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## Technical Memorandum:

# Ballona Wetlands Ecological Reserve Vegetation Alliance and Habitat Crosswalk

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This document serves as a reference for a vegetation alliance and association to habitat crosswalk at an impacted and degraded salt marsh system in Los Angeles County. Surveys were conducted at the Ballona Wetlands Ecological Reserve (BWER) by The Bay Foundation (I. Medel and team) from May – October 2013 in accordance with methods created by the California Department of Fish and Wildlife's (DFW) Vegetation and Classification Mapping Program with supplemental information derived from previous monitoring surveys (2009-2013) conducted throughout the site (Johnston et al. 2011, 2012). The BWER has experienced hydrological restrictions, dumping of dredge spoils, Non-native species invasions, habitat fragmentation, and development. Habitat categories were highly variable from subtidal to high elevation upland and are classified on an individual basis based on georeferenced polygons classifying dominant vegetation community and physical characteristics such as soil and hydrology. Habitat categories represent functionally distinct ecological communities and are described in this document specifically for the BWER.

When applicable, categories are crosswalked from alliance and association types in accordance with the Manual of California Vegetation (2<sup>nd</sup> Ed) and from previous site surveys (Guastafson 1981 and CDFG 2007). Additional habitat categories were identified to accurately reflect current site conditions (i.e. Non-native habitats). Habitat categories and the final crosswalk were reviewed and vetted by a technical advisory team (ICF, WRA, TBF, and DFW). Habitat descriptions and crosswalk determinations contained within this document focus primarily on vegetation, soil, and hydrological characteristics and do not describe habitats based on the potential for the presence any particular animal species.

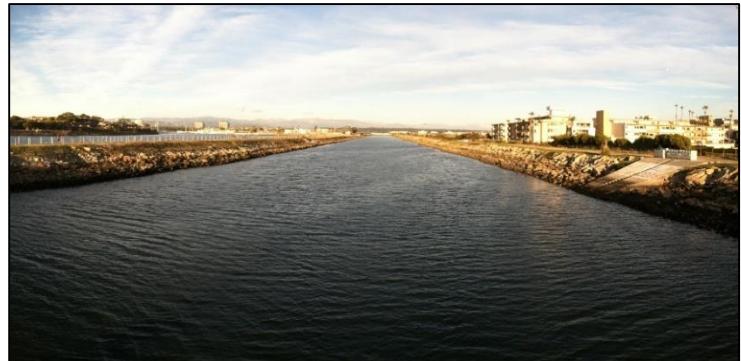
Appendix 1 contains a summary description of the physical characteristics, dominant vegetation species, and general BWER location for each habitat type. Appendix 2 lists each vegetation community, summarized by area and total polygons per habitat type. Appendix 3 contains the final existing habitat units map.

## Category 1: Aquatic water habitats

### **Subtidal**

Subtidal habitats in estuarine systems provide a connective habitat between open ocean and estuarine intertidal waters. Their primary defining characteristics are hydrological and physical, including waters or habitats that are permanently flooded. These areas provide habitats for fish and subtidal benthic invertebrate communities and are associated with subtidal vegetation such as eelgrass or surfgrasses and non-vascular taxa such as macroalgae and phytoplankton.

The primary example of Subtidal habitat within the BWER is the Ballona Creek channel, which is also responsible for the majority of dry weather freshwater inputs to the tidal areas of the BWER. This concrete and rip-rap channelized system has a soft, sediment bottom within the BWER boundaries and is bisected by roadway bridges.



### **Intertidal Channels**

The primary difference between Subtidal and Intertidal habitats is elevation (other parameters and hydrologic processes may also differ, such as water temperature, water movement, connectivity, etc.).



Intertidal channels are estuarine geographic areas subject to some degree of tidal regime, in southern California expressed as mixed semi-diurnal tidal fluctuations. The channels may also have significant freshwater inputs during the wet season or with dry weather runoff. The channels include mudflats, providing foraging habitat for avifauna and mammals, and are typically fine grained to sandy substrates. Some intertidal channels may remain inundated during periods of low tide, though they may also drain completely, dependent

on their hydrology; they are often completely inundated at high tides. Vegetative taxa within intertidal channels include both non-vascular algae (e.g. phytoplankton, diatoms, *Ulva* spp.) and vascular plants [e.g. surfgrasses, *Ruppia* spp. (ditch grass)]. Terrestrial vascular taxa [e.g. *Salicornia pacifica* (pickleweed), *Jaumea carnosa* (fleshy jaumea), *Distichlis littoralis* (salt grass)] are also found at higher elevations on intertidal channel banks along habitat margins.

Within the BWER, the largest area of Intertidal Channel habitat is found in the western portion of Area B. This area receives muted tidal inputs up to 1.1m from Ballona Creek through two self-regulating tide gates and exits the wetlands through those same two gates and one additional flap gate on a western branch channel. A small, fully tidal ditch also persists in northeast Area A (i.e. Fiji Ditch) which receives tidal flows from Basin H in Marina del Rey though a culvert under Dock 52.

## Category 2: Native and semi-native wetland habitats

### Tidal Wetland

Tidal wetland habitat areas consist of vegetated salt marsh floodplain where the direct or immediately adjacent hydrology is influenced primarily by tidal flooding hydrology. Tidal wetland areas may be further subcategorized based on tidal regimes and vegetation communities from lower elevation areas which are exposed to daily inundation (low marsh) to higher elevation areas which only experience irregular or intermittent flooding on spring tides or extreme high tides (high marsh). Dependent on inundation patterns and soil texture, soil salinities within tidal wetland areas vary from estuarine salinities (approximately 25 ppt) to hypersaline conditions (approximately 70 ppt) in locations which are inundated infrequently and are prone to evaporation.

In California, *Spartina* spp. (cordgrass) is a common indicator species in most low marsh habitats; however, it is absent within the BWER. Any habitats in the BWER that may be considered 'low marsh' based on a specific elevation range are within the 'Intertidal Channel' category. Marsh plain is considered to be areas that maintain a native salt marsh vegetation community and are inundated regularly on high tides; high marsh is considered to be areas of higher elevation that are inundated on spring tides or hydrologically connected to tidal areas.



Within the BWER, the largest area of tidal wetland habitat is found in the western portion of Area B. Due the variety of physical conditions (e.g. elevation, inundation regime, soil texture), tidal wetland habitat supports a diverse range of hydrophytic and halophytic vegetation communities. The muting of

the tidal regime by the tide gates and the lack of *Spartina* spp. as an indicator species suggest that the low marsh habitat is absent from the BWER. Both marsh plain and high marsh are present, primarily in Area B. Table 1 highlights general descriptions of typical vegetation community distribution within both tidal wetland sub-categories. A small zone also persists along the Fiji Ditch in northeast Area A, which is connected to Basin H in Marina del Rey though a culvert under Dock 52.

Table 1. Typical vegetation community descriptions of both tidal wetland sub-categories.

Tidal marsh habitat	Vegetation description
Marsh plain	<i>Jaumea carnosa</i> , <i>Salicornia pacifica</i> , <i>Cuscuta</i> spp., <i>Distichlis littoralis</i> , and <i>Cressa truxillensis</i> understory
High marsh	<i>Arthrocnemum subterminale</i> , <i>Salicornia pacifica</i> , <i>Frankenia salina</i> ; interspersed <i>Distichlis littoralis</i> and <i>Cressa truxillensis</i> in areas of higher elevation; some mixed Non-native grasses in areas lacking tidal inundation

### Non-tidal Salt Marsh

Non-tidal Salt Marsh habitat is defined by the persistence of native-dominant euryhaline salt marsh vegetation in areas whose hydrology is not influenced by tides. This habitat is typically in depressional or historic saltmarsh areas where remnant accrued salts remain in high enough concentrations within soils to sustain salt-tolerant vegetation. These areas are typically influenced by ponded water from overland flows following rain events.



High soil salinity concentrations, periodic freshwater inundation, and a strong native species seed bank within these areas have encouraged minimal cover and propagation of non-native species. Plant species common within these areas include *S. pacifica*, *Cressa truxillensis* (alkali weed), *Malvella leprosa* (alkali mallow), and *Frankenia salina* (alkali heath). Non-native plant species are more prevalent within non-tidal habitats than tidal wetland areas but are not considered to be co-dominant. Common Non-native plant species include *Brassica nigra* (black mustard), *Festuca perennis* (Italian rye grass), *Polypogon monspeliensis* (rabbit's foot grass), and *Bromus* spp. (brome grass).

Within the BWER, the largest of these areas is located in the eastern portion of Area B to the south of Jefferson Blvd. Additional areas include the northern portion of area immediately adjacent and west of the Culver Blvd curve and some small areas mixed into lower elevation depressions in Area A.

### Salt Pan

The Salt Pan habitat consists of low gradient unvegetated (<5% total cover) hypersaline flats (i.e. >100 ppt.) which typically receive infrequent tidal inundation at the most extreme high tides (e.g. king tides).

These habitats typically exist at the highest elevations between the high marsh and transition zones and have reduced or absent hydrologic connectivity via intertidal channels. They are sufficiently flat and compacted to promote an extended period of ponding for several months and evaporation of both tidal inundation and stormwater accumulation. Occasional subshrubs [e.g. *Arthrocnemum subterminale* (Parish's glasswort)] may also be present.



The Salt Pan habitat within the BWER has restricted tidal influence to only the northeastern arm of the habitat area adjacent to the branch channel due to the muting of the tidal influence from the self-regulating tide gates, although most of the habitat receives freshwater input and exhibits ponding during the wet season.

### Ruderal Marsh

The Ruderal Marsh habitat category is similar to non-tidal salt marsh habitat but with higher or co-dominant Non-native species cover and distinct functional differences and reductions based primarily on



altered and Non-native vegetation communities. These areas may experience lower soil salinities or more infrequent freshwater inundation, which would serve to increase the habitat vulnerability to Non-native species invasion along the salt marsh – upland transitional boundaries. Non-native monocultures of vegetation species such as *Helminotheca echiooides* (bristly ox-tongue), *Atriplex prostrata* (fat-hen), or *Bassia hyssopifolia* (fivehook bassia) may also be classified as Ruderal Marsh if suitable wetland soil and hydrologic characteristics are present.

For the BWER, Non-native ruderal brackish and salt marsh habitats are both included within this category. Common invasive species within the salt marsh habitats include *B. nigra*, *Carpobrotus* spp. (iceplant), and *Mesembryanthemum* spp. (iceplant) and Non-native annual grasses (e.g. *Bromus* spp., *Festuca* spp.); these habitat areas are common in central and northern Area A, adjacent to the Southern California Gas Company monitoring roads. Common invasive species within ruderal brackish marsh habitats include *H. echiooides* and *F. perennis*; these habitat areas are located in the southeastern portions of Area B at the base of the bluffs.

## Brackish Marsh

Brackish marsh habitats form in areas of mixed salinity with high levels of freshwater influence and are typically found in areas lacking direct tidal influence. The majority of the BWER's native Brackish Marsh habitats include areas which experience seasonal freshwater inputs from wet weather and stormwater flows and residual accumulated soil salts in concentrations capable of discouraging Non-native propagation. Native species common to these areas include *Typha* spp. (cattail), *Schoenoplectus* spp. (naked-stemmed bulrush), *Anemopsis californica* (yerba mansa) and *Euthamia occidentalis* (western goldenrod). Brackish Marsh habitat areas occur in the southwestern portions of Area B at the base of the bluffs. However, most of the BWER's brackish marsh habitats have been heavily invaded by Non-native species and categorized into the 'Ruderal Wetland' habitat category. Also, due to the low areal extent of palustrine wetlands, these lower salinity areas have been incorporated into the 'Brackish Marsh' habitat category.



## Brackish Scrub

The brackish scrub habitat is defined by the presence of halophytic shrubs, primarily *Atriplex lentiformis* (big saltbush). These areas are typically in lower elevation drainage areas with poorly drained soils, as compared to other upland habitats within Areas A and C. Native monocultures tend to form within these areas; however, non-native annual grasses may also be present in higher elevation clearings and along habitat margins.

## Riparian Scrub and Woodland

Riparian Scrub and Woodland habitat areas generally occur in lower elevation regions which direct and capture both overland and subterranean water flows from higher elevation areas; the primary characteristic is defined by the presence of riparian woody vegetation [e.g. *Salix* spp. (willow) and *Baccharis salicifolia* (mulefat)]. Areas lacking defined riparian hydrology which support riparian woody vegetation are also included within this habitat category for the BWER.



These areas maintain primarily native cover but may include some Non-natives such as palms *Cortaderia* spp. (pampas grass), and *Acacia* spp. (thorntree). Riparian scrub and woodland habitat areas are most common in the southeastern and western portions of Area B located at the base of larger, well drained bluffs. *B. salicifolia*, may be present but is not an indicator species for this habitat category; a hydrologic evaluation and specific soil characteristics separate the riparian scrub *B. salicifolia* from the upland scrub *B. salicifolia*.

### **Category 3: Non-native, invasive monoculture wetland habitats**

These habitats have defining wetland hydrology characteristics and for the most part were delineated as wetland areas in 2007 (DFW) and 2011 (WRA). However, due to the habitat-altering nature of these Non-native, invasive monocultures, these areas no longer support the native species, biodiversity, and functions expected of a true wetland habitat. They have therefore been removed and classified as independent habitat types.

#### **Iceplant Wetland**



Iceplant Wetland habitat is defined by a monoculture of *Carpobrotus* spp. with significant seasonal freshwater inputs and insufficient drainage promoting prolonged ponding. These areas experience ponding for durations sufficient to support amphibians and some other freshwater species and are located only in southwestern Area B at the base of the bluffs. Due to the highly adverse effects and habitat-altering nature of iceplant on native plant communities, all areas supporting co-dominant *Carpobrotus* spp. populations with native species are automatically classified as Iceplant Wetland if the appropriate hydrology criteria are present.

#### **Pampas Grass Stand**

The 'Pampas Grass' habitat is defined by a monoculture or high relative cover of *Cortaderia* spp. (pampas grass) and typically has a strong freshwater-influenced hydrology via either stormwater inputs or subterranean riparian flows. Some pampas grass stands support a low relative cover of *S. pacifica* interspersed between individual bunches. These areas are located in the southern portions of Area B adjacent to riparian scrub and woodland habitats and lower elevation locations in Area A.



## Category 4: Upland habitats

A high proportion of the upland habitats throughout the BWER have been significantly altered or were created by filling or grading (PWA 2006). They are classified in a distinct category as lacking wetland characteristics such as hydrophytic vegetation, poorly draining soils, and hydrologic influence.

### Dune

Dune habitat areas exist in locations with coarse grained, well drained sandy soils which support native dune indicator species such as *Cammisoniopsis* spp. (evening primrose), *Lupinus chamissonis* (dune bush lupine), *Acmispon glaber* (deerweed), and *Croton californica* (California Croton). Most dune areas may contain a moderate to co-dominant Non-native herb understory, particularly by *Bromus diandrus* (ripgut brome) and *Erodium* spp. (filaree).



The majority of native dominant dune areas located on the BWER are remnant historic sand dunes which have either resisted Non-native propagation or have undergone hands-on restoration by local non-profit groups. The largest of these areas is the westernmost portion of Area B which is maintained by the Friends of Ballona Wetlands. Habitats categorized as dune on-site may also be represented by areas with low to moderate pressures of Non-native species such as *B. nigra*, *Raphanus sativus* (wild radish), and *Carpobrotus* spp. These areas include the sandy regions on the Cabo Rd bluffs, particularly the sandy drainage wash in the southeastern portion of Area B. Additionally, a small dune patch persists in the southwest corner of north Area C by the entrance to the Culver curve.

### Non-native Dune

Non-native Dune habitats consist of the same sandy soil profile as 'Dune' habitats but are plagued by high cover to monoculture of Non-native and invasive species, particularly *Carpobrotus* spp., annual



grasses, and species common within the 'Non-native "Tall" Herbaceous' habitat category. Non-native dune areas can be found mainly in the westernmost portion of Area B, but also include portions of the sandy hill just below Cabo Rd. in south Area B and portions of the drainage wash in southwest Area C.

## **Disturbed Hard-pack**



The Disturbed Hard-pack habitat classification is unique to the BWER and is identified by sparsely vegetated areas on hard-pack ‘desert pavement’ upland soils. Vegetation communities generally include disturbed native species such as *Heterotheca grandiflora* (telegraph weed) and *Psuedognaphalium* spp. (cudweed) emergent over Non-native *Erodium* spp. and sparsely vegetated monocultures by opportunistic Non-native invaders such as *B. nigra* and *Euphorbia terracina* (carnation spurge). However, some areas

include populations of *Camissoniopsis* spp. These areas are located only in the northeastern portions of Area A and C.

## **Annual / Ruderal Grassland**

Annual and/or ruderal grassland habitat areas are characterized by a dominant cover of Non-native grasses but retain some of the functions of native annual California grassland habitats. These areas typically have well-draining soils but may cover a broad spectrum of soil characteristics due to the range of species assimilated and their related tolerances. Common grass species within these areas include *Brome* spp., *Avena* spp. (wild oat), and *F. perennis* and are located primarily within Areas A and C.



## **Non-native "Tall" Herbaceous**



Non-native “Tall” Herbaceous habitat areas are defined by monocultures or co-dominant mixes of invasive herbs, particularly *B. nigra*, *Glebionis coronaria* (crown daisy), *R. sativus*, and *E. terracina*. While not classified as an herb, *Ricinus communis* (castor bean) monocultures are also included in this habitat category as they exhibit similar habitat functions. These areas are ubiquitous across the BWER, yet are commonly located on well-draining soils with higher elevations than the surrounding landscape such as berms and raised upland areas. Non-native “Tall” Herbaceous habitat

areas present a high risk to native vegetation due to their highly invasive and fast growing nature; however, the presence of any defined hydrology (e.g. tidal influence, ponding, directed stormwater runoff) generally minimizes the impacts and relative cover of the associated species.

## **Iceplant Stand**

The Iceplant Stand habitat category incorporates all areas covered with monocultures of various iceplant species (e.g. *Carpobrotus* spp., *Mesembryanthemum* spp., *Malephora crocea*) that do not meet the criteria for classification in the ‘Iceplant Wetland’ or ‘Non-native Dune’ habitat categories due to a lack of wetland-specific characteristics and/or sandy dune soils.



These areas are generally interspersed within ‘Upland Scrub’ and ‘Annual / Ruderal Grassland’ habitat areas within Areas A and C and may share similar soil characteristics. Similar to Category 3 habitat types, monocultures of iceplant species within upland areas are significantly habitat-altering and for the most part no longer support native species, biodiversity, and habitat functions to a degree sufficient to categorize them independently.

## **Upland Scrub**

Upland scrub habitat areas are characterized by native shrub-dominated plant communities on well-drained soils in upland areas. While the majority of shrubs are native, these areas generally also support a co-dominant, Non-native understory of herbs and grasses, primarily *Bromus* spp., *E. terracina*, and *B. nigra*. Most common shrub species defining the upland scrub areas include *Baccharis pilularis* (coyote bush), *Artemesia californica* (California sage scrub), and *Malosma laurina* (laurel sumac). *B. salicifolia* areas may also be characterized as upland scrub in the absence of ‘Riparian Scrub and Woodland’ hydrology. Upland Scrub areas are common in higher elevation areas within Areas A and C.



## **Eucalyptus Grove**



Eucalyptus Grove habitat areas are characterized by a collection of *Eucalyptus* spp. (eucalyptus) trees. While hydrology is not the single defining attribute, these areas are generally located at the base of the

Cabora bluffs in south Area B where hydrology is primarily influenced by freshwater runoff inputs from surrounding areas. The understory within Eucalyptus groves are composed primarily of leaf litter and detritus. These areas provide overwintering habitat for Monarch butterfly (*Danaus plexippus*) populations.

### **Non-native Tree**



The Non-native Tree habitat category contains assemblages of all Non-native tree species with the exception of *Eucalyptus* spp. The habitat includes a broad range tree species, from exotic landscaping trees whose seeds have been transported from adjacent residential areas to palm stands and disturbed propagating invaders. The range and diversity of incorporated species makes general soil and hydrology statements difficult, however many of these areas are located along fence lines and berms on BWER margins. Additionally, *Acacia* spp. and *Myoporum laetum* (lollypop tree) stands are also found contiguous to native tree groves, particularly in western Area B adjacent to 'Riparian Scrub and Woodland' habitat areas.

## **Category 5: Developed areas**

### **Developed**

Developed areas are defined as anthropogenically altered unvegetated locations such as levees, structures, and both dirt and hardscape roads. Substantial developed areas include the Southern California Gas Company, major thoroughfares (e.g. Lincoln, Culver, and Jefferson Blvds.), and the levees along Ballona Creek. Less significant developed areas include dirt Gas Company monitoring roads and all dirt access roads. These areas may vary in size and impact to surrounding habitats through fragmentation, fill, paving, and hydrologic impairments, yet all provide little to no ecological value and are therefore grouped similarly.



The baseball fields in south Area C are a noteworthy exception as they do support some vegetative cover; however they are classified into the developed category due to the severity of the anthropogenic modifications and ongoing maintenance in those areas. These factors remove most natural ecosystem functions.

## Appendix 1. Habitat types, descriptive characteristics, and general crosswalk categories.

General Category	Habitat	Area	Location	Hydrology	Soil	Dominant Vegetation	Nativity	Primary Defining Parameter(s)
1	<b>Subtidal</b>	Creek	Ballona Creek Estuary	Submerged; fully tidal; estuarine	Silt / Sand (high compaction)	N/A	N/A	Hydrology
1	<b>Intertidal Channel</b>	A, B	West B; Fiji Ditch	Muted tidal; freshwater inputs from Creek	Clay / Silt	Submerged aquatic vegetation; algae; <i>Ulva spp.</i>	N/A	Hydrology
2	<b>Tidal Wetland</b>	A, B	West B; Fiji Ditch	Muted tidal influence directly or in soil infiltration	Clay / Silt	<i>Jaumea carnosa</i> , <i>Salicornia pacifica</i> , <i>Cressa truxillensis</i> , <i>Arthrocnemum subterminale</i>	High	Vegetation, Hydrology
2	<b>Non-tidal Salt Marsh</b>	B	South B	Water retention through freshwater ponding	Clay / Silt	<i>Salicornia pacifica</i> , <i>Cressa truxillensis</i> , <i>Malvella leprosa</i>	Med to High	Vegetation, Hydrology
2	<b>Ruderal Marsh</b>	A, B	South B; triangle B; central A	Water retention through freshwater ponding	Clay / Silt	<i>Salicornia pacifica</i> , <i>Frankenia salina</i> , <i>Brassica nigra</i>	Low to Med	Vegetation, Hydrology
2	<b>Brackish Marsh</b>	B	South B	Water retention through freshwater ponding	Poorly draining	<i>Euthamia occidentalis</i> , <i>Anemopsis californica</i>	High	Vegetation, Soil
2	<b>Brackish Scrub</b>	A, B	Interspersed throughout A and B	Water retention through freshwater ponding	Clay/ Silt; Poorly draining	<i>Atriplex lentiformis</i>	High	Vegetation, Soil
2	<b>Salt Pan</b>	B	Central B, north of Culver	Muted tidal influence; Water retention through freshwater ponding	Hard-packed Clay; poorly draining	Generally none; small patches of <i>Salicornia pacifica</i> and <i>Arthrocnemum subterminale</i>	High	Vegetation, Soil
2	<b>Riparian Scrub &amp; Woodland</b>	B	South B	Water retention through freshwater ponding; some connectivity through drainage ditch	Variable	<i>Salix spp.</i>	High	Vegetation
3	<b>Iceplant Wetland</b>	B	South B	Water retention through freshwater ponding	Poorly draining	<i>Carpobrotus spp.</i>	None	Vegetation, Hydrology
3	<b>Pampas Grass</b>	B	South B	Water retention through freshwater ponding; some connectivity through drainage ditch	Poorly draining	<i>Cortaderia spp.</i>	None	Vegetation

General Category	Habitat	Area	Location	Hydrology	Soil	Dominant Vegetation	Nativity	Primary Defining Parameter(s)
4	<b>Dune</b>	B	West B; South B	Bluff stormwater runoff; direct rainfall	Sandy; well drained	<i>Camissoniopsis spp., Lupinus chamissonis, Acmispon glaber, Croton californica</i>	Med to High	Vegetation, Soil
4	<b>Non-native Dune</b>	B	West B; South B	Bluff stormwater runoff; direct rainfall	Sandy; well drained	invasive annual grasses, <i>Carpobrotus spp.</i>	None to Med	Vegetation, Soil
4	<b>Disturbed Hard-pack</b>	C	North C	Direct rainfall	Hard-packed cobbles and sand	Sparsely vegetated; <i>Pseudognaphalium spp.; Heterotheca grandiflora</i>	Med to High	Soil
4	<b>Annual / Ruderal Grassland</b>	A, C	Interspersed throughout A & C; Central A	Direct rainfall	Coarse grained; well-draining	<i>Brome spp., Avena spp., Festuca perennis</i>	None to Low	Vegetation
4	<b>Non-native "Tall" Herbaceous</b>	A, B, C	Interspersed throughout A, B, & C; Central A	Direct rainfall	Variable	<i>Brassica nigra, Glebionis coronaria, Raphanus sativus, Ricinus communis, Euphorbia terracina, Centaurea diluta</i>	None to Low	Vegetation
4	<b>Iceplant Stand</b>	A	North & West A	Direct rainfall	Coarse grained; well-draining	<i>Carpobrotus spp., Mesembryanthemum spp., Malephora crocea</i>	None to low	Vegetation, Hydrology
4	<b>Upland Scrub</b>	A, B, C	Interspersed throughout A, B, & C	Direct rainfall	Coarse grained; well-draining	<i>Baccharis pilularis, Artemesia californica, and Malosma laurina; Non-native grass understory</i>	Low to High	Vegetation
4	<b>Non-native Tree</b>	A, B, C	Along fence lines and berms	Direct rainfall	Variable	<i>Schinus spp., Acacia spp., Myoporum laetum, palms</i>	None to Low	Vegetation
4	<b>Eucalyptus Grove</b>	B	Southwest along Cabora; west of Gas Co road	Bluff stormwater runoff	Variable	<i>Eucalyptus spp. with leaf litter understory</i>	None to Low	Vegetation
5	<b>Developed</b>	A, B, C	Bisecting all major areas	Direct rainfall	Gravel, concrete, or compacted loam	N/A	None	

Appendix 2. Vegetation alliance and association acreages by habitat type. Note: Within nativity column 'n'=native, 'nn' = non-native, and 'c' = co-dominant native and non-natives.

Vegetation Type	Nativity	Category 1		Category 2						Category 3		Category 4						Category 5	Acres	Total Polygons					
		Subtidal	Intertidal	Tidal Wetland	Non-tidal Salt Marsh	Ruderal Marsh	Brackish Marsh	Brackish Scrub	Salt Pan	Riparian Scrub and Woodland	Iceplant Wetland	Pampas Grass	Dune	Non-native Dune	Disturbed Hard-pack	Annual / Ruderal Grassland	Non-native "Tall" Herbaceous	Iceplant Stand	Upland Scrub	Non-native Tree	Eucalyptus Grove	Developed			
Acacia spp. mu	nn																		1.70			1.7	15		
Acmispon glaber - Croton Californicus mu	n												3.62										3.6	4	
Acmispon glaber alliance	n												1.08										1.1	1	
Ambrosia psilostachya alliance	n												0.14										0.1	1	
Anemopsis californica alliance	n								0.10														0.1	1	
Artemesia californica alliance	n												0.66						1.43				2.1	4	
Arthrocnemum subterminale alliance	n			1.02	0.56																		1.6	6	
Arundo donax stand	nn																0.38						0.4	7	
Atriplex lentiformis alliance	n								10.56														10.6	18	
Atriplex prostrata stand	nn								0.04														0.0	1	
Atriplex semibaccata mu	nn								0.04														0.0	1	
Avena fatua - mixed herb association	nn															2.87							2.9	1	
Baccharis pilularis - annual grass/ herb association	c															0.87		2.06					2.9	7	
Baccharis pilularis - Artemesia californica association	n																	20.07					20.1	5	
Baccharis pilularis - Baccharis salicifolia mu	n																0.22						0.2	2	
Baccharis pilularis - Carpobrotus edulis mu	c															0.26							0.3	3	
Baccharis pilularis - Glebionis coronaria mu	c														0.10								0.1	1	
Baccharis pilularis - Isocoma menziesii - annual grass mu	c														0.95								0.9	1	
Baccharis pilularis - Malosma laurina mu	n																0.89						0.9	1	
Baccharis pilularis alliance	n																14.47							14.5	14
Baccharis salicifolia - annual grass mu	c								0.12														0.1	2	
Baccharis salicifolia - Helminotheca echooides mu	c							0.19															0.2	2	
Baccharis salicifolia alliance	n										5.84					0.02		0.20					6.1	14	
Bassia hyssopifolia - Spergularia macrotheca - annual grass mu	nn								1.05							0.02							1.0	1	
Bassia hyssopifolia mu	nn								0.16						0.08		0.37						0.6	4	
Bolboschoenus maritimus alliance	n								0.80														0.8	2	
Bolboschoenus spp. - Malvella leprosa mu	n								0.48														0.5	1	

Vegetation Type	Nativity	Category 1		Category 2						Category 3		Category 4							Category 5					
		Subtidal	Intertidal	Tidal Wetland	Non-tidal Salt Marsh	Ruderal Marsh	Brackish Marsh	Brackish Scrub	Salt Pan	Riparian Scrub and Woodland	Iceplant Wetland	Pampas Grass	Dune	Non-native Dune	Disturbed Hard-pack	Annual / Ruderal Grassland	Non-native "Tall" Herbaceous	Iceplant Stand	Upland Scrub	Non-native Tree	Eucalyptus Grove	Developed	Acres	Total Polygons
Brassica nigra - Euphorbia terracina mu	nn															0.36							0.4	2
Brassica nigra - Gleibonis coronaria mu	nn															15.68							15.7	6
Brassica nigra - Ricinus communis mu	nn															0.33							0.3	1
Brassica nigra - Salsola tragus mu	nn															0.21							0.2	1
Brassica nigra stand	nn														0.91		65.67						66.6	22
Bromus spp. stand	nn														0.03								0.0	1
Bromus diandrus - Avena spp. stand	nn													0.82									0.8	1
Bromus diandrus - Frankenia salina mu	c					0.05																	0.1	1
Bromus diandrus - mixed herb stand	nn													4.17		2.39							6.6	14
Bromus madritensis stand	nn															0.11							0.1	1
Bromus spp. - mixed herb stand	nn															3.75							3.7	4
Bromus spp. stand	nn													0.03		3.49							3.5	11
California annual grassland mu	nn															0.80							0.8	1
Carpobrotus edulis - Acacia sp. mu	nn																0.21						0.2	1
Carpobrotus edulis - Baccharis pilularis - Glebionis coronaria mu	c															1.90		2.24					4.1	3
Carpobrotus edulis - Distichlis littoralis mu	c												0.72					0.05					0.8	6
Carpobrotus edulis - Glebionis coronaria mu	nn															1.01							1.0	1
Carpobrotus edulis - mixed herb mu	nn																0.89						0.9	5
Carpobrotus edulis stand	nn													1.21		0.66							28.2	97
Centaurea diluta stand	nn																0.85						0.8	2
Clematis ligusticifolia mu	n												0.21										0.2	1
Cortaderia selloana - Salicornia pacifica mu	c													0.08									0.1	1
Cortaderia selloana stand	nn													5.71									5.7	23
Cressa truxillensis - annual grass mu	c												8.47										8.5	9
Cressa truxillensis - Distichlis littoralis alliance	n												1.40										1.4	7
Cressa truxillensis - Festuca perennis - Helminotheca echoioides mu	c												1.27										1.3	1
Cressa truxillensis - Festuca perennis mu	c												0.71										0.7	1
Cressa truxillensis - mixed herb mu	c												0.26										0.3	1
Cressa truxillensis mu	n												0.24	7.69	0.40								8.3	28

Vegetation Type	Nativity	Category 1		Category 2						Category 3		Category 4							Category 5						
		Subtidal	Intertidal	Tidal Wetland	Non-tidal Salt Marsh	Ruderal Marsh	Brackish Marsh	Brackish Scrub	Salt Pan	Riparian Scrub and Woodland	Iceplant Wetland	Pampas Grass	Dune	Non-native Dune	Disturbed Hard-pack	Annual / Ruderal Grassland	Non-native "Tall" Herbaceous	Iceplant Stand	Upland Scrub	Non-native Tree	Eucalyptus Grove	Developed	Acres	Total Polygons	
Croton californicus mu	n												0.24										0.2	1	
Deinandra fasciculata - ruderal herbaceous mu	c																0.17						0.2	1	
Distichlis littoralis - annual grass association	c					1.77																	1.8	5	
Distichlis littoralis - Bassia hyssopifolia mu	c					0.06																	0.1	1	
Distichlis littoralis - Bromus diandrus association	c					0.87																	0.9	2	
Distichlis littoralis - Heliotropium curassavicum mu	n				0.58																		0.6	1	
Distichlis littoralis - Jaumea carnosa association	n				0.05																		0.1	1	
Distichlis littoralis - mixed herb mu	c					0.32																	0.3	2	
Distichlis littoralis - Salicornia pacifica association	n				0.10	0.30																	0.4	3	
Distichlis littoralis alliance	n				0.18	3.40								0.46									4.0	20	
Elymus triticoides alliance	n				0.03		0.07						0.24										0.3	3	
Encelia californica - Artemesia californica association	n												0.89										0.9	1	
Eriogonum parvifolium - Heterotheca grandiflora mu	n												0.09										0.1	1	
Eriogonum parvifolium mu	n												0.25										0.2	2	
Erodium spp. - annual grass mu	nn																0.12						0.1	1	
Eucalyptus spp. stand	nn																				3.40		3.4	5	
Euphorbia terracina - Glebionis coronaria - annual grass mu	nn															0.31							0.3	1	
Euphorbia terracina mu	nn													0.45		7.01	0.01						7.5	27	
Euthamia occidentalis mu	n						1.03																1.0	7	
Exotic landscaping mu	nn																			2.65			2.7	3	
Frankenia salina - annual grass mu	c					1.02																	1.0	4	
Frankenia salina - Brassica nigra mu	c					1.61																	1.6	3	
Frankenia salina - Carpobrotus edulis mu	c											0.03											0.0	1	
Frankenia salina - Cressa Truxillensis mu	n					0.04																	0.0	1	
Frankenia salina - Distichlis littoralis association	n					0.28	0.60																0.9	4	
Frankenia salina alliance	n					0.79	0.01																0.8	17	
Glebionis coronaria - annual grass mu	nn															12.23							12.2	1	
Glebionis coronaria mu	nn															7.83							0.20	8.0	14

Vegetation Type	Nativity	Category 1		Category 2						Category 3		Category 4						Category 5						
		Subtidal	Intertidal	Tidal Wetland	Non-tidal Salt Marsh	Ruderal Marsh	Brackish Marsh	Brackish Scrub	Salt Pan	Riparian Scrub and Woodland	Iceplant Wetland	Pampas Grass	Dune	Non-native Dune	Disturbed Hard-pack	Annual / Ruderal Grassland	Non-native "Tall" Herbaceous	Iceplant Stand	Upland Scrub	Non-native Tree	Eucalyptus Grove	Developed	Acres	Total Polygons
Gleibionis coronaria - annual grass mu	nn															0.49							0.5	1
Helminotheca echoioides - annual grass mu	nn					2.75																	2.7	2
Helminotheca echoioides - Cressa truxillensis mu	c					0.19																	0.2	1
Helminotheca echoioides - Distichlis littoralis mu	c					0.18																	0.2	3
Helminotheca echoioides - Malvella leprosa mu	c					0.71																	0.7	2
Helminotheca echoioides mu	nn					0.85																	0.9	5
Heterotheca grandiflora - Artemesia douglasiana - annual grass mu	c															0.13							0.1	1
Heterotheca grandiflora mu	n														0.11								0.1	1
Isocoma menziesii alliance	n																	0.14					0.1	2
Jaumea carnosa mu	n			0.40						0.09													0.5	11
Juncus mexicanus alliance	n							0.11															0.1	2
Lupinus chamissonis - Ericameria ericoides alliance	n												0.04										0.0	1
Lupinus chamissonis association	n												2.79										2.8	4
Malephora crocea stand	nn																0.02						0.0	1
Malosma laurina alliance	n																0.08						0.1	1
Malvella leprosa - annual grass mu	c					1.99																	2.0	1
Malvella leprosa mu	n			1.35																			1.3	4
Myoporum laetum stand	nn																		0.60				0.6	2
Opuntia microdasys mu	nn																0.02						0.0	1
Palm spp. mu	nn																	0.31					0.3	4
Phacelia ramossissima mu	n											0.11											0.1	1
Psuedognaphalium canescens mu	n													0.45									0.4	1
Psuedognaphalium sp. - Heterotheca grandiflora - Erodium spp. mu	c													1.09									1.1	1
Psuedognaphalium sp. - Heterotheca grandiflora mu	n													1.04									1.0	1
Raphanus sativus stand	nn															2.32			0.06				2.3	5
Rhus integrifolia alliance	n																						0.1	1
Ricinus communis - Raphanus sativus mu	nn														0.13								0.1	1
Ricinus communis mu	nn														0.46								0.5	3
Ruderal herbaceous mu	nn												8.58	0.92		40.57						0.25	50.4	31
Salicornia pacifica - annual grass association	c					6.71																	6.7	7
Salicornia pacifica - Arthrocnemum subterminale - annual grass mu	c					0.90																	0.9	1

Vegetation Type	Nativity	Category 1		Category 2						Category 3		Category 4						Category 5	Acres	Total Polygons						
		Subtidal	Intertidal	Tidal Wetland	Non-tidal Salt Marsh	Ruderal Marsh	Brackish Marsh	Brackish Scrub	Salt Pan	Riparian Scrub and Woodland	Iceplant Wetland	Pampas Grass	Dune	Non-native Dune	Disturbed Hard-pack	Annual / Ruderal Grassland	Non-native "Tall" Herbaceous	Iceplant Stand	Upland Scrub	Non-native Tree	Eucalyptus Grove	Developed				
Salicornia pacifica - Arthrocnemum subterminale association	n			0.03	7.52	2.37																	9.9	10		
Salicornia pacifica - Brassica nigra association	c					2.77																		2.8	2	
Salicornia pacifica - Cressa truxillensis mu	n			0.17	8.47																			8.6	7	
Salicornia pacifica - Distichlis littoralis association	n			0.89	1.47																			2.4	11	
Salicornia pacifica - Frankenia salina - Distichlis littoralis mu	n				0.02																			0.0	1	
Salicornia pacifica - Frankenia salina association	n			0.04	1.29																			1.3	4	
Salicornia pacifica - Jaumea carnosa - Distichlis littoralis association	n			1.79																					1.8	9
Salicornia pacifica - Jaumea carnosa association	n			2.95																					2.9	13
Salicornia pacifica - Malvella leprosa mu	n				0.18																				0.2	2
Salicornia pacifica - mesembryanthemum nodiflorum mu	c					0.39																			0.4	1
Salicornia pacifica - mixed herb mu	c					0.30																			0.3	3
Salicornia pacifica - Schoenoplectus spp. mu	n					0.35																			0.3	1
Salicornia pacifica - Symphyotrichum subulatum mu	n			0.74																					0.7	1
Salicornia pacifica alliance	n			10.37	49.54	0.39																			60.3	62
Salix exigua - Baccharis salicifolia mu	n											0.12													0.1	1
Salix exigua alliance	n											0.32													0.3	2
Salix lasiolepis alliance	n											8.84													8.8	16
Schinus molle association	nn																			0.03				0.0	1	
Schinus sp. - Myoporum laetum stand	nn																		0.03					0.0	1	
Schinus terebinthifolius - mixed palm - mixed herb mu	nn																		0.24					0.2	1	
Schoenoplectus (S. americanus, Bulboschoenus maritimus, B. robustus) mu	n					0.50																			0.5	3
Schoenoplectus americanus alliance	n					0.17																			0.2	1
Schoenoplectus californicus alliance	n					0.16																			0.2	2
Schoenoplectus spp. - Distichlis littoralis mu	n					0.03																			0.0	1

Vegetation Type	Nativity	Category 1		Category 2						Category 3		Category 4								Category 5				
		Subtidal	Intertidal	Tidal Wetland	Non-tidal Salt Marsh	Ruderal Marsh	Brackish Marsh	Brackish Scrub	Salt Pan	Riparian Scrub and Woodland	Iceplant Wetland	Pampas Grass	Dune	Non-native Dune	Disturbed Hard-pack	Annual / Ruderal Grassland	Non-native "Tall" Herbaceous	Iceplant Stand	Upland Scrub	Non-native Tree	Eucalyptus Grove	Developed	Acres	Total Polygons
Schoenoplectus spp. - Malvella leprosa mu	n								2.08														2.1	1
Suaeda taxifolia mu	n				0.05																		0.0	1
Typha spp. - Cortaderia selloana mu	c					0.10																	0.1	1
Typha spp. alliance	n						0.43																0.4	2
Unvegetated	----							0.21					0.03										0.2	2
Unvegetated (development)	----																						62.31	62.3
Unvegetated (dirt road)	----																						2.35	2.3
Unvegetated (open water)	----	53.69																					53.7	1
Unvegetated (salt scald)	----								22.81														0.02	22.8
Unvegetated (tidal channel)	----		3.49																				3.5	3
Total Acres	----	53.7	3.5	18.2	85.6	39.5	6.5	10.6	22.8	15.5	2.0	5.8	10.7	14.3	5.0	14.6	159.2	27.8	41.9	5.6	3.4	65.1	611.3	811

Appendix 2. Habitat acreage summary.

Habitat Type	Acres
Subtidal	53.69
Intertidal	3.49
Tidal Wetland	18.23
Non-tidal Salt Marsh	85.64
Ruderal Marsh	39.55
Brackish Marsh	6.51
Brackish Scrub	10.56
Salt Pan	22.81
Riparian Scrub and Woodland	15.46
Iceplant Wetland	2.04
Pampas Grass	5.80
Dune	10.65
Non-native Dune	14.34
Disturbed Hard-pack	4.96
Annual / Ruderal Grassland	14.64
Non-native "Tall" Herbaceous	159.21
Iceplant Stand	27.77
Upland Scrub	41.91
Non-native Tree	5.56
Eucalyptus Grove	3.40
Developed	65.14
<b>TOTAL</b>	<b>611.35</b>



# Ballona Wetlands Ecological Reserve Existing Habitat Units

## Habitat Units by Type

### Category 1

- Subtidal
- Intertidal Channels

### Category 2

- Tidal Wetland
- Non-tidal Salt Marsh
- Salt Pan
- Ruderal Marsh
- Brackish Marsh
- Brackish Scrub
- Riparian Scrub and Woodland

### Category 3

- Iceplant Wetland
- Pampas Grass Stand
- Dune
- Non-native Dune
- Disturbed Hard-pack

### Category 4

- Annual / Ruderal Grassland
- Non-native "Tall" Herbaceous
- Iceplant Stand
- Upland Scrub
- Eucalyptus Grove
- Non-native Tree

### Category 5

- Developed

N

0 250 500 Meters

Existing habitat units map was based on survey fieldwork conducted by Ivan Medel of The Bay Foundation, May - October 2013.  
Map created by Ivan Medel.



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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