plant growth following the revegetation effort, when weeds can easily out-compete native plants. The intensity of the maintenance activity is expected to subside each year as the native plant materials become more established and local competition from non-native plants for resources on the site is minimized through direct removal and treatment of non-native plants.

5.1 Maintenance Activities

Maintenance activities will be primarily related to non-native invasive plant species control. Supplemental watering, supplemental planting, trash removal and erosion control will also be conducted, as necessary.

- Non-native plant species should be controlled as soon as they begin to establish. Recommended control methods should be tailored to the each specific weed species and should include the most effective control measures for the species and time of year. Control methods may include a combination of manual, mechanical and chemical control.
- Container plants should be watered when natural rainfall is not adequate to sustain the establishing plants. The project's restoration ecologist will be responsible for scheduling the supplemental watering to promote plant establishment. Supplemental watering should be conducted as deep, soaking watering to promote deep rooting.
- Generally, the sites will not be fertilized during the maintenance period unless determined necessary by the project's restoration ecologist as a remedial measure to correct soil nutrient deficiencies.
- Deadwood and leaf litter of native vegetation should not be removed. Deadwood and leaf litter provide valuable microhabitats for invertebrates, reptiles, small mammals and birds. Non-organic trash and debris should be removed from the revegetation areas on a regular basis.
- Erosion control materials should be maintained in working order until they are deemed no longer necessary by the project's restoration ecologist. Maintenance of erosion control materials may include repairing or replacing dilapidated, damaged, or ineffective materials.

5.2 General Habitat Maintenance Guidelines

5.2.1 Weed Control

Weeds are expected to be the primary pest problem in the restoration area during the first several years of the maintenance period. Weeds should be controlled so they do not prevent the establishment of the native species or invade adjacent areas. Weeds should be controlled prior to setting seed and removed from the site. A combination of physical removal, mechanical treatments (weed whipping) and appropriate herbicide treatments should be used to control the non-native/invasive plant species.

Re-establishment of non-native plants onto the site can be adequately minimized by regular and timely maintenance visits with implementation of effective weed control measures. Weed control will require constant diligence by the maintenance personnel. Invasive plant species, such as those listed in Table 1 should be controlled wherever possible within the restoration area. The pine trees taller than 5 feet will be left in place to retain the character of the site in Restoration Area 3. However, pine tree seedlings and saplings under 5 feet will be controlled along with the other target species in Table 1.

Removal of weeds by hand where practicable and effective is the most desirable method of control and should be used around individual plantings and native seedlings to avoid inadvertent damage to the native species. However, several of the invasive species are more effectively controlled with herbicide due to their tenacious and spreading root systems, their size, or their ability to re-sprout from root fragments. All herbicides shall be used in accordance with label instructions, following the recommendations of a licensed Pest Control Advisor, and any application shall be applied under the direction of a state-certified Qualified Applicator. The project's restoration ecologist should monitor control efforts to ensure that the target weed species are being adequately addressed without impacting the native plants.

The non-native Bagrada bug (*Bagrada hilaris*) has been documented on the Palos Verdes Peninsula, and is known to cause substantial damage to plant species from the mustard family (*Brassicaceae*) (County of Los Angeles 2013; University of California, Riverside 2013). As black mustard is a predominant species within the proposed restoration sites, the Bagrada bug may occur; however, it is expected that the damage caused by this insect would be to non-native mustard species, and not native plants. However, if this species becomes problematic as a pest species on the native plants, then the restoration ecologist will evaluate whether or not control measures are necessary.

5.2.2 Supplemental Watering

Supplemental watering will be provided during the first year to help the container plants become established. Supplemental watering will likely be provided with a watering truck. The watering would be conducted using a hose connected to the watering truck to manually water the planting basins of the container plants. Supplemental watering would likely be necessary every 3–4 weeks during the dry season, and more frequently immediately after installation if natural rainfall does not provide adequate moisture.

If a temporary, on-grade supplemental watering system is installed as described in Section 4.4, it would need to be maintained and repaired as necessary. Maintenance and repairs would be minimal, as the design would be a simple mainline with manually operated ball valves and hose bibs.

5.2.3 Clearing and Trash Removal

Trash consists of all man-made materials, equipment, or debris dumped, thrown, washed into or left within the restoration area. Pruning or clearing of native vegetation is not anticipated to be necessary within the restoration area, unless extensive growth is causing a maintenance problem for a utility or for an area outside of the restoration area. Any pruning or clearing of native vegetation should be approved by the project's restoration ecologist. Deadwood and leaf litter of native vegetation will be left in place to replenish soil nutrients and organic matter.

5.3 Schedule of Maintenance Inspections

The project's restoration ecologist will perform quarterly maintenance/monitoring inspections during the scheduled maintenance and monitoring period. Recommendations for maintenance efforts will be based upon these site observation visits. Weed control by the PVPLC staff shall be conducted as needed to ensure adequate control to promote healthy establishment of the target habitat types. It is anticipated that weed control will be necessary on a monthly basis during the winter and early spring when weeds are vigorously growing. Weed control during other times of the year should be diminished, but conducted as necessary, and as directed by the project's restoration ecologist.

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6.0 MONITORING PLAN

Monitoring of the restoration site has a two-fold purpose: **(1)** To monitor the progress of the Abalone Cove ER restoration areas by assessing native habitat establishment relative to the established performance standards; and **(2)** To direct and monitor the maintenance activities and determine remedial actions in a manner that ensures that appropriate maintenance occurs in a timely manner. The monitoring will be performed by the project's restoration ecologist.

The project's restoration ecologist will be responsible for monitoring activities of all the work crews during preparation of the restoration area including site clearing and soil preparation, weed control, container plant and seed application, and quarterly monitoring for the duration of the 3-year maintenance and monitoring period.

6.1 Performance Standards

Performance standards have been established for the habitat restoration area based on expected vegetative development relative to undisturbed habitat of the same type. Interim performance standards are provided for each of the three years (Table 6).

Table 6
Performance Standards

Year	Percent Cover of Native Species (%)*		
	Coastal Sage Scrub	*Coastal Bluff Scrub*	*Mixed Coastal Scrub***
Year 1	>10%	>10%	>10%
Year 2	>20%	>20%	>15%
Year 3	>40%	>30%	>20%

* Percentage based upon visual estimates
**Percent coverage totals exclude cover of pine trees

These performance standards will be utilized to assess the annual progress of the restoration areas, and are regarded as interim project objectives designed to reach the final goals. Fulfillment of these standards will indicate that the restoration areas on the project site are progressing toward the habitat types and functions that constitute the long-term goals of the plan. If the restoration efforts fail to meet the performance standards in any year, the project's restoration ecologist may recommend remedial action to be implemented the following year with the intent to enhance the vegetation to a level of conformance with the original standard. These remedial actions may include re-seeding, re-planting, applying soil amendments, additional weed control measures, erosion control, or adjustments to the watering and maintenance practices.

6.2 Monitoring Methods and Schedule

The PVPLC will monitor and report on the restoration work underway at the Abalone Cove ER. The project's restoration ecologist will conduct annual qualitative monitoring visits for three years.

Annual qualitative assessments will be conducted through visual analysis of the restoration area to assess vegetation development, weed presence, and plant establishment. Qualitative monitoring will include reviewing the health and vigor of container plants and seed plantings, assessing survival/mortality, checking for the presence of pests and disease, soil moisture content and the effectiveness of the supplemental watering, erosion problems, invasion of weeds, and the occurrence of trash and/or vandalism. Representative photographs of the restoration site from stationary photo points will be taken annually.

Each monitoring visit will be followed by a summary of observations, recommendations, and conclusions. Results from the annual monitoring will be used to evaluate the progress of each habitat toward the ultimate goals of the project, and recommend appropriate management.

6.3 Monitoring Reports

The PVPLC will monitor and report on the restoration work underway in the Abalone Cove ER. The restoration areas will be monitored for three years, with reports prepared annually. Monitoring reports should provide concise, meaningful summaries of the restoration progress and provide direction and maintenance recommendations.

6.4 Project Conclusion

At the end of the 3-year monitoring period, a final report will be prepared by PVPLC and submitted to the funding entities to document completion of the project. The final report will summarize the project relative to project goals. The site will be managed along with other reserve lands in the Palos Verdes Nature Preserve by the PVPLC.

7.0 REFERENCES

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APPENDIX A

Soil Test Results

WALLACE LABORATORIES
365 Coral Circle
El Segundo, CA 90245
phone (310) 615-0116 fax (310) 640-6863

April 9, 2013

Dudek & Associates, Inc.
Andy Thomson, athomson@dudek.com
605 Third Street
Encinitas, CA 92024

RE: Abalone Cove, Job No. 7718

Dear Andy,

The pH is moderately alkaline at 7.79. Salinity is high at 4.42 millimho/cm. Chloride is high at 1,442 parts per million in the saturation extract. Nitrogen, phosphorus, and iron are low. Potassium is high. Manganese, zinc, copper and boron are sufficient. Sulfur is modest. Magnesium is high. Sodium is high. The soil is sodic. SAR (sodium adsorption ratio) is 13.8.

Recommendations

Reclaim the soil and lower the sodicity if the plant palette is not tolerant of the current conditions. The application of gypsum is used to decrease the sodicity but will increase the salinity. If the soil is not to be reclaimed, apply the modest amounts of gypsum.

General soil preparation on a square foot basis. Broadcast the following materials uniformly. The rates are per 1,000 square feet. Incorporate them homogeneously 6 inches deep:

Triple superphosphate (0-45-0) – 4 pounds
Agricultural gypsum – 40 pounds, 150 pounds if the soil is to be reclaimed
Organic soil amendment – about 3 cubic yards, sufficient for 2 to 3% soil organic matter on a dry weight basis

For the preparation on a volume basis, homogeneously blend the following materials into clean soil. Rates are expressed per cubic yard:

Triple superphosphate (0-45-0) – 1/4 pound
agricultural gypsum – 2 pounds, 7 pounds if the soil is to be reclaimed
Organic soil amendment – about 15% by volume, sufficient for 2 to 3% soil organic matter on a dry weight basis

Organic soil amendment suggestions:

1. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. Organic matter shall be at least 50% on a dry weight basis.
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° C. in a saturated paste extract.

4. Boron content of the saturated extract shall be less than 1.0 part per million.
5. Silicon content (acid-insoluble ash) shall be less than 50%.
6. Calcium carbonate shall not be present if to be applied on alkaline soils.
7. Types of acceptable products are composts, manures, 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 red wood or cedar.
9. Sludge-based materials are not acceptable.
9. Carbon:nitrogen ratio is less than 25:1.
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 for soil amending.

Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

arsenic	20	copper	150	selenium	50
cadmium	15	lead	200	silver	10
chromium	300	mercury	10	vanadium	500
cobalt	50	molybdenum	20	zinc	300
		nickel	100		

Leach the soil. Lower the salinity and sodicity. Lower the salinity to less than 3 millimho/cm. Lower the chloride to less than 150 parts per million in the saturation extract for salt-sensitive plants Reduce the SAR to less than 6 or as needed.. Additional gypsum may be needed to lower the SAR. High sodicity impairs soil physical properties. After leaching, apply ammonium sulfate (21-0-0) at 5 pounds per 1,000 square feet.

Monitor the site with periodic testing for maintenance fertilization. Ammonium sulfate (21-0-0) can be applied at 5 pounds per 1,000 square feet about once per quarter. Adjust the maintenance program as needed.

Sincerely,

Garn A. Wallace, Ph. D.
GAW:n

WALLACE LABS
365 Coral Circle
El Segundo, CA 90245
(310) 615-0116

SOILS REPORT

Print Date: April 9, 2013 Receive Date: 4/8/13

Location: Abalone Cove, Job No. 7718

Requester: Andy Thomson, Dudek

graphic interpretation: * very low, ** low, *** moderate, **** high, ***** very high

ammonium bicarbonate/DTPA

extractable - mg/kg soil

Interpretation of data

low	medium	high
0 - 7	8-15	over 15
0-60	60 -120	121-180
0 - 4	4 - 10	over 10
0- 0.5	0.6- 1	over 1
0 - 1	1 - 1.5	over 1.5
0- 0.2	0.3- 0.5	over 0.5
0- 0.2	0.2- 0.5	over 1

Sample ID Number	13-99-02	
Sample Description	Soil Sample Received 04/08/2013	
elements		graphic
phosphorus	7.22	**
potassium	1,048.29	*****
iron	1.24	*
manganese	0.64	***
zinc	1.26	***
copper	2.22	****
boron	0.32	***
calcium	325.53	***
magnesium	586.94	*****
sodium	1,487.60	*****
sulfur	23.61	*
molybdenum	0.01	**
nickel	0.65	*
aluminum	n d	*
arsenic	0.04	*
barium	0.91	*
cadmium	0.49	*
chromium	n d	*
cobalt	0.07	*
lead	0.86	*
lithium	0.26	*
mercury	0.07	*
selenium	0.55	**
silver	n d	*
strontium	1.39	*
tin	n d	*
vanadium	0.56	*

The following trace elements may be toxic. The degree of toxicity depends upon the pH of the soil, soil texture, organic matter, and the concentrations of the individual elements as well as to their interactions.

The pH optimum depends upon soil organic matter and clay content- for clay and loam soils: under 5.2 is too acidic 6.5 to 7 is ideal over 8.0 is too alkaline

The ECe is a measure of the soil salinity: 1-2 affects a few plants 2-4 affects some plants, > 4 affects many plants.

problems over 150 ppm
good 20 - 30 ppm

toxic over 800

toxic over 1 for many plants

increasing problems start at 3

Saturation Extract

pH value	7.79	****	
ECe (milli-mho/cm)	4.42	*****	
			millieq/l
calcium	84.3		4.2
magnesium	48.6		4.0
sodium	641.7		27.9
potassium	25.4		0.6
cation sum			36.8
chloride	1,442		40.6
nitrate as N	6		0.4
phosphorus as P	0.6		0.0
sulfate as S	37.6		2.3
anion sum			43.4
boron as B	0.13	*	
SAR	13.8	*****	
est. gypsum requirement-lbs./1000 sq. ft.	364		
relative infiltration rate	fair		
estimated soil texture	loam		
lime (calcium carbonate)	low		
organic matter	low/fair		
moisture content of soil	12.8%		
half saturation percentage	30.8%		

Elements are expressed as mg/kg dry soil or mg/l for saturation extract.

pH and ECe are measured in a saturation paste extract. nd means not detected.

Analytical data determined on soil fraction passing a 2 mm sieve.

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