Los Angeles Living Shoreline Project

Restoration and Monitoring Plan for Beach and Bluff Habitat

June 2021

Prepared for:

California Coastal Commission
Los Angeles County Department of Beaches and Harbors
California Department of Parks and Recreation
California State Coastal Conservancy

The Bay Foundation
8117 W. Manchester Ave. #750, Playa Del Rey, CA 90293
(888) 301-2527
www.santamonicabay.org

Los Angeles Living Shoreline Project:
Restoration and Monitoring Plan for Beach and Bluff Habitats

30 June 2021

Timing of Operations: The beach and dune restoration components of the Los Angeles Living Shoreline Project will begin implementation likely in Winter 2021 once a Coastal Development Permit has been approved. Outreach and baseline monitoring efforts are ongoing. The project will be scientifically monitored for a period of no less than five years post-implementation.

Prepared by:

The Bay Foundation

Prepared for:

California Coastal Commission, Los Angeles County Department of Beaches and Harbors, California Department of Parks and Recreation, City of Los Angeles, State Coastal Conservancy

Scientific Contributors and Reviewers:

Karina Johnston, Chris Enyart, Maggie Jenkins, Sara Cuadra, Dane Lazarus; The Bay Foundation
Melodie Grubbs, University of Southern California Sea Grant Program
Evyan Sloane, California State Coastal Conservancy
Maral Tashjian, Los Angeles County Department of Beaches and Harbors
Danielle Le Fer, California Department of Parks and Recreation
Katy Kughen, US Fish and Wildlife Service
Stacey Vigallon, Los Angeles Audubon Society

Landscape Architecture and Graphic Design:

David Revell, Integral Consulting; Matthew Jamieson, Integral Consulting; Clark Stevens, New West Land Company, Inc.; Calene Luczo Fletcher, Luczo Illustration and Design

Suggested Citation:

Johnston, K.K., C. Enyart, M. Jenkins, S. Cuadra, and D. Lazarus. 2021. Los Angeles Living Shoreline Project Restoration and Monitoring Plan. Plan prepared by The Bay Foundation for the California Coastal Commission, Los Angeles County Department of Beaches and Harbors, City of Los Angeles, and State Coastal Conservancy. 102 pp.

Acknowledgements

We would like to thank the California State Coastal Conservancy and the Honda Marine Science Foundation for funding this demonstration living shoreline project, and our partners: Los Angeles County Department of Beaches and Harbors, California Department of Parks and Recreation, City of Los Angeles, and Audubon Society. Some of the graphics of this report were provided by Integral Consulting and New West Land Company, Inc. Additionally, we recognize and acknowledge that we are on the land of the Gabrielino-Tongva people who have lived and continue to live here. We pay respects to their elders past and present, and thank them for their strength, perseverance, and resistance. The project team endeavored to use culturally appropriate native vegetation in the planting plan and minimize disturbance in restoration techniques.

Table of Contents

Introduction 1
Background 1
Historical Ecology 2
Historical Dockweiler Beach Nourishment 3
Western Snowy Plover Enclosure 6
Project Goals 8
Site Description and Baseline Data 11
Survey Methods 12
Beach Area Results 14
Bluff Area Results 20
Western Snowy Plover Results 25
California Least Tern Results 28
Additional Plants and Wildlife 28
Opportunities and Constraints 30
Site Opportunities: 30
Site Constraints: 30
Project Description 31
Beach Area 32
Bluff Area 33
Coastal Processes 34
Permitting 38
Restoration Plan 40
Restoration Techniques 42
Perimeter Fencing 42
Symbolic Pathways and Interpretive Signage 42
Beach Restoration 43
Bluff Restoration 44
Invasive Non-Native Species Control 45
Re-vegetation Strategies 45
Native Plants: Seeding and Container Stock 46
Water Truck 51

Conservation Measures 51
Adaptive Management 53
Scientific Monitoring 54
Individual Protocol Details 56
Photo-Point 56
Wrack Cover 56
Vegetation Cover 57
Avifauna (and Pollinator Presence) 57
Physical Characteristics 58
Weather Conditions 58
Human Use, Volunteer Event Data, Site Checklist 58
Additional Studies 58
Success Criteria 58
Maintenance 60
Reporting 60
Literature Cited 61

The contents of this report do not necessarily reflect the views and policies of partner entities, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Introduction

Background

Los Angeles County beaches are some of the most recognizable and popular beaches in the world. They feature cliffs, tidepools, marine life, and hold many recreational opportunities for the millions of people who visit the vast coastline each year. In recent years, over 70 million people have visited beaches in Los Angeles County annually. Although sandy beaches traditionally have been and continue to be managed primarily as recreation areas, they are also important natural ecosystems that link marine and terrestrial environments and are considered a major habitat. The protection of sandy beaches and an understanding of their condition has become increasingly important in their relationship to sea level rise and coastal resilience.

Beaches are broadly recognized and highly valued as cultural and economic resources for coastal regions (Dugan et al. 2015). However, their value as ecosystems is often less appreciated. Southern California beach systems and associated wildlife are highly impacted by threats, including native species extirpation and extinction, erosion, non-natural sediment and sand transport through mechanical means, pollution, and loss of natural morphology due to grooming and other maintenance activities (Dugan et al. 2003, Dugan et al. 2008, Defeo et al. 2008, Dugan and Hubbard 2010, Hubbard et al. 2013). However, these systems can also offer a nature-based adaptation approach, or "living shoreline", form of protection for our coastlines. As a vital part of our coastline, beaches and dunes support and protect our homes, roads, and infrastructure, providing a natural buffer from sea level rise (SLR) as well as from tidal and wave action from the ocean. Dunes and other beach habitats are critical in managing sand transport to create resilient beach morphologies, which naturally adapt to climate change impacts. By restoring natural processes to impacted beach systems, we will improve their ecological and utilitarian functions, and serve as a model for similar projects statewide.

Since the 1960s, many of the beaches in the Los Angeles area have been subjected to the continuous removal of natural features as they begin to develop. Additional impacts have occurred from development such as roads and highways, homes, and other types of infrastructure. When beaches are allowed to maintain or create natural features, such as low vegetated dunes, they provide a cost-effective buffer to storm surges and other regular, predictable threats, including sea level rise and increased erosion.

In April 2016, Los Angeles (LA) County Department of Beaches and Harbors (LACDBH) published the LA County Public Beach Sea Level Rise Vulnerability Assessment, made possible by a grant from the California State Coastal Conservancy (LACDBH 2016). This assessment identified 28 public beach facility assets at Dockweiler State Beach, including restrooms, parking lots, lifeguard facilities, concession stands, and others, many of which would be vulnerable to impacts from sea level rise. Additionally, with no shoreline protection measures implemented, the analysis suggests that Dockweiler State Beach could lose up to 40% of its beach or more with 200 cm of sea level rise, and up to 60% of its beach due to combinations of sea level rise and storm erosion. The Los Angeles Living Shoreline Project (LA-LSP) provides an opportunity to evaluate a cost-effective and low-impact solution to increase the resiliency of the shoreline at Dockweiler State Beach in LA County and potentially inform scalable future efforts. Dockweiler State Beach is designated as a California State Park and is managed by LACDBH, with

multiple stakeholder interests, including US Fish and Wildlife Service (USFWS) and Los Angeles Audubon Society.

Historical Ecology

Historical ecology is the study of how humans have interacted with natural landscapes over time. A basic tenant of this field is that different societies alter ecological landscapes in different ways. Historically, large expanses of dunes once covered the coastal zone at Dockweiler Beach, extending into large, stabilized back dunes or bluff that now exist at the LAX Dunes owned by City of Los Angeles, Los Angeles World Airports. The dunes extended throughout much of the central Santa Monica Bay (Figure 1). Due to urbanization, an increase in development, and beach grooming (raking) practices, a significant portion of these historical dunes have disappeared. The historical ecology of the adjacent subtidal habitat is not included in this document, as the eelgrass (*Zostera pacifica*) portion of this project is permitted separately and is not part of this Restoration and Monitoring Plan.

Figure 1. USGS Topographical map from 1896 for the Redondo quadrangle (courtesy: USC Digital Library, downloaded March 2021, cropped).

Historical Dockweiler Beach Nourishment

Historical photos and beach profile data suggest that Santa Monica Bay beaches, including Dockweiler Beach, were historically narrow due to limited sand supplies from the Santa Monica Mountains watershed (Figure 2). The development of dams, channelization of streams, mining, and altering the course of the Los Angeles River have exacerbated low sediment supply (Flick 1993, Orme et al. 2011, Griggs & Patsch 2018). To combat low sediment supply, Dockweiler Beach was heavily nourished with sand from the late 1930s to 1989. Sand for the nourishment projects was supplied by the Hyperion Sewage Treatment Plant and Scattergood Power Plant construction, just inland of Dockweiler Beach, and the dredging of Marina del Rey, just upcoast of Dockweiler Beach (Flick 1993, Orme et al. 2011). In 1938, approximately 1.37 million cubic meters (m^3) of sand was deposited on Dockweiler Beach from the Hyperion site, and again in 1989 approximately 840,000 m^3 of sand was deposited (Wiegel 1994, Flick 1993). In total, Dockweiler Beach received 22.2 million m^3 of sand over at least ten major nourishments (Orme et al. 2011). In 1993 Flick reported that the beaches in the Santa Monica Bay region were 150 m wider than in 1935; similarly, Orme (2011) reported that Dockweiler Beach was over 150 m wider in 2002 compared to 1927. Despite erosion, there has been an overall trend of beach widening at Dockweiler Beach due to the repeated nourishments (Hapke 2006).

Figure 2. Historical distribution of open water, beach, and dune habitat types overlaid onto present-day aerial imagery of the project site. Historical habitat types were determined by the Southern California Coastal Water Research Project 2010 analysis on the Historical Ecology of southern California Coastal Wetlands, which digitized T-sheets (historical coastal topographic maps) from 1851 to 1889.

Figure 2 depicts the historically narrow beach backed by dunes, where the present-day project footprint was historically submerged. Figure 3 – Figure 5 show a historical photograph series replicated from the USC Digital Commons Library beginning with Figure 3 in 1921 prior to nourishment activities (historical mouth of Ballona Creek is to the left). Figure 3 – Figure 5 illustrate Dockweiler Beach and surrounding areas in the 1950's after nourishment.

Figure 3. Dockweiler Beach and LAX Dunes in 1921, prior to beach nourishment activities (replicated and cropped from the USC Digital Commons Library, accessed May 2021).

Figure 4. Historical image of Dockweiler Beach (to the south, above) and Venice Beach (to the north, below) after nourishment in 1957 (replicated and cropped from USC Digital Library Commons, accessed May 2021).

Figure 5. Historical image of the Surfridge neighborhood and the adjacent Dockweiler Beach c. 1950's after nourishment (replicated and cropped from USC Digital Library Commons, accessed May 2021).

Western Snowy Plover Enclosure

USFWS designated 34 acres of the northern portion of Dockweiler State Beach (DSB North CA-45B), near Lifeguard Tower 47, as critical habitat for the recovery of the federally threatened western snowy plover (*Charadrius alexandrinus nivosus*, USFWS 2005, USFWS 2012). To protect the Dockweiler State Beach western snowy plover population, a small subset of the critical habitat was marked off in 2008 as a protected area, using orange road cones to delineate the protected area perimeter (Ryan et al. 2010 and 2017, Figure 6). The cones were then replaced by a 3-sided orange plastic mesh fence in February 2010. The fenced area measured 100 x 300 ft long with an opening to the ocean that has post-rope fencing (Talbot 2010, Ryan et al. 2010). The plover enclosure was again upgraded in August 2010 with wood-slat fencing secured to metal posts (Vigallon 2013, Ryan et al. 2017, Figure 7). By 2011, both native and non-native dune plant species germinated naturally within the Dockweiler plover enclosure. Native species included beach saltbush (*Atriplex leucophylla*), red sand verbena (*Abronia maritima*), beach bur (*Ambrosia chamissonis*), and beach evening primrose (*Camissonia cheiranthifolia*). Non-native plant species included sea rocket (*Cakile maritima*) and iceplant (*Carpobrotus* spp.).

LACDBH was concerned about the vegetation within the enclosure and requested that all vegetation be removed in spring of 2015 and 2016 (Vigallon 2013, Ryan et al. 2015, Ryan et al. 2017). Following removal, well-established species, such as beach bur, quickly returned (Ryan et al. 2015); native vegetation has not been removed since 2016, except within areas where sand removal has occurred for fence maintenance. In early 2019, new wood-slat fencing was installed within the same enclosure footprint to replace the deteriorating fence posts. As a part of the installation, LACDBH mechanically removed sand accumulation on the north and south sides along the inside edge of the enclosure fence, extending in about the width of a tractor. Topography and plants on the interior of the enclosure were otherwise left intact during this event. Invasive, non-native plant species, such as iceplant and sea rocket, inside the enclosure have continued to be removed by hand, but native plants have been allowed to re-establish in the areas where sand removal occurred. (S. Vigallon, pers. comm., 17 June 2021).

Regular beach grooming occurs outside the enclosure year-round, but LACDBH typically avoids grooming the dry sand directly seaward of the enclosure. The beach grooming removes kelp wrack, trash, and any other vegetation, while flattening the beach. Minimal trash has been identified to date within the enclosure but what is found is removed regularly (Ryan et al. 2010 and 2017). Since spring of 2020, removal of the wood-slat fencing for use in illegal beach bonfires has been a problem. The fencing is currently being replaced with PVC-coated wire mesh to discourage damage to the fence by beachgoers. The north and south sides of the fence have been replaced and replacement of the east side is planned for Summer 2021 (S. Vigallon, pers. comm., 17 June 2021).

Figure 6. Cones placed around roost at Dockweiler Beach in 2008 (credit Ryan et al. 2010).

Figure 7. Photograph of the plover enclosure in July 2020 taken facing northeast (bluffs).

Project Goals

The purpose of the Los Angeles Living Shoreline Project (LA-LSP) is to create an innovative multi-habitat living shoreline at Dockweiler State Beach. The project aims to restore approximately four acres of sandy beach and coastal bluff habitat and implement a pilot restoration to establish adjacent offshore eelgrass within a 1-acre footprint. The eelgrass (*Zostera pacifica*) portion of this project is permitted separately and is not part of this Restoration and Monitoring Plan. For more information about the eelgrass habitat restoration portion of the project, contact The Bay Foundation: https://www.santamonicabay.org/contact/.

LA-LSP will utilize existing sediments to transform a portion of the current beach into a sustainable coastal strand and bluff habitat complex resilient to sea level rise. As an alternative to traditional hardscaping options, this project will evaluate a living, restored shoreline with a diverse wildlife community as an alternate approach to combat climate change. Three specific goals of the Los Angeles Living Shorelines Restoration Project include:

1. Improve ecosystem benefits through habitat restoration;
2. Implement a nature-based adaptation measure against sea level rise and storm erosion; and
3. Engage the community through enhanced beach experiences, outreach, and education.

Encouraging natural accretion of sand will build topography and increase elevation across the upper shore to store sand. This will help alleviate the effects of large winter storms and in the long-term, sea level rise. Intact and native dune systems are more resilient to disturbance than degraded systems.

LA-LSP aims to enhance the beach habitats by replacing the existing plover fence (Figure 7), restricting grooming in a larger area, enhancing dune formation through sand fencing and biomimicry stakes, restoring plant communities through seeding and planting native vegetation, and engaging the public through interpretive signage and educational elements. LA-LSP aims to enhance the bluff or back dune habitats by replacing the invasive existing plants with native dune and coastal bluff species and using a combination of erosion control features and restoration elements to reduce potential erosion. After seeding and planting vegetation, sandy coastal strand habitats and dunes would naturally develop, which will then support higher levels of the ecological community (e.g., invertebrates, birds). Scientific literature highlights the need for ecosystem-level, rather than species-level, beach restoration planning to achieve the greatest ecological benefits (e.g., Schlacher et al. 2008). The ecosystem benefits living shorelines projects provide are not limited to a narrow time period but continue over time as the shoreline establishes, compared to hard shorelines that require maintenance and often result in the loss of beach.

This demonstration site will also serve as a model for the region, showing that heavy recreational use of beaches and meaningful habitat restoration are not incompatible goals. It will provide not only a scientific basis to develop guidelines and protocols but an integrated, locally based program for increasing the usefulness of natural environments in a developed area. It will evaluate nature-based low-cost natural living shoreline protection from sea level rise and storms while providing public benefits and enhancing natural resource values.

Additionally, this project will help reestablish an appreciation that has been lost in the Los Angeles region of a natural, functioning beach ecosystem and the site will provide educational and recreational opportunities. In addition to reducing coastal hazards and protecting birds, this project will encourage nature-based tourism and increase community awareness of living shorelines while still allowing other existing recreational uses of the beach to continue.

This project would not be possible without additional project partners: California Department of Parks and Recreation (CDPR, land owners), LACDBH (land managers), City of Los Angeles (bluff owners and co-jurisdiction of the beach), California State Coastal Conservancy (funders), Honda Marine Science Foundation (funders), and Los Angeles Audubon Society (stakeholders and advisors). We are grateful for their support and enthusiasm for this pilot project. In addition to the partners listed above, we are also grateful for the many proponents and supporters of this project and scientific advisors, including but not limited to: USFWS, Santa Monica Bay Audubon Society, United States Geological Survey, California Department of Fish and Wildlife, University of Southern California Sea Grant Program, Loyola Marymount University's Coastal Research Institute (CRI), Tom Ryan Consulting, Inc., Cooper Ecological Monitoring, Inc., Coastal Restoration Consultants, Inc., Heal the Bay, US Environmental Protection Agency, Assemblymember Bloom, Assemblymember Burke, City of Santa Monica, Climate Resolve, Southern California Marine Institute, Los Angeles World Airports, Congressmember Lieu, community stakeholders, and local residents and visitors to the site.

Figure 8. Aerial photographs pre-restoration from 2006 (top) and 2013 (bottom) (courtesy: California Coastal Records Project, accessed 10 May 2021).

Site Description and Baseline Data

Dockweiler Beach is owned by CDPR and actively managed by LACDBH. The nearby El Segundo Blue Butterfly Preserve at the LAX Dunes, and a history of wintering and nesting federally threatened western snowy plovers, gives USFWS a vested interest in the habitat value and restoration of the project site. The proposed bluff restoration area is currently dominated by invasive iceplant and is in poor condition. Project activities would involve removing invasive vegetation species and planting with a native California coastal dune and bluff species palette that would provide habitat for nearby wildlife. The proposed beach restoration area is varied, with a portion of the restoration site currently containing a bird enclosure for western snowy plovers and the remaining portion of the site managed by beach grooming activities. While some native plants are present in the enclosure portion of the beach site, there is non-native vegetation present, and the site is not actively managed aside from the installation and maintenance of fencing, with some removal of non-native plants. No seeding or planting of native vegetation has historically occurred on site. Historically, dune systems were a prominent feature of this area; over time with increased development and urbanization, these dune features disappeared. The project site consists of approximately four acres of sandy beach and bluff restoration. Restoration activities are proposed on 3.35 acres in the beach area, and 0.60 acres in the bluff area (Figure 9). The beach portion of the project footprint includes a 0.83-acre protective enclosure for the western snowy plover.

This section of the Restoration and Monitoring Plan contains site descriptions, photographs, and baseline data from pre-implementation monitoring surveys used to characterize ecological and physical baseline site conditions, including vegetation, avifauna, and elevation profiles. Surveys were conducted by scientists at The Bay Foundation (TBF), with support from CRI, interns, and other partner organizations. Western snowy plover data were collected by Tom Ryan, ornithologist, and Los Angeles Audubon Society. Additional pre-restoration surveys will be conducted prior to restoration activities to further assess the baseline conditions of the site, which are further described in the Scientific Monitoring section.

Figure 9. Overview map of the LA-LSP beach and bluff restoration area.

Survey Methods

To characterize existing vegetation and topographic variability at the site, fieldwork was conducted on 13, 15, 17, and 21 July 2020. Data were collected for a variety of survey protocols described in Table 1, with results for vegetation cover, mapping, and elevation profiles reported here. The goal of the baseline data assessment was to collect data that would inform restoration planning, determine existing conditions, map baseline vegetation, and inform an opportunities and constraints analysis for the site. Surveys were not intended as a full floristic survey or to characterize presence of all wildlife. Photographs can be used as qualitative assessments of seasonal variation and changes following restoration activities. Georeferenced photographs (Photo Point surveys) were taken at eight beach stations and six bluff stations on 17 and 21 July 2020. Photos will be available in future monitoring reports for comparative temporal analysis at fixed sites.

Vegetation cover and elevation was measured along six 100-meter transects (running approximately east-west) in the beach restoration area and four 20-meter transects on the bluff restoration area (running approximately east-west). Restoration transects were generated by first establishing a baseline transect parallel to the ocean running the length of each of the beach and bluff areas and then randomizing meter marks at which monitoring transects would run perpendicular to the baseline. Two

control transects were also established for each of the beach and bluff areas. Figure 10 displays a map of final restoration and control monitoring transects.

Figure 10. Map of beach and bluff restoration and control monitoring transects.

Table 1. Survey methods for baseline monitoring

Parameter	Protocol
Photo Point	Georeferenced Photographs
Vegetation Cover	Line-Intercept and cover class quadrats along transects, Vegetation mapping
Physical Characteristics	Elevation profiles using elevation poles and GPS Trimble

Line-intercept transect and cover class quadrat survey methods were used to asses vegetation cover. Additional details on these vegetation cover survey methods can be found in SOP 3.2 Vegetation Cover Surveys (TBF 2015b) and below in the Vegetation Cover subsection of the Scientific Monitoring section. Data were evaluated as percent cover by species. Additionally, vegetation mapping was conducted to further characterize the project and control areas. This protocol uses a combination of aerial imagery, high-resolution Trimble GPS, and in-situ observations to delineate polygons depicting species composition. Vegetation mapping protocols are described in detail in SOP 3.5 Vegetation Mapping (TBF

2015c). Furthermore, elevation profiles were collected using a combination of elevation poles and a Trimble GPS (Figure 11). Methods are described in detail in Dugan et al. 2015 and below in the Physical Characteristics subsection of the Scientific Monitoring section. Western snowy plover data were collected by Tom Ryan, ornithologist, and LA Audubon Society through monthly roost surveys of historic roosting and nesting areas. Additional information on avifauna surveys can be found below in the Avifauna (and Pollinator Presence) subsection of the Scientific Monitoring section.

Figure 11. TBF conducting elevation profile survey on 15 July 2020.

Beach Area Results

Figure 12 displays representative photographs of the beach project area. The area is comprised of the protective plover enclosure and surrounding mechanically groomed beach. Figure 13 and Figure 14 displays absolute percent native cover, non-native cover, and bare ground for all beach transects. Vegetation cover in the beach area was entirely restricted to within the plover enclosure (Transects: T2-T4) and along the fence perimeter (T5). Control transects (C1 and C2) and transects located in areas currently groomed (T1, T4, T5) were comprised of 100% sandy beach or bare ground.

Vegetation mapping results show cover was densest in the eastern (landward) portion of the enclosure and sparser oceanward, with a mixture of native and non-native cover occurring along the fence perimeter (Figure 14). Non-native cover consisted solely of sea rocket, and native cover included beach bur, red sand verbena, beach evening primrose, and beach saltbush. The large expanse of beach surrounding the enclosure was devoid of vegetation due to current grooming activities. Appendix 1 includes a list of plant species encountered during field work.

Figure 15 displays beach elevation profiles for restoration transects inside (top) and outside (bottom) of the plover enclosure, and Figure 16 shows profiles for the control transects. Transects located outside the enclosure, where beach grooming occurs, exhibited a consistent decline in elevation oceanward with a steep drop off at the berm (at approximately 80 meters). While T5 is outside of the enclosure, it runs closely parallel to the northern fence perimeter, thus showed a slight increase in elevation around the 35–65-meter mark likely due to sand accumulating along the fence. Transects within the enclosure

showed slightly more topographic complexity, likely due to the presence of native dune building species. Several hummocks occurred at approximately the 35-meter mark, which is where the enclosure begins (Figure 15, top). This is consistent with vegetation mapping results, which showed the highest native cover in this same approximate area.

Additional photos of the beach project area can be found in the photo point section (Appendix 2). Photos support results of the vegetation cover and elevation surveys, showing relatively flat and unvegetated sandy beach in areas currently mechanically groomed, and patchy vegetation and vegetated dune hummocks existing within the plover enclosure and along the perimeter.

Figure 12. Representative photographs from Dockweiler Beach, including the plover enclosure (credit: TBF, 13 July 2020).

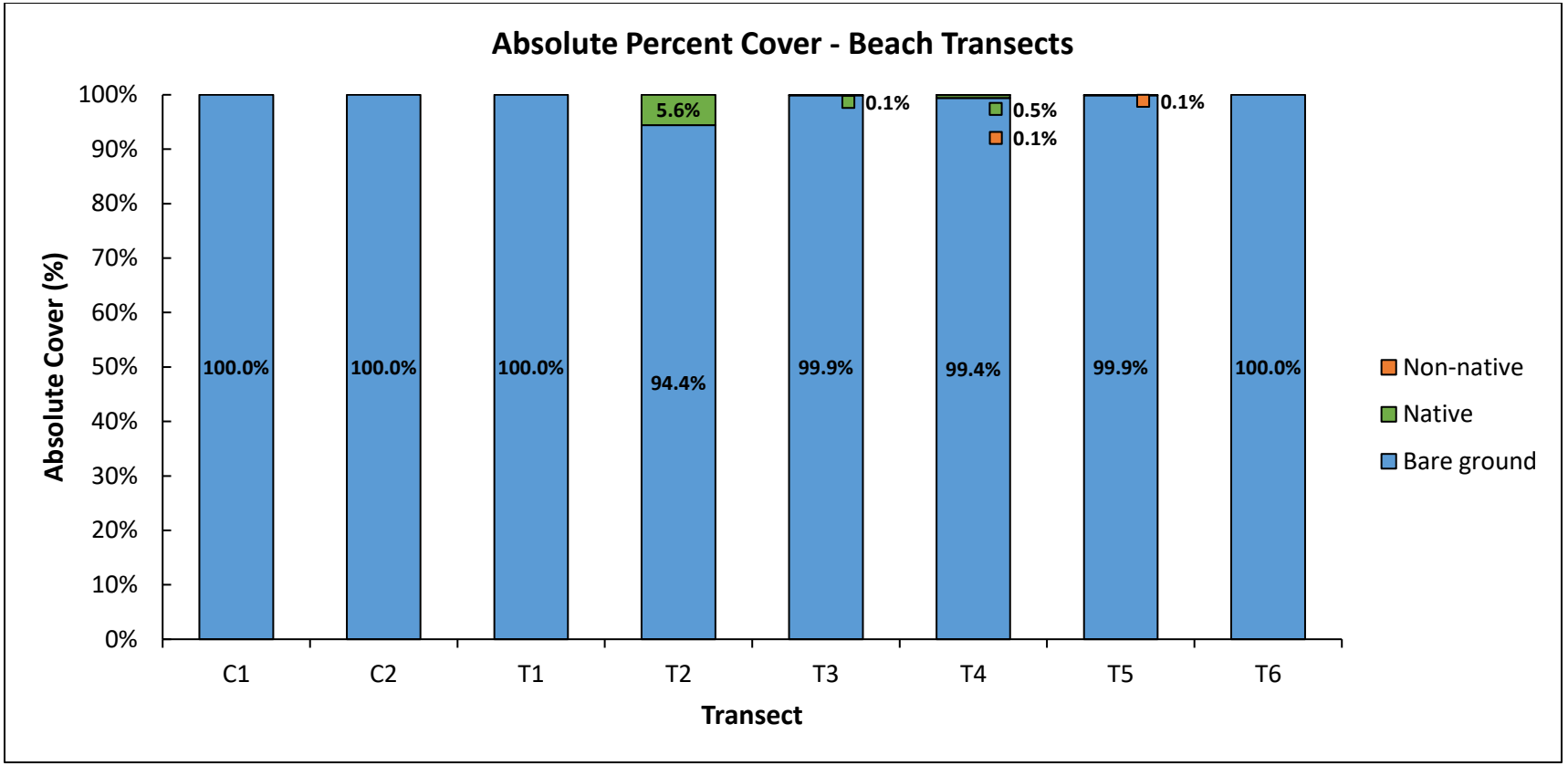


Figure 13. Absolute percent native cover, non-native cover, and bare ground for all beach transects.

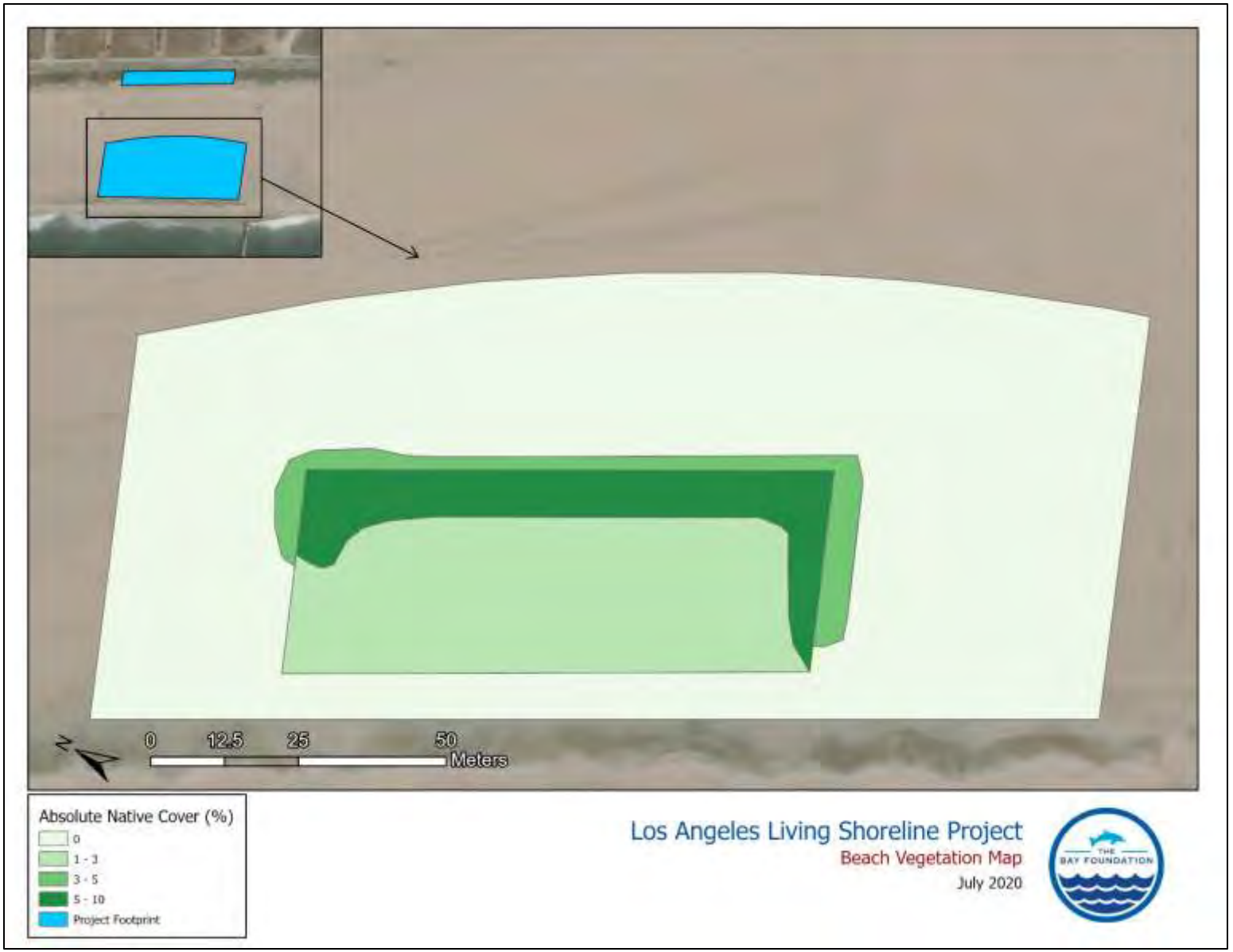


Figure 14. Beach vegetation mapping results displaying absolute native cover (July 2020).

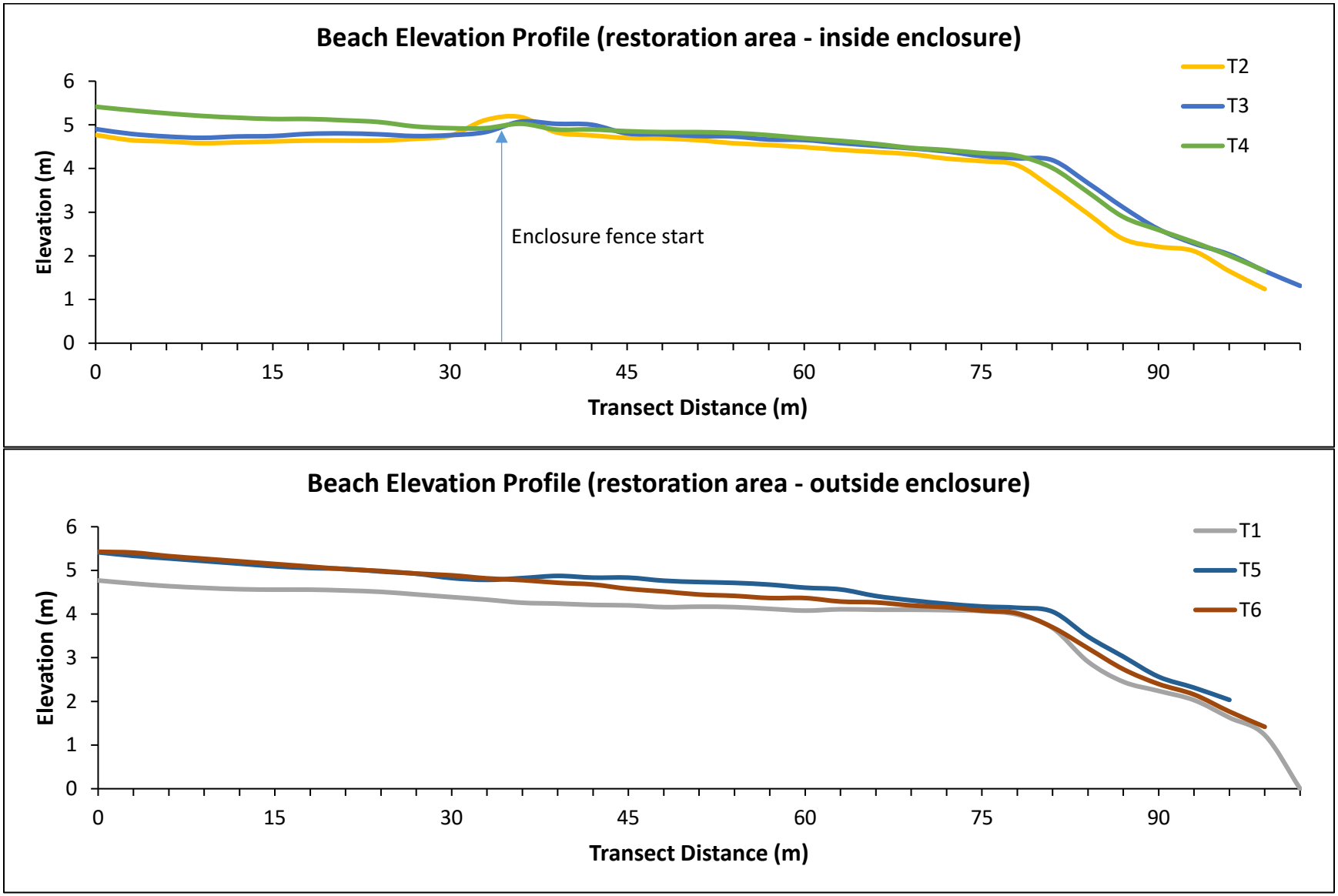


Figure 15. Baseline elevation profiles for located inside (top) and outside (bottom) of the plover enclosure (Elevation in NAVD88).

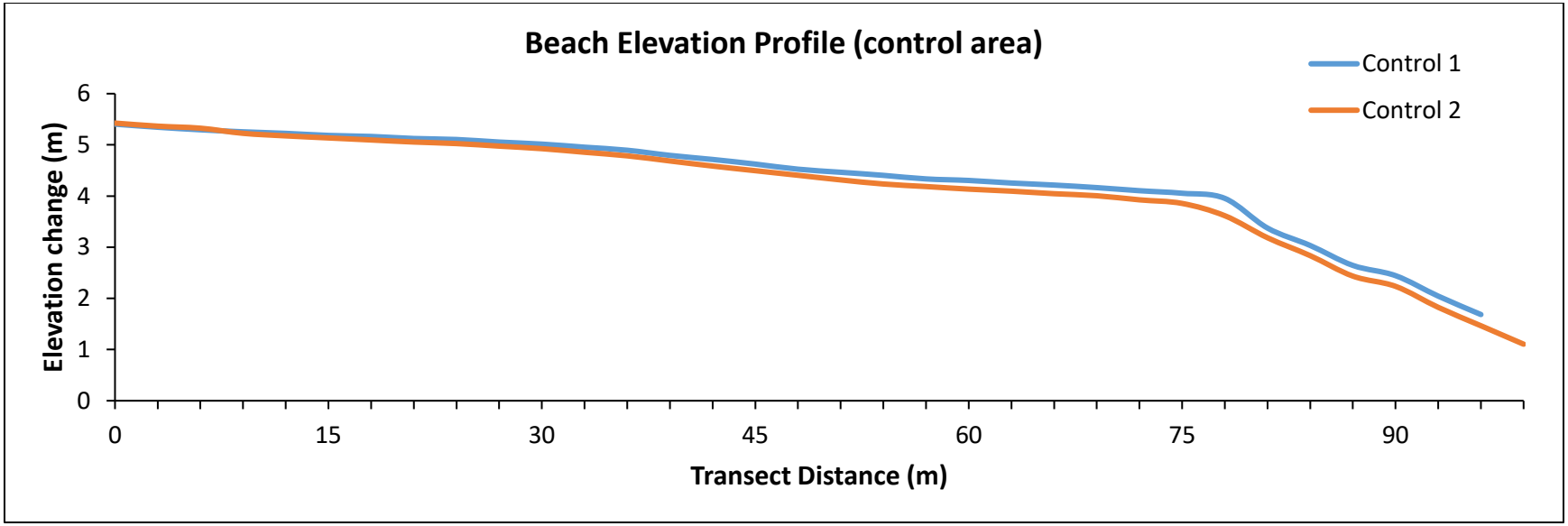


Figure 16. Baseline elevation profiles for control transects.

Bluff Area Results

Figure 17 shows representative photographs of the bluff project area. Photos display a monoculture of iceplant existing along most of the bluff with intermittent mounds of sand along the base. Figure 18 and Figure 19 display absolute percent native cover, non-native cover, and bare ground for all bluff transects. Very little native cover was detected along transects with only a small amount recorded on one restoration transect (T2 – 0.2%) and one control transect (C2 – 0.1%). Cover was comprised primarily of non-native species (65.7-85.6%) for nearly all transects (T1-T4 and C1). Only C2 consisted of mostly bare ground (80.3%), as the transect ran through a largely unvegetated pathway with intermixed iceplant.

Vegetation mapping displayed similar results; the bluff project area was primarily composed of non-native iceplant with other native and non-native species existing intermittently (Figure 19). Other non-natives recorded in the area included Australian saltbush (*Atriplex semibaccata*), sea rocket, wild radish (*Raphanus sativus*), Russian thistle (*Salsola tragus*), prickly lettuce (*Lactuca serriola*), mustard (*Brassica* spp.), brome grass (*Bromus diandrus*), and other non-native grasses. Native species included beach evening primrose, California croton (*Croton californicus*), Jimsonweed (*Datura wrightii*), and telegraph weed (*Heterotheca grandiflora*). Appendix 1 includes a list of plant species encountered during field work.

Figure 20 and Figure 21 display bluff elevation profiles for the restoration and control transects, respectively. Profiles show a swift decline in elevation for all transects, with C2 exhibiting the steepest slope. This can likely be attributed to a lack of vegetation and potential erosion occurring in this control area.

Additional photos of the bluff project area can be found in the photo point section (Appendix 2). Photo point results support finding of the vegetation cover and elevation surveys, depicting large areas dominated by iceplant with other non-natives and sparse native vegetation intermixed.

Figure 17. Representative photographs from bluff area of Dockweiler (credit: TBF, 13 July 2020).

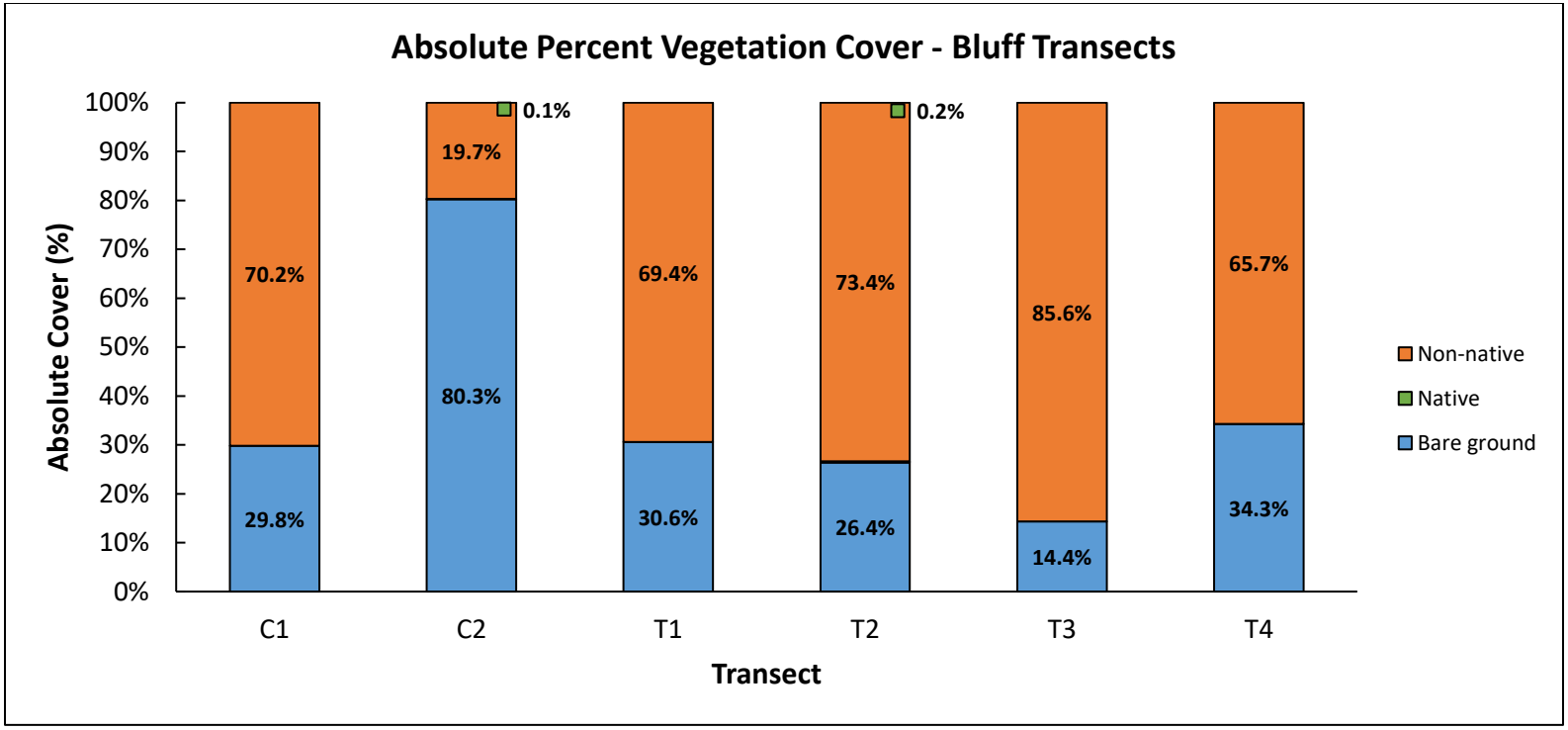


Figure 18. Absolute percent native cover, non-native cover, and bare ground for all bluff transects.

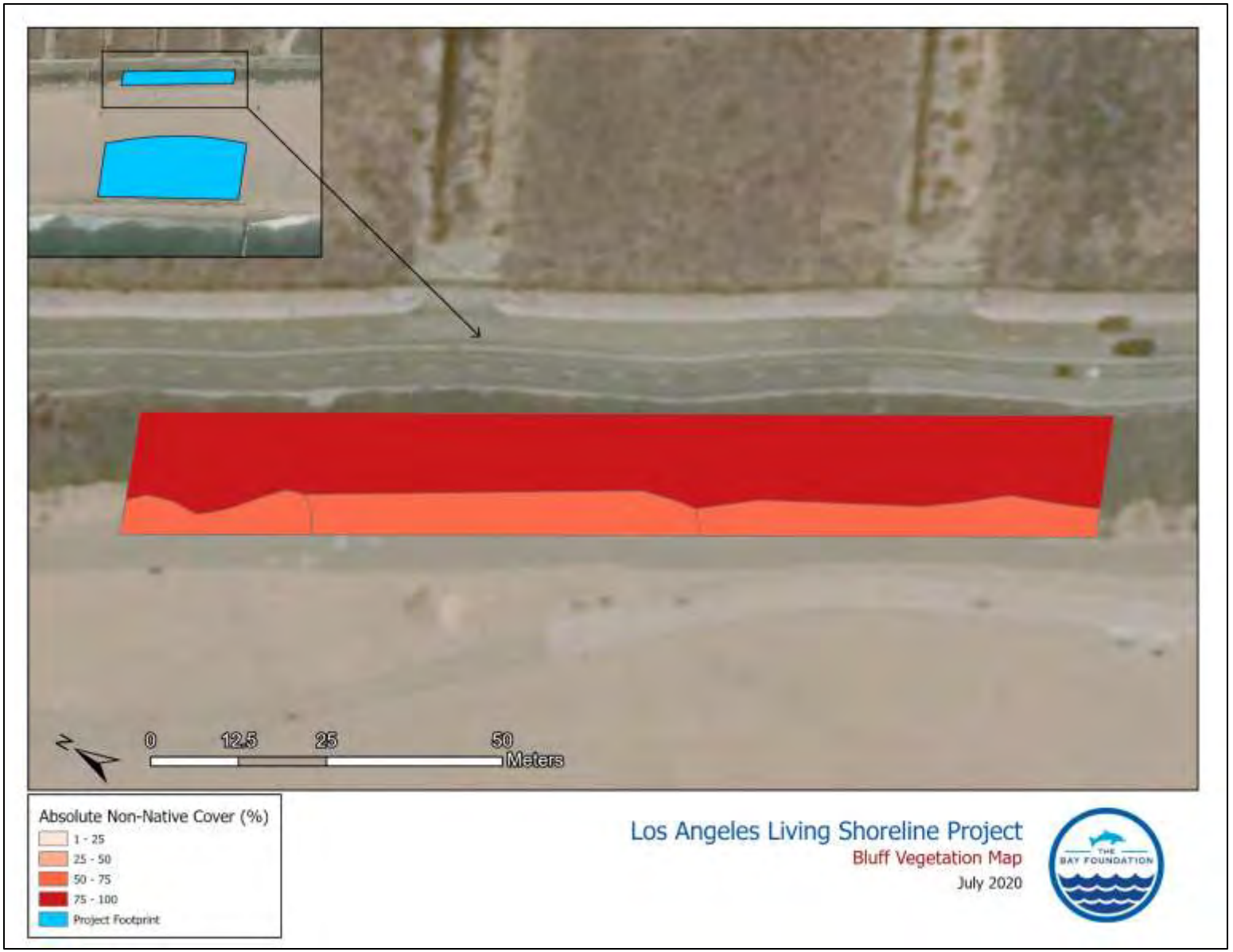


Figure 19. Bluff vegetation mapping results displaying absolute non-native cover.

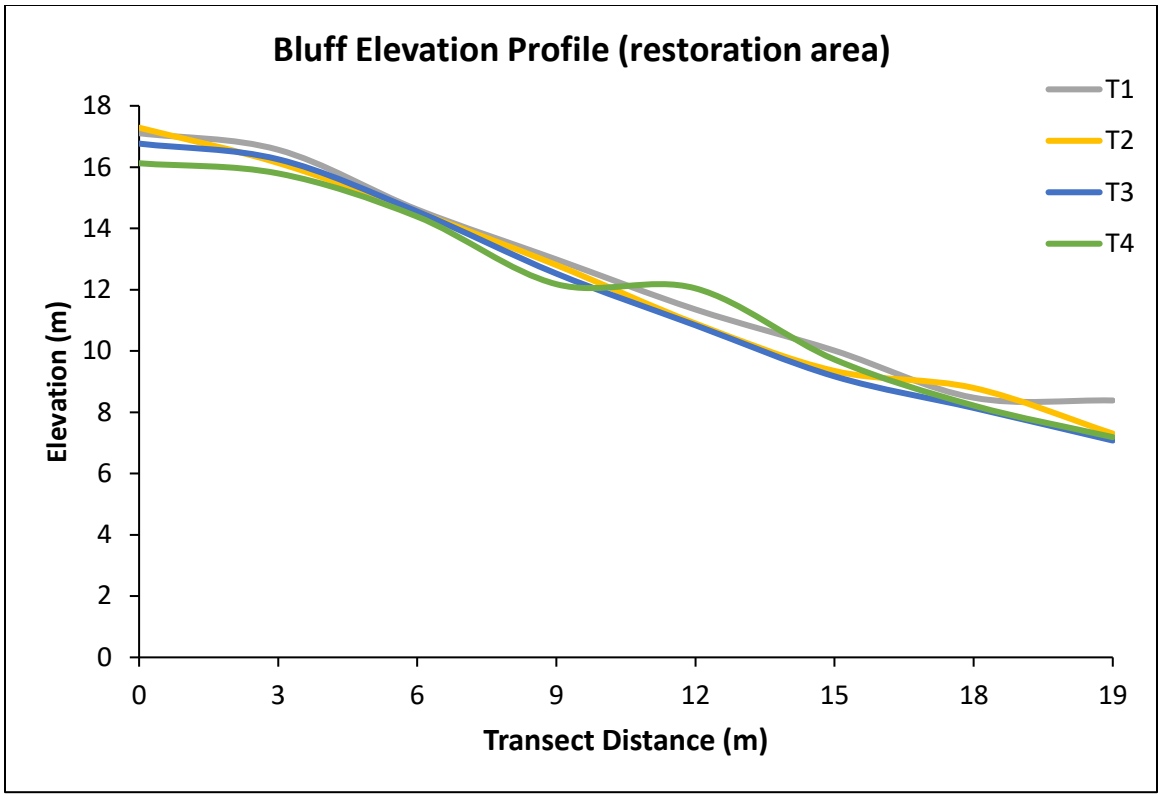


Figure 20. Baseline bluff elevation profile for pre-restoration transects (Elevation in NAVD88).

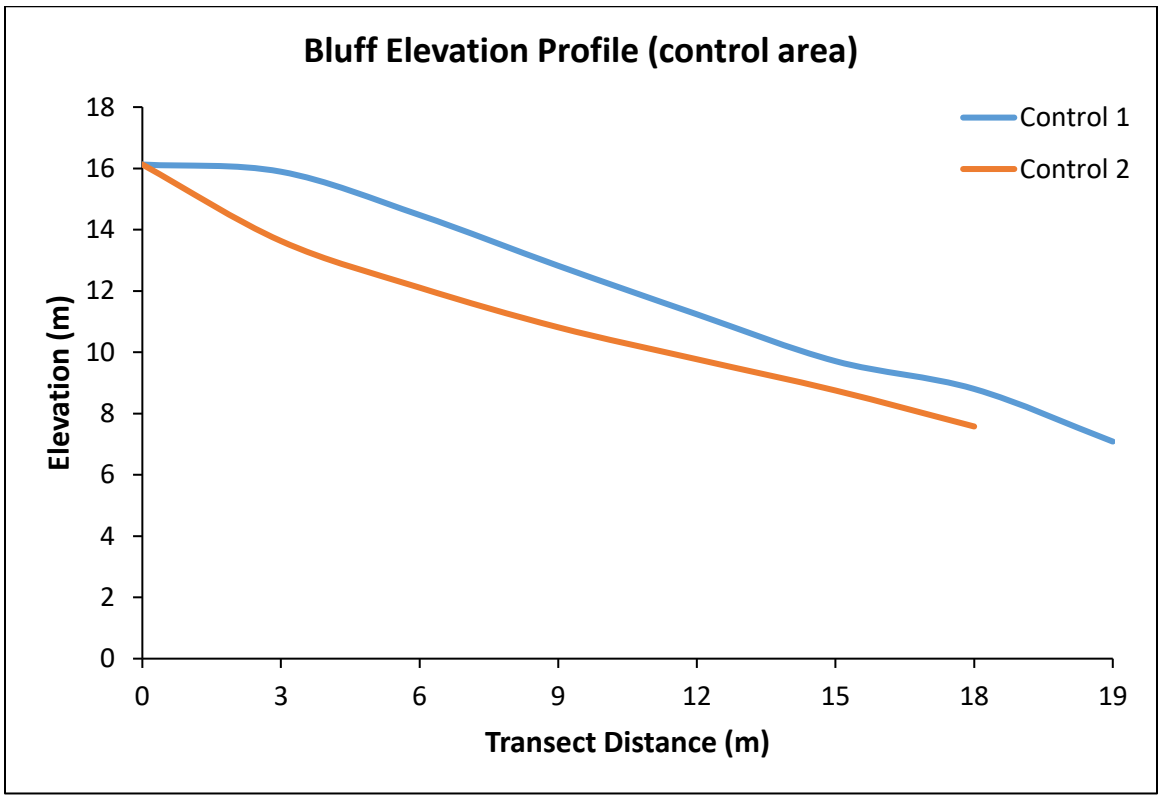


Figure 21. Baseline bluff elevation profile for control transects (Elevation in NAVD88).

Western Snowy Plover Results

Western snowy plovers, a federally threatened species of bird (USFWS 1993), are known to inhabit roosting and nesting areas at Dockweiler State Beach North, specifically within the plover enclosure maintained by LA Audubon Society. Western snowy plovers are also listed as a California Species of Special Concern (Shuford and Gardali 2008). Plovers were historically present on LA County beaches and were documented at the project site in 1993 when the Pacific Coast population segment was listed (Ryan et al. 2017, USFWS 1993). Surveys conducted from 2004 to 2017 show the continued presence of western snowy plovers at Dockweiler Sate Beach North (Table 2). Roosting locations of plovers within the snowy plover enclosure between 2012 and 2017 are depicted in Figure 22 (Ryan et al. 2017).

The northern area of Dockweiler State Beach, encompassing the present-day plover enclosure, is a part of the Dockweiler State Beach North critical habitat subunit CA-45B designated by USFWS (USFWS 2005 and 2012). The area contains physical and biological features essential for their recovery, including a wide sandy beach with wrack that supports small invertebrates (USFWS 2005 and 2012). Snowy plovers typically forage for small invertebrates in wet or dry beach-sand, among tide-cast kelp, and within low foredune vegetation. Individuals show high site fidelity and have been observed returning to Los Angeles County to the same beach for as many as six years (Ryan et al. 2010, Ryan et al. 2017).

The population of snowy plovers in coastal LA County has declined from a peak of 334 in 2006 to 174 in 2017. The largest declines were seen at Zuma and Dockweiler State Beach (Ryan et al. 2017). Degradation of beach and dune habitat has contributed to the decline of western snowy plovers (USFWS 2007, Ryan et al. 2010). Beaches with no remaining vegetation or dune systems are not suitable habitat for plovers (Powell 1995), and daily sand grooming reduces the ability of plovers to nest on LA County beaches (Ryan et al. 2010). While sand grooming removes trash, it also removes kelp wrack and associated arthropods that plovers feed on, removes other inorganic debris that provides plovers shelter, removes favorable nesting habitat, removes vegetation, and may destroy nest scrapes and snowy plover eggs (Powell 1995, Page et al. 2009, Ryan et al. 2010, Ryan et al. 2017). Historically, plovers have nested on LA County beaches (Allen et al. 2016 cited in Ryan et al. 2017), but LA county beaches are now primarily utilized by over-wintering plovers during the non-breeding season (Ryan et al 2010 and 2017). Between 2004 – 2017, plover counts ranged from a low of nine in 2007 to a high of 45 in 2014. Restoration of dune habitat is associated with plover recovery (Raby and Colwell 2020).

Table 2. Western snowy plovers roosting at Dockweiler Beach North (DSBLT47) by year (data obtained from Ryan et al. 2017 and reviewed by Los Angeles Audubon Society).

YEAR	COUNT		YEAR	COUNT
2004	12		2011	34
2005	34		2012	33
2006	23		2013	29
2007	9		2014	45
2008	10		2015	16
2009	20		2016	26
2010	6		2017	27

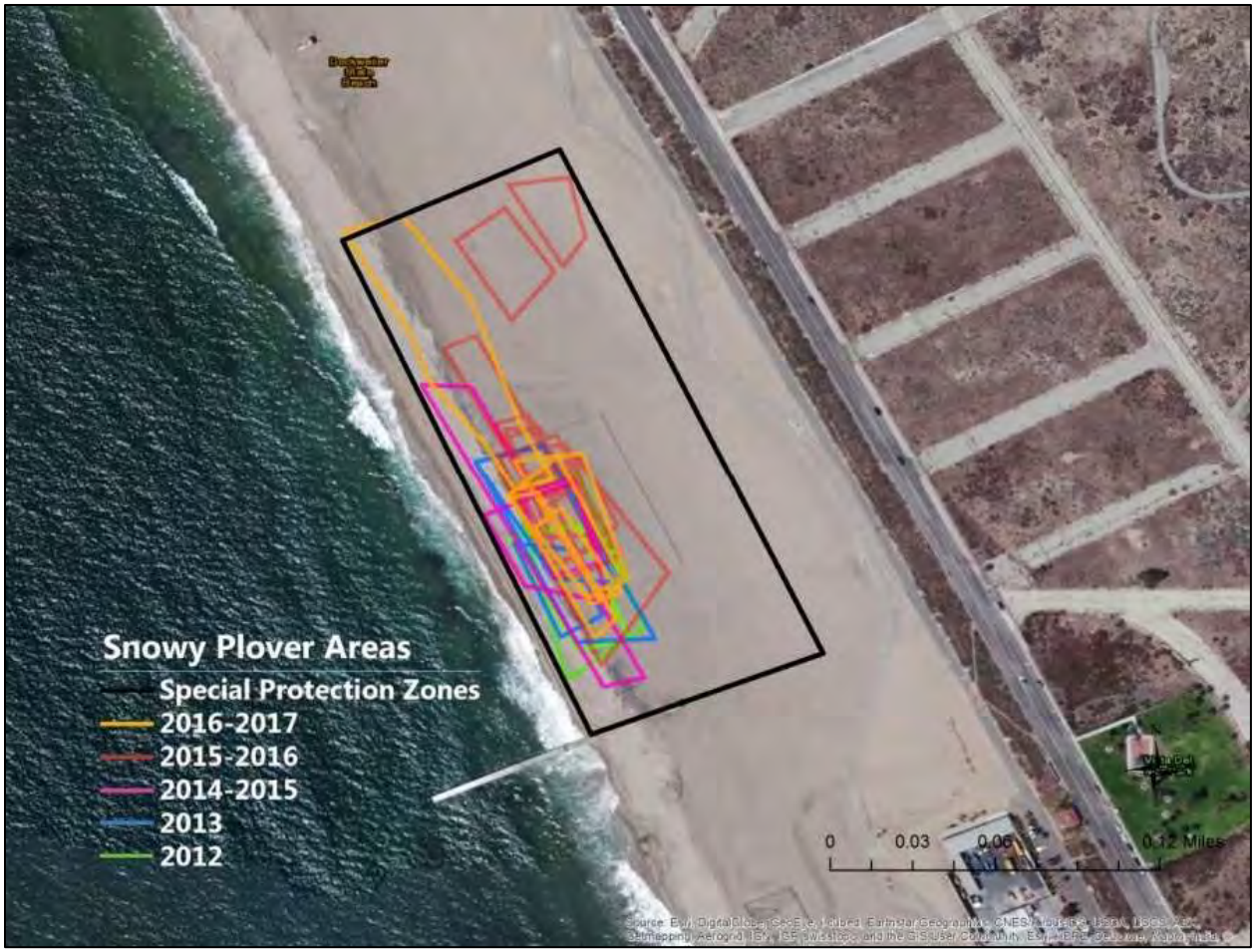


Figure 22. Western snowy plover roosting locations between 2012 and 2017 within and adjacent to the plover enclosure at Dockweiler State Beach (map replicated from Ryan et al. 2017).

The number of snowy plovers present on California coastal beaches fluctuates seasonally, where the highest population roost counts generally occur outside of the nesting season. In LA County, plovers inhabit their non-breeding roosts on coastal beaches between July and April (Ryan et al. 2017). The number of snowy plovers on coastal California beaches generally declines during peak nesting season between April and June, as most plovers migrate north, south, or inland to breeding grounds (Warriner et al. 1986, Powell 1995, USFWS 2007, Table 3). However, some plovers are year-round residents and have been observed nesting on southern California coastal beaches (Ryan and Vigallon 2019, 2020, 2021; USFWS 2007).

The first nest in the LA region in almost 70 years was recorded within the restoration area at Santa Monica Beach in April 2017. Nests were also found at the Dockweiler State Beach enclosure and Malibu Lagoon State Beach that year (Johnston et al. 2017, Ryan et al. 2019). Prior to 2017, the last recorded active nest on LA County beaches was in 1949 at Manhattan Beach (Stager 1949 in Page and Stenzel 1981). Snowy plovers have successfully nested at the Dockweiler enclosure in 2017, 2018 (Figure 23, Figure 24), and 2020 (S. Vigallon, pers. comm., 17 June 2021). In April of 2020, two plovers were observed nesting within the Dockweiler State Beach snowy plover enclosure (Table 3; Ryan and Vigallon 2020).

Figure 23. Western snowy plover nest at Dockweiler State Beach in 2018 (Photo credit: LA Audubon Society).

Seasonal patterns in snowy plover use of Dockweiler State Beach North are shown in Table 3 below. Surveys were conducted by LA Audubon Society community volunteers with the support of project biologists. For all years, surveys were conducted monthly, except in April 2021 where surveys were conducted weekly. Total number of plovers counted ranged from zero to a maximum of 75 birds in September 2019. Data were provided by Ryan Ecological Consulting and LA Audubon Society in the LA and Orange County Western Snowy Plover Monthly Reports from 2019 to 2021 and reviewed by LA Audubon.

Table 3. Number of western snowy plovers observed at Dockweiler State Beach Lifeguard Tower 47 survey location between January 2019 to April 2021. Single asterisk indicates nesting birds. Double asterisk indicates data are from weekly surveys.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	0	0	2	12	1	0	10	67	75	56	3	42
2020	46	2	2	2	2*	5	50	74	60	14	0	2
2021	1	0	2	11 **								

Figure 24. Western snowy plover male with chick at Dockweiler State Beach in 2017 (credit: Grace Murayama).

California Least Tern Results

California least terns (*Sternula antillarum browni*), a federally endangered species of bird, have a distinctive black cap with black stripes running from the cap across the eyes to the beak. They are the smallest North American tern. Their food is primarily small fishes, but also shrimp and occasionally other invertebrates (USFWS website, accessed May 2020).

The 5-year review of the California least tern recovery plan (USFWS 2006) includes the closest known least tern colony areas to the north of the project location in Coastal Management Area G in Los Angeles at Venice Beach and Playa del Rey Beach. The closest sites further north above that location are in Coastal Management Area F at Ormond Beach and Mugu Lagoon. To the south, the closest site is Terminal Island in Coastal Management Area I (USFWS 2006). Least terns also nest at Malibu Lagoon State Beach when beach configuration and dynamics prevent overwash by high tide events (S. Vigallon, pers. comm., 17 June 2021). Least terns are not known to nest within the LA-LSP restoration area and have not been identified in repeated Audubon Society surveys from 2010-2019 (Ryan et al. 2019 to 2021). However, least terns have occasionally been present on or adjacent to the project site and were detected in September 2020 on Dockweiler State Beach (Ryan et al. 2019 to 2021, Appendix 3)

Additional Plants and Wildlife

A list of additional wildlife and plants with special status listing is prepared as Appendix 3. Data were downloaded from the California Natural Diversity Database (CNDDB) hosted by California Department of Fish and Wildlife on 10 April 2020 for the Venice Quad and a 9-quad search centered on Venice Quad

(https://wildlife.ca.gov/Data/CNDDB). The goal of the CNDDB is to provide the most current information available on the state's most imperiled elements of natural diversity and to provide tools to analyze these data.

The full 9-quad search identified three amphibians, one arachnid, 69 birds, four fish, 16 insects, 12 mammals, one mollusk, seven reptiles, 68 vascular plants, and six terrestrial vegetation communities. Appendix 3 contains the list of plants and animals, project site notes, and recommended conservation measures. Appendix 3 contains the full list of CNDDB potential species, with additional notes on occurrences and potential Conservation Measures. Many of the species listed do not have suitable habitat within the restoration area, though additional information can be found in the Conservation Measures subsection for those species which are most likely to potentially occur on site.

Additionally, wildlife were noted when present during all survey days. Table 4 lists wildlife identified as present on all surveys combined. Foraging shorebirds are commonly seen in the beach habitat, and insects and small lizards are seen commonly in the bluff habitat area. No special status species have been observed to-date, but pre-restoration Conservation Measures will be applied prior to any restoration activities, including wildlife and plant surveys (see "Conservation Measures" later in this document).

Table 4. Wildlife species identified across all survey days for the beach area (yellow) and the bluff area (green).

Scientific Name	Common Name	Wildlife Type	Habitat Type
Sceloporus occidentalis	Western fence lizard	Reptile	Bluff
Uta stansburiana	Side-blotched lizard	Reptile	Bluff
Otospermophilus beecheyi	California ground squirrel	Mammal	Bluff
Charadrius alexandrinus nivosus	Western snowy plover	Bird	Beach
Tringa semipalmata	Willet	Bird	Beach
Calidris alba	Sanderling	Bird	Beach
Corvus brachyrhynchos	American crow	Bird	Beach
Pelecanus spp.	Pelican	Bird	Beach
Pandion haliaetus	Osprey	Bird	Beach
Calidris mauri	Western sandpiper	Bird	Beach

Opportunities and Constraints

Analyses of current biological and physical conditions of the site, with some information from historical ecology or management practices, provide a basis for developing a restoration strategy for the project area. While it may be tempting to simply propose restoring the site to its pre-disturbance condition, this is unrealistic in this setting given the anthropogenic changes over time, nourishment activities, long history of grooming, and other constraints. However, there are important opportunities for restoring more natural ecosystem functioning within the constraints put on the project by development and human use, especially those ecosystem services that maximize the potential of the site to be resilient to sea level rise and coastal storm erosion. Building resilience to sea level rise and coastal storm erosion through nature-based solutions that conserve natural processes is a priority of California State Parks and aligns with the California State Parks Sea Level Rise Adaptation Strategy (CA State Parks 2020). The identification of site opportunities and constraints allows for the development of a realistic project that maximizes ecological and other benefits while working within the real-world constraints of the site.

Site Opportunities:

- Beach does not appear to be sand-starved, suggesting there will be sufficient sand available for dune-building processes
- Existing plover enclosure allows for the opportunity to enhance habitat specifically for this species
- Multi-habitat project offers opportunity for more diversity within the restoration footprint
- Some presence of existing native coastal strand species in the plover enclosure suggests native vegetation has the potential to thrive; some native seed bank exists
- Bluff restoration offers opportunity to provide habitat for the El Segundo Blue Butterfly (*Euphilotes battoides allyni,* ESB) in the form of seacliff buckwheat (*Eriogonum parvifolium*)
- Bluff restoration may support additional birds and wildlife, including those with special status
- Restored dunes will offer opportunity for visitors to learn about natural habitats on beaches and bluffs and present educational opportunities on western snowy plovers, coastal resiliency, and sea level rise
- Pathways through site will encourage organized site use; adjacent bike path is heavily recreated with bicyclists, joggers, etc.

Site Constraints:

- Need to maintain bike path and minimum grooming distance, which splits the restoration areas; need to maintain lifeguard access
- Bordered by a large stormwater outfall to the north and jetty to the south, both which constrain the boundaries of the site
- Existing plover enclosure and bird population sets maximum plant cover success criteria within the plover area, which may need adaptive management to maintain; also restricts project activities outside the nesting season
- High cover of invasive iceplant along the bluff will need to be carefully removed to avoid erosion
- Some existing natives present in the plover enclosure will need to be protected when removing non-natives from the area
- Multiple site jurisdictions will require agency agreement
- Heavily recreated area; need to consider adaptive management strategies

Project Description

The project aims to restore approximately four acres of impacted beach and bluff habitat into a healthy living shoreline that will provide rare coastal habitat, ecosystem services, and adaptation measures for coastal storms and sea level rise (Figure 25). This pilot project will use a combination of native plants and seeds and strategically placed fencing, wooden slats, symbolic pathways, and signage as part of the Restoration Plan. Encouraging accretion of sand through native vegetation, sand fences, and wooden slats will build topography and increase elevation across the upper shore to store sand. This will help alleviate the effects of large winter storms and in the long-term, sea level rise. Intact and native dune systems are more resilient to disturbance than degraded systems.

Figure 25. Overview map of the LA-LSP beach and bluff restoration area.

The proposed beach restoration area at Dockweiler Beach has good potential for supporting more natural coastal habitats because it retains relatively intact coastal processes, e.g., wind transport, space, sediment flux. Similarly, the 'bluff' area is a stabilized back dune that was historically planted with iceplant for stability. While portions of the bluff are experiencing substantial erosion, the cover of iceplant remains high. Natural dune processes are unlikely to occur (e.g., sediment accretion); thus, coastal bluff and dune scrub plant communities are proposed for this area. The proposed restoration

areas are currently under pressure from non-native vegetation, mechanized grooming, compromised sediment supplies from up-coast sources, heavy recreation, and other impacts.

This subsection contains summary information related to project descriptions for each of the two restoration locations included as part of the terrestrial side of this project (i.e., beach area and bluff area) as well as before and after artistic renderings of the project areas five years post-restoration (Figure 28 – Figure 30). Detailed implementation methods are included in the next report subsection. Eelgrass restoration and monitoring are written separately into the California Department of Fish and Wildlife scientific collecting permit application and other permits for that portion of the project.

Beach Area

The 3.35-acre beach project footprint is comprised of the existing 0.83-acre protective plover enclosure and a 2.52-acre area of beach surrounding the existing enclosure that is currently mechanically groomed (Figure 26).

Figure 26. Photograph of plover enclosure and surrounding groomed beach.

Existing Plover Enclosure – The habitat type within the enclosure is coastal strand, which occurs on fine to coarse sand that is subject to aeolian processes. Native dune species that are specifically adapted to this harsh environment include red sand verbena, beach bur, beach saltbush, and beach evening primrose, all of which are present within the enclosure in low densities. These species are adapted to repeatedly being buried by blowing sand and then growing taller. This process leads to the building of dune topography. The southern foredune area within the enclosure consists primarily of patchy beach bur and beach evening primrose, with scattered beach saltbush, red sand verbena, and non-native sea rocket. Restoration activities will include removal of non-native sea rocket and any others identified,

seeding of native species to increase cover, and removal of sand fencing and replacing with post and rope fencing. All existing native vegetation will be carefully protected in place and left undisturbed.

Surrounding Beach Area – The remaining approximately 2.5 acres of the beach project footprint surrounding the enclosure is currently mechanically groomed. Groomed beach has very limited habitat value and no vegetation. Restoration activities will include halting of grooming activities followed by seeding and supplemental planting of species such as beach bur, red sand verbena, beach evening primrose, and beach saltbush, which would allow southern foredune habitat to re-establish. In addition to revegetation, other restoration actions include installation of temporary sand fencing and biomimicry stakes to promote dune growth and symbolic post and rope fencing to delineate limit of grooming activities and symbolic pathways. Establishment of dune topography will lead to increased sand storage and resilience to sea level rise.

Bluff Area

The bluff project area is approximately 0.6 acres and is dominated by invasive non-native iceplant, with other non-natives such as Australian saltbush, sea rocket, wild radish, Russian thistle, prickly lettuce, mustard, brome grass, and other non-native grasses (Figure 27). Native species exist sparsely in very low densities and include beach evening primrose, California croton, Jimsonweed, and telegraph weed. The bluff habitat is more stabilized and less susceptible to wind-blown sediment transport. The lack of movement leads to the build up of nutrients and inclusion of some fine-grained sediments (i.e., silt, clay, or organic compounds) in the soil. This soil structure could allow for a wide range of native shrub and forb species such as seacliff buckwheat, sage (*Salvia* spp), California sagebrush (*Artemisia californica*), giant coreopsis (*Coreopsis gigantea*), California sunflower (*Encelia californica*), and other similar species. Restoration actions will include non-native vegetation removal, native seeding and container stock planting, and erosion control installation. Establishment of native bluff habitat would serve to prevent erosion and potentially create habitat for rare and sensitive plants and wildlife, including the federally endangered ESB.

TBF aims to utilize the Los Angeles Conservation Corps (LACC), partners, and community volunteers to aid in on-the-ground restoration activities. Following the completion of project implementation, TBF will coordinate and lead five years of post-restoration monitoring and maintenance and, if necessary, perform adaptive management actions to ensure the success of the restoration project such as trash or non-native vegetation removal (see also “Adaptive Management” later in this document). Further, post-restoration outreach will continue to maximize community involvement in the site and identify stewardship and educational opportunities as well as continue to explore other partnerships such as with Audubon Society and the El Segundo Blue Butterfly Coalition.

Figure 27. Photograph of iceplant-dominated bluff area with the plover enclosure in the left background.

Coastal Processes

Seeded and planted specialized foredune vegetation will grow and develop and begin trapping sand transported by wind. Wind-driven sand will bump into vegetation, fall, and accrete, increasing the elevation of the plant hummocks and dunes over time. Subsequently, the vegetation will continue to grow and develop on top of the newly accreted vegetated sand hummocks. Because beach dunes accrete sediment being transported from the ocean, they will continue to grow concurrently with rising sea levels. This process can continue as long as the vegetation community is robust and healthy. This process has repeatedly been demonstrated in the scientific literature as well as in pilot projects in other California Counties, such as the Surfer's Point restoration project in Ventura County, the Santa Monica Beach Restoration Pilot Project in Los Angeles County, and the Cardiff Dune Restoration Project in San Diego County.

Additional processes such as beach erosion occur seasonally in southern California in the winter months, and the project will be designed specifically to maximize the potential for the beach to retain sediment in the long-term. Intact systems in areas with adequate sand supply and with large seed banks have the capacity to regenerate vegetation cover and then re-build dunes by trapping wind-blown sand. The below images show before and after artistic renderings of the project areas five years post-restoration created by Integral Consulting, Inc. (Figure 28, Figure 29, Figure 30).

Figure 28. Photograph of existing view of beach habitat (top) and artistic rendering five years post-restoration (bottom) (credit: Integral).

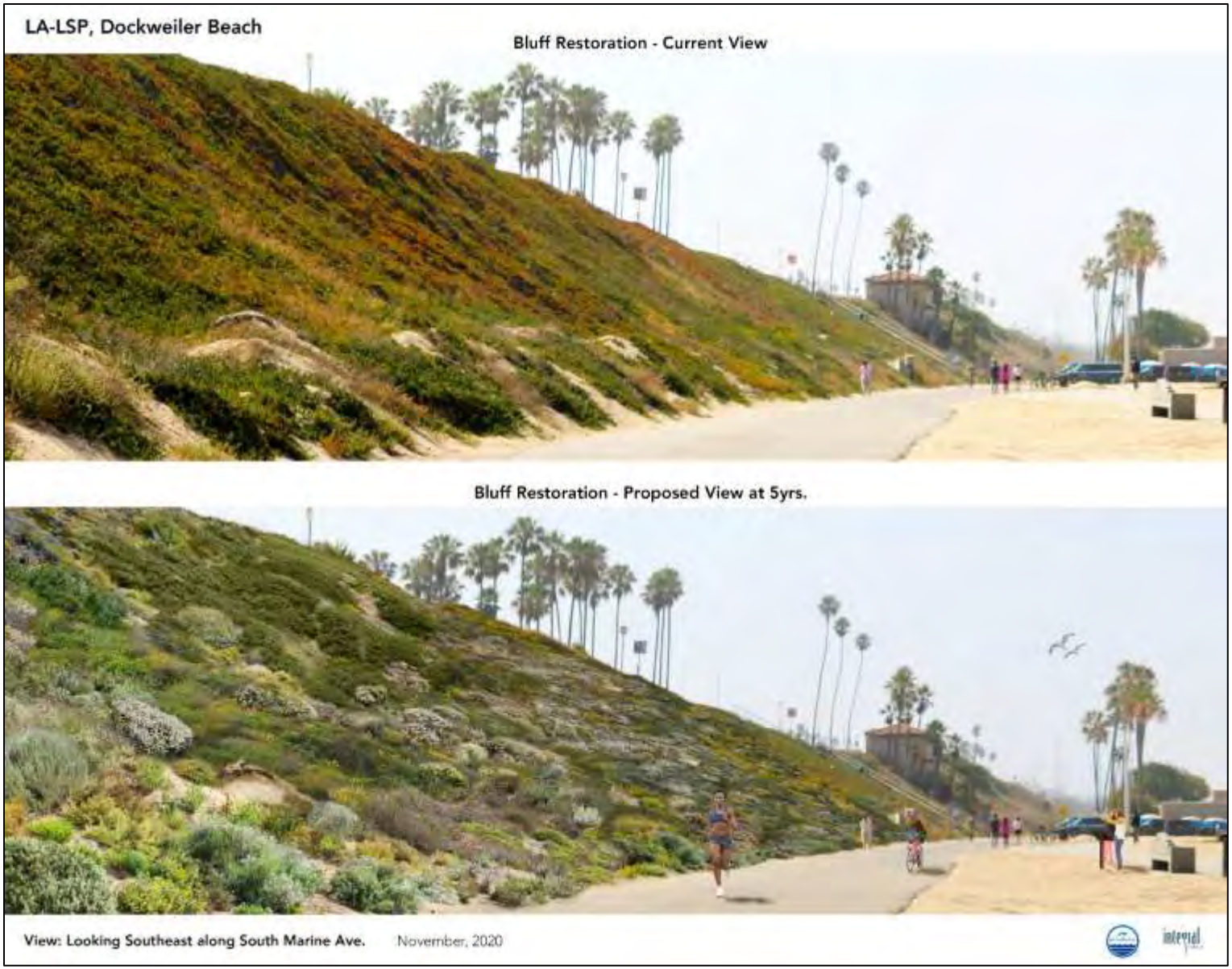


Figure 29. Photograph of existing view of bluff habitat (top) and artistic rendering five years post-restoration (bottom) (credit: Integral).

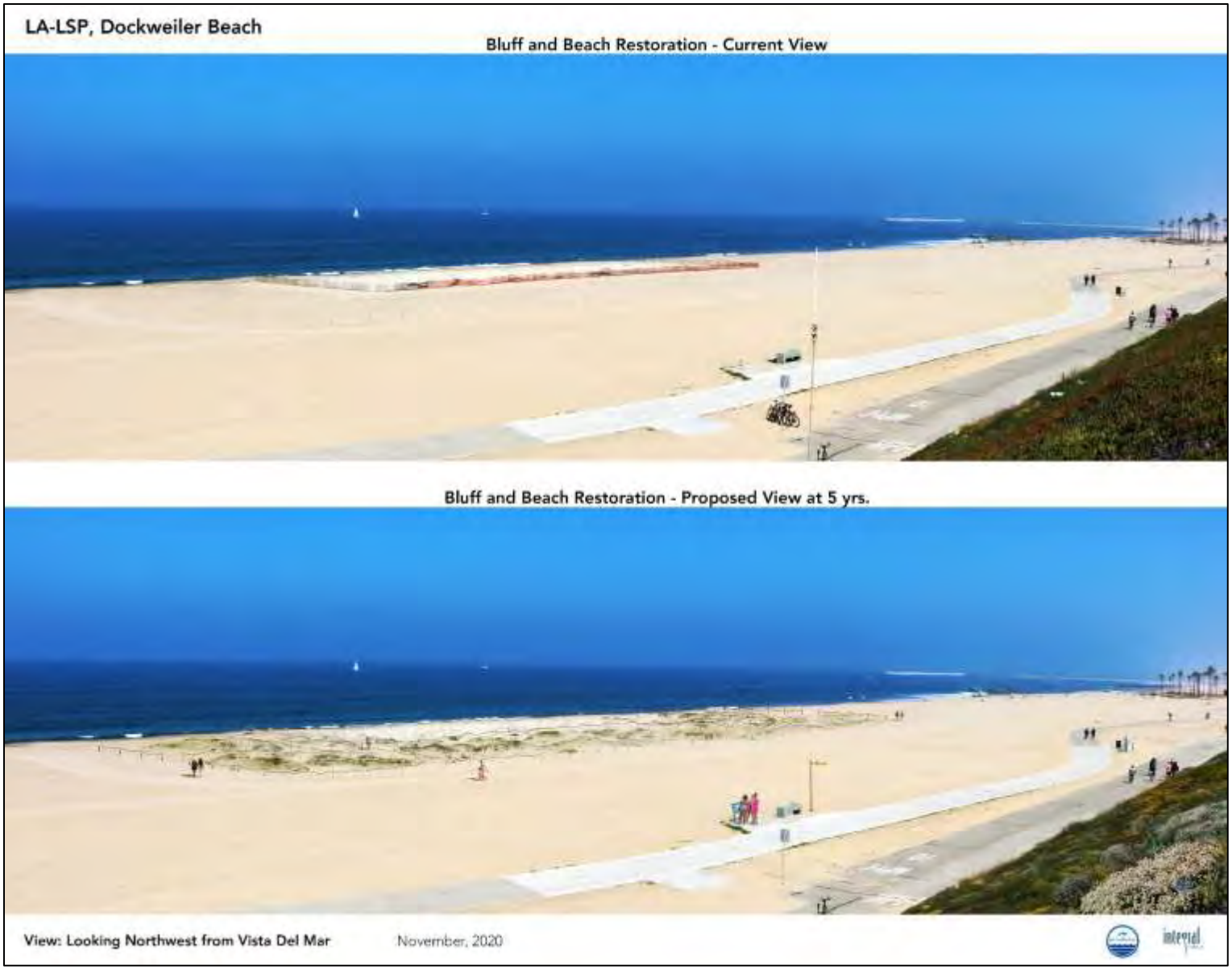


Figure 30. Photograph of existing view of bluff and bluff habitat (top) and artistic rendering five years post-restoration (bottom) (credit: Integral).

Permitting and Outreach

TBF, in coordination with LACDBH, the California Coastal Commission (CCC), the City of Los Angeles, and CDPR, will obtain the necessary permits to implement the Los Angeles Living Shoreline Project. The document is part of LACDBH's application to CCC for a Coastal Development Permit (CDP), in partnership with TBF and with permission by the City of LA. TBF will be responsible for fulfillment of the CDP conditions. While this project is CEQA exempt and not a development or construction project, it does have the potential to affect beach activities and as such requires a public process. LACDBH also requested TBF obtain a Right of Entry (ROE) Permit to cover scientific monitoring and restoration activities. TBF acquired a ROE permit on 11 May 2021 which covers pre-restoration scientific monitoring. This permit will be amended to include implementation and post-restoration activities following the completion of other application packages. Lastly, this project requires a scientific collecting permit (SCP) from CDPR. This document will be an integral component of both the ROE permit amendment and SCP applications.

Substantial public outreach and community engagement has occurred for this project to receive input and feedback on planning, design, and various restoration elements. The project team would like to thank all of the partners for providing input and without whom this project would not be possible, including LACDBH, City of Los Angeles, California State Coastal Conservancy (SCC), California Department of Parks and Recreation (CDPR), and Honda Marine Science Foundation. Additionally, several stakeholder groups have been integral to the planning and design, including LA Audubon Society and El Segundo Blue Butterfly Coalition, especially to the plant palette, Conservation Measures, and success criteria. In June 2020, the project launched a webpage on TBF's website as an opportunity to provide background information and engage the public.

Over 20 presentations have been given on this project, including two podcasts, many public meetings, and two scientific conferences. Groups such as AdaptLA, led by USC Sea Grant Program; Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC), led by UCLA; and Beach Ecology Coalition, led by Pepperdine University, have all been great opportunities to provide information about the project to stakeholders, municipalities, coastal planners, climate scientists, and members of the public. In one example, on 28 July 2020, TBF convened a large group of agencies to provide feedback on the beach and bluff restoration elements of the project, and to inform planning, design, and permitting. This diverse group included scientists and staff from entities such as: California Coastal Commission, SCC, LACDBH, LA County Public Works, City of Los Angeles, CDPR, LA County Lifeguards, US Fish and Wildlife Service (USFWS), CDFW, US Environmental Protection Agency, and others. Consensus was reached on several key elements of design (e.g., pathways through the beach site, aiming to remove sand fencing over time, options for interpretive signage). Ongoing communication was maintained with several of the agencies to develop restoration design elements, and several of them have also reviewed and contributed to this document (e.g., LACDBH, SCC, USFWS).

Lastly, coordination and communications are ongoing with federal and state agencies with an interest in this project, beach management, and/or wildlife (e.g., US Fish and Wildlife Service). All annual reports for this project will be made publicly available on The Bay Foundation's website: https://www.santamonicabay.org/explore/beaches-dunes-bluffs/beach-restoration/los-angeles-living-shoreline-project.

Figure 31. Native beach bur photographed within beach project area current plover enclosure.

Restoration Plan

Through habitat restoration and the installation of symbolic pathways and interpretive signage, the site will provide new opportunities to enhance recreational beach experiences, including opportunities to observe native dune plants growing and flowering, bird watching, and to simply enjoy the scenery. A detailed site plan map with project implementation components can be found below in Figure 32 (sand fencing and biomimicry stake plots in map are approximate in size, quantity, and location). Narrative details on project implementation strategies, components, specific methods, and vegetation species can be found in the subsections below.

Project implementation is scheduled to begin in winter 2021 and may require up to six months. Pre-restoration monitoring is ongoing, and the project implementation will be followed by post-restoration monitoring for a time period of no less than five years. TBF has a long-term commitment to post-implementation monitoring, maintenance, and adaptive management, if needed. Maintenance may include removing or replacing fencing, removing non-native vegetation, supplemental planting or seeding, spot watering, and picking up trash. For more information, details, artistic renderings, and links to public documents and photographs, please visit the project website: https://www.santamonicabay.org/explore/beaches-dunes-bluffs/beach-restoration/los-angeles-living-shoreline-project/.

The remainder of this restoration plan outlines the appropriate techniques for restoring more natural foredune and bluff habitats at the project site. These techniques were developed in consideration of the following set of goals and were informed by project partners:

1. Improve ecosystem benefits through restoration of approximately four acres of sandy beach and coastal bluff habitats;
2. Implement nature-based living shoreline protection measures against sea level rise and coastal storm erosion; and
3. Increase engagement of the community through enhanced beach experiences, outreach, and education.

There are multiple potential approaches to meeting these goals at the project site. The most appropriate approach seeks to optimize the accomplishment of these goals in light of the historical ecology, current conditions, and opportunities and constraints of the sites. Objectives include:

1. Reduce cover of non-native plants, especially the bluff habitat;
2. Increase cover of native plants;
3. Stabilize blowing sand to build dune topography and decrease erosion potential;
4. Enhance recreation with wildflowers, wildlife, and pedestrian paths through dunes; and
5. Engage the public through interpretive signage and educational tours.

Figure 32. Project site plan including various restoration elements.

Restoration Techniques

The following descriptions of techniques for restoring more natural coastal habitats includes proven strategies that have been employed elsewhere in southern California by TBF and other partners or scientific colleagues. Also presented are some approaches that were developed with the specific opportunities and constraints of the project site in mind. Approaches include symbolic perimeter fencing and pathways, beach and bluff restoration through invasive plant removal and native seeding/planting, interpretive signage, temporary sand fencing and biomimicry staking to facilitate sand stabilization and plant growth, and adaptive management strategies.

Perimeter Fencing

Boundaries will be defined and established at the beach site using symbolic fencing. Symbolic post and rope fence will be installed around the existing plover enclosure. A combination of symbolic post and rope fence and standalone posts will be used around the outer perimeter of the beach project site. This perimeter establishment will serve several purposes, including discouraging beachgoers from entering the plover enclosure, delineating areas to be restricted from mechanical grooming, encouraging safe recreational activities, and minimizing excessive disturbance to the dune areas, especially during establishment. The fenced area will be consistent with project permits, goals, and management objectives. Post and rope fencing will be used consistent with park guidelines.

Symbolic Pathways and Interpretive Signage

Symbolic post and rope fence will also be installed through several cross-cutting trails to formally delineate beach pathways. Pathways will primarily be guided by single sided post and rope. This will be an improvement both for recreation purposes as well as native habitat protection. No pathways will go through the plover enclosure. The post and rope fence will be no more than 36 inches (3 feet) in height and designed to be removable in the event of significant storm events or emergencies.

Interpretive signs or exhibits offer stories that are designed to stimulate visitors' interest while challenging their imaginations, and present new perspectives on familiar topics. Four interpretive signs were designed by the project design consultant team (comprised of Integral Consulting, New West Land Company Inc., and Luzco Illustration and Design) and will be installed at the project site. Signage includes one primary sign with a general overview of the project and living shorelines and three additional signs each highlighting one of the three habitat types (i.e., eelgrass, beach, and bluff). All signs include a Spanish translation. The dune restoration sign design is displayed in Figure 33. All interpretive sign graphics relevant to the beach and bluff project components are included as Appendix 4. Interpretive signs will help visitors and beachgoers understand the importance of living shoreline for plants and wildlife, but also as buffers to help improve our coastal resiliency to storm erosion and sea level rise. Signs were developed specifically for use in the restoration area to help engage the public with the site and to facilitate a unique opportunity for education and recreation on their way to the beach.

Figure 33. Beach dune restoration interpretive sign.

Beach Restoration

One of the primary goals in increasing resiliency at the site is to trap more of the blowing sand in the upper beach area and to increase topography and elevations in key areas. There are several options for increasing resilience to rising sea level by building topography. These will be used both individually and in combination, depending on the specific area. Actions will be supported by LACC and volunteers (if allowed by state and local Covid guidelines).

1. Sand fencing. Sand fencing is a proven technique for stabilizing areas with high levels of blowing sand and will be most effective in strategic locations outside of the plover enclosure. Sand

fencing can be effectively mixed with re-vegetation techniques to delineate restoration areas, slow sand movement, build topography, and create areas suitable for plant establishment. Segments of sand fencing (approximately 10-30 ft in length) will be installed perpendicular to predominant wind direction to enhance rapid dune establishment. Sand fencing will be a temporary feature and will be removed after a maximum of five years, or after fenced dunes accrete to a height of approximately 3-4 feet. Fencing will have the bottom cross wire removed prior to installation, so fencing can be carefully pulled up over time without damaging the dune hummock.

2. Wooden slats or "Biomimicry Stakes". Recently, groups including TBF have been using groupings of wooden slats, or biomimicry stakes, instead of fencing to build topography in degraded dunes and replicate the stability of vegetation. This technique had been shown to be preliminarily successful at TBF's Malibu Living Shoreline Project (MLSP), as well as the mouth of the Tijuana River Estuary. Preliminary results at MLSP and Tijuana suggest promise for this method, though further assessments and testing are warranted. Groups of wooden slats will be installed in conjunction with strategic sand fencing to maximize sand retention and encourage plant growth. Wooden slats will not be permanent and will be raised over time and eventually removed once plants are established and sand accretes to a height of 2-3 feet. No stakes will be installed within the plover enclosure. Installed biomimicry stakes will be small wooden garden stakes, paint stirrers, or their equivalent, measuring 1-2 inches in width, between approximately 30-60 cm in length, and installed to an approximate depth of 10-15 cm. Several installation techniques will be implemented and replicated to determine cost-efficiency and effectiveness for dune accretion.

3. Non-native vegetation removal. Non-native sea rocket (and historically, iceplant) exists sporadically throughout the plover enclosure and along the fence perimeter. Sea rocket and any other non-native species will be hand removed without disturbing native plants.

4. Re-vegetation. Native dune plants are the best sustainable long-term choice for building coastal dunes in California. There are situations in which some form of sand stabilization may help in the establishment phase (see 1 and 2 above). California native dune plants also benefit greatly from protection from driving and trampling, so directing foot and vehicle traffic around vegetated areas is important. Re-vegetation will occur throughout the entire beach project area through seeding and some supplemental planting of container stock (outside the plover enclosure).

Bluff Restoration

A coastal bluff restored with native vegetation will provide increased biodiversity and native habitat. Transforming the iceplant-dominated bluff into a stabilized and native dune habitat will be achieved through a series of strategies and supported by LACC, partners, and community volunteers.

1. Non-native vegetation removal. The bluff project area is currently dominated by large monocultures of invasive non-native iceplant. Iceplant and other non-natives will be removed through hand pulling. Removal of non-natives will allow for native plant propagation and expansion. Precautions will be taken to maintain existing native cover within the area.

2. Erosion control. Precautions will be taken to prevent erosion following iceplant removal. Erosion control measure will include a combination of container stock planting to re-establish vegetation cover, installation of jute matting, wattle, and/or clean straw mulch, and leaving pulled iceplant flipped upside down in targeted areas. Flipped iceplant will be left to mulch or removed later.
3. Re-vegetation. Establishment of native bluff habitat will serve to provide increased protection, prevent erosion, and create habitat for rare and sensitive plants and wildlife. Re-vegetation will occur on the bluff project area through a combination of container stock planting and seeding. Planting will occur within one week of iceplant removal (sooner, if possible).
4. Irrigation: Irrigation is not likely to be needed in most areas, but spot spraying with a water truck is proposed as an adaptive management strategy pending wet season rain events.

Invasive Non-Native Species Control

To successfully establish native plant populations within the project area, certain non-native plants will need to be controlled or eradicated following initial restoration efforts. Non-native plants will be managed for a minimum of five years post-restoration, though additional maintenance may be necessary after that time period and will be determined by TBF through systematic scientific surveys upon completion of the five years of monitoring. Removal of invasive or non-native plants will be done by hand.

1. Iceplant on bluff. Remove iceplant that re-spouts or creeps into project area by hand with support from volunteers as needed.
2. Sea rocket. Annually hand-pull large plants in beach areas before seed drops in April and May. Volunteer help will also be utilized as needed.
3. Other non-native species. Other invasive and non-native species will also be identified through scientific monitoring and removed within the project area. Removal of species will be prioritized based on the Cal-IPC rating. Due to the steep nature of the bluff and the potential impacts of trampling on native species and potential to increase erosion, small areas or broadly interspersed annual non-native species that are not substantially impacting the site may be selectively left in place. If the impacts from removing non-natives outweigh the benefits that their removal provides, they will be selectively left. Rigorous scientific monitoring will inform this evaluation and adaptive process.

Re-vegetation Strategies

In sand dune areas, one of the most effective strategies for re-introducing native species is to seed the areas in the late fall and to let seed germinate with winter rains. Seed on the beach area will be supplemented with some container stock planting in the area outside of the plover enclosure. Upland bluff and shrub areas will also be seeded and planted with container stock. Irrigation is not likely to be needed in most areas, but spot spraying with a water truck is proposed as an adaptive management strategy, especially in the back dune areas with upland shrub species within the bluff restoration area.

The following re-vegetation strategies will take place:

Beach

1. Sandy beach areas will be seeded with dune forming species. Beach areas outside of the enclosure will be seeded at a rate of 21.2 lbs/acre and seeded at half that rate (10.6 lbs/acre; Table 5) within the enclosure, focused on the landward half of the enclosure area. The sand surface will be prepared using a rock rake (to leave deep grooves). Seeds will be scattered by hand and buried by raking again with rock rakes. It is important to discourage driving and trampling in seeded areas, which will be accomplished through perimeter barriers.
2. Seeding in beach areas outside of the enclosure will be supplemented with planting of native dune forming species (Table 5). 2-inch and 4-inch sized container stock will be used for planting. No container stock planting will occur within the enclosure.
3. Most dune plant seeds remain viable for years. Germination rates are low in any given year. If year one performance is poor because of very low rainfall, supplemental seed may be reapplied in year two as an adaptive management strategy.

Bluff

4. The bluff area will be planted with native dune, shrub, and herb species to achieve rapid vegetation establishment following iceplant removal (Table 8). Gallon sized container stock will be used for bluff planting. Approximately 1/3 of the container stock for the bluff will consist of seacliff buckwheat, the host plant for the ESB. This is consistent with recommendations made by the El Segundo Blue Butterfly Coalition, USFWS, and other scientific advisors.
5. The bluff area will be seeded at a rate of 21.1 lbs/acre using native herb and shrub species (Table 9).

Beach and Bluff

6. Supplemental planting/seeding of appropriate species in the beach and/or bluff areas may occur in subsequent years as determined through adaptive management actions (i.e., success criteria for vegetation cover and species richness).

Implementation of this project will occur primarily during the winter/rainy season to allow for natural germination and establishment of native seeds during the winter rains. The proposed project is not anticipated to adversely affect the seasonal California grunion run and egg incubation period which ranges from 1 March through 31 August. All activities will take place outside the high tide zone line. Beach management practices that restrict beach grooming (raking) during grunion spawning will continue as before.

Native Plants: Seeding and Container Stock

Hand seeding will occur in the beach and bluff project areas. In addition to seeding, container stock will be planted on the bluff to promote rapid establishment and prevent interim erosion. Seed and container stock will be sourced from a vendor who has experience supplying regionally sourced seed/plants, such as S&S Seeds, Inc., Tree of Life Nursey, or California Botanical Gardens. TBF developed plant palettes and custom seed mixes, with input from partners and relevant stakeholders. Table 5 and Table 6 display the custom seed mix, seeding rates, and number of pure live seeds per pound for both the beach areas

outside and inside the plover enclosure, respectively. Table 7 includes the container stock plant palette for the beach area outside of the enclosure. For the bluff area, Table 8 identifies the container stock plant list and Table 9 displays the custom seed mix, seeding rates, and number of live seeds per pound.

Table 5. Custom seed mix design for beach habitat outside of western snowy plover enclosure.

Species Name	Common Name	Lbs / Acre	Number of Pure Live Seeds / Lb.
Abronia maritima	red sand verbena	17.50	2,415
Abronia umbellata	pink sand verbena	-	*
Ambrosia chamissonis	beach bur	1.50	20,000
Atriplex leucophylla	beach saltbush	2.00	23,552
Camissoniopsis cheiranthifolia	beach evening primrose	0.10	2,074,850

* Seed for *A. umbellata* is difficult to find/purchase but will be included in the custom seed mix if available.

Table 6. Custom seed mix design for beach habitat inside the western snowy plover enclosure.

Species Name	Common Name	Lbs / Acre	Number of Pure Live Seeds / Lb.
Abronia maritima	red sand verbena	8.75	2,415
Abronia umbellata	pink sand verbena	-	*
Ambrosia chamissonis	beach bur	0.75	20,000
Atriplex leucophylla	Beach saltbush	1.00	23,552
Camissoniopsis cheiranthifolia	beach evening primrose	0.05	2,074,850

* Seed for *A. umbellata* is difficult to find/purchase but will be included in the custom seed mix if available.

Table 7. Container stock plant list for beach habitat outside of western snowy plover enclosure.

Species Name	Common Name
Abronia maritima	red sand verbena
Ambrosia chamissonis	beach bur
Atriplex leucophylla	beach saltbush
Camissoniopsis cheiranthifolia	beach evening primrose

Table 8. Container stock plant list for bluff habitat.

Species Name	Common Name
Artemisia californica	California sagebrush
Baccharis salicifolia	mulefat
Calystegia macrostegia	coast morning glory
Coreopsis gigantea	Giant coreopsis
Datura wrightii	Jimsonweed
Dudleya virens var. insularis	Island Green Dudleya
Encelia californica	California sunflower
Ericameria ericoides	mockheather
Eriogonum parvifolium	seacliff buckwheat
Erysimum capitatum	western wallflower
Peritoma arborea	bladderpod
Lupinus chamissonis	dune lupine
Mirabilis laevis	four o' clock
Opuntia littoralis	coast prickly pear
Rhus integrifolia	lemonadeberry
Salvia mellifera	black sage
Salvia leucophylla	purple sage

Table 9. Custom seed mix design for bluff habitat.

Species Name	Common Name	Lbs / Acre	Number of Pure Live Seeds / Lb.
Acmispon glaber	deerweed	1.00	158,840
Clarkia purpurea	purple clarkia	0.05	1,225,700
Corethrogyne filaginifolia	California aster	2.50	25,800
Cucurbita foetidissima	buffalo gourd	9.00	6,324
Eschscholzia maritima	Coast California poppy	0.50	308,000
Heterotheca grandiflora	telegraph weed	0.75	216,150
Lupinus bicolor	miniature lupine	1.75	85,000
Lupinus succulentus	succulent lupine	2.75	17,000
Lupinus truncatus	truncated lupine	2.50	30,600
Salvia columbariae	chia	0.10	500,050
Verbena lasiostachys	western verbena	0.20	483,000

Each of the beach habitat plant species are discussed in detail below. Native plant species characteristics and growing pattern information was retrieved from CalFlora (www.calflora.org), Calscape (www.calscape.org), and S&S Seeds databases. The combined seed mix with all five species will be distributed across the restoration site using a broadcast hand seeder. The combined seed mix will be spread at a rate of 21.1 pounds per acre (outside the enclosure) and will be immediately raked into the sand.

Beach evening primrose is a perennial native to California and is a low-lying shrub that provides good ground cover and soil/dune stabilization. This plant species is native to open dunes and sandy soils,

growing prostrate along the beach surface and forming mats. Typically blooming from as early as January to the end of August, beach evening primrose features small solitary bright yellow flowers, and is tolerant to low water conditions, surviving year round on seasonal winter rains and ocean spray (Figure 34).

Figure 34. Beach evening primrose) [CalFlora: L. Watson 2007 (Left) and J. Pawek 2013 (right)].

Red sand verbena is a beach-adapted perennial, native to the coastlines of southern California, including the Channel Islands, and northern Baja California. Red sand verbena is a mat-like herb growing under 1 foot, with fleshy leaves, and clustered pink to purple flowers which bloom in the Spring and Summer (Figure 35). Red sand verbena was chosen for its association with fore-dune habitats and ability to stabilize sand and create small dunes as well as its characteristics of high salt tolerance and low water requirements.

Figure 35. Red sand verbena [CalFlora: G.A. Monroe 2010 (Left) and L. Watson 2007 (right)].

Pink sand verbena is a perennial herb native to the western United States, with its distribution stretching along the western coast from British Columbia, Canada to Baja California, Mexico. It is adapted to sandy, well-drained soil in areas with low precipitation, typically found on beach and sand dunes throughout most of the year (Figure 36). Pink sand verbena can become a striking carpet-like groundcover in undisturbed areas after winter rains and its foliage can be deciduous based on

environmental stress. It should be noted that pink sand verbena frequently hybridizes with other species of *Abronia*, including red sand verbena.

Figure 36. Pink sand verbena [CalFlora: K. Hickman 2018 (Left) and C. Wilcox 2021 (right)].

Beach bur is a low-lying perennial herb native to California's coastline. This plant species is commonly found along the coastline and dune environments and produces tiny, clustered blooms from June to July (Figure 37). Beach bur sage has a high salt tolerance, low water requirement, and is conducive for sand stabilization and dune formation.

Figure 37. Beach bur [CalFlora: N. Kramer 2008 (left) and M. Bors 2008 (right)].

Beach saltbush is a perennial herb native to the sandy beaches and dunes of the California coastline. Like the other species in the seed pallet, beach saltbush has a high salt tolerance and low water requirement, with the capability of surviving harsh dynamic coastal environments. Beach saltbush forms low-lying mats that spread up to 3 feet and blooms from April to October with tiny inconspicuous green flowers (Figure 38).

Figure 38. Beach saltbush [CalFlora: (left) and Z. Akulova 2015 (right)].

Water Truck

The back dunes within the bluff restoration area may require supplemental irrigation in the first growing season for good initial plant establishment, especially for areas with container stock. In particular, the bluff may benefit from periodic irrigation to allow for quick establishment of erosion control species, depending on rain events that occur after planting. If rain does not occur for the first 2-3 weeks following planting, planted container stock will be watered by hose from a water truck parked in the parking lots adjacent to the sites. This may be repeated every 2-4 weeks during the wet season until rainfall occurs (> 0.25 in) or plants become fully established.

Conservation Measures

Care will be taken throughout the restoration process to protect native species and wildlife. One of the objectives of this project is to enhance the habitat areas for native species. As this is a hand-restoration project with no heavy equipment and no sediment/soil movement, impacts to wildlife should not occur. As non-native plants are removed by hand, they will be gently shaken to make sure that as much sand as possible is left in place. If wildlife is visually seen, it will be left alone and avoided. Pre-implementation bird and wildlife surveys will be conducted. No work is proposed in bird nesting season, but pre-implementation surveys will confirm site use by species.

The following Conservation Measures (CM) reviewed by USFWS will be applied to the project to avoid and minimize adverse effects to snowy plovers, least terns, and ESB:

CM 1. Workers will be prohibited from bringing domestic pets or any animals to project sites to ensure that domestic pets do not disturb or depredate wildlife in adjacent native habitats. Additionally, dogs are not allowed on Dockweiler Beach.

CM 2. The project sites will be kept as clean as possible to avoid attracting predators of the snowy plover and the least tern. All food-related and other trash will be removed from the sites when assessments are performed. No trash will be left by TBF or project implementers.

CM 3. To the maximum extent practical, project-related activities except scientific monitoring (e.g., Audubon plover monitoring) that occur within 500 feet of occupied snowy plover and least tern habitat will take place outside of the snowy plover breeding season (March 1 to August 31) and the least tern breeding season (April 1 to September 15).

CM 4. If avoiding the snowy plover and least tern breeding seasons are not possible, and work needs to occur within 500 feet of occupied snowy plover and/or least tern habitat, then TBF, LA Audubon, or a qualified ornithologist will conduct a pre-restoration survey to determine if plovers or terns are present. If they are not present, work may continue; if they are present, TBF will contact the Carlsbad Fish and Wildlife Office to evaluate if additional measures are necessary.

CM 5. Habitat restoration work/maintenance within the coastal bluff restoration site will not occur during the flight season for the butterfly (late May to August 31) after butterflies have been identified on site. A pre-restoration butterfly survey will occur prior to bluff activities.

CM 6. All workers will avoid stepping within a 2-foot diameter around each seacliff buckwheat, and only cut weeds, not pull weeds, within this zone to protect ESB individuals that have pupated within the leaf litter below the seacliff buckwheat plants.

CM 7. Workers will endeavor to minimize erosion when working in the coastal bluff restoration site.

CM 8. Non-native plants that have been pulled/cut will be removed from the project sites and disposed of within the proper facilities.

Native plants that are co-occurring in the project sites will be protected and left in place to encourage expansion and continued establishment. No native plants will be removed as part of this project. For example, native red sand-verbena (CNPS 4.2 listed species) has been identified on site and will not be removed. No additional rare plant species have been identified on site, but if any are found in the course of restoration activities, they will be flagged, marked with GPS, and avoided. Additional pre-implementation vegetation assessment surveys will be conducted directly prior to restoration activities in case additional vegetation species establish after the finalization of this document (see Appendix 3). If other native, rare, or sensitive plant species are identified during pre-restoration vegetation surveys, measures will be put in place to avoid their removal.

Federally threatened western snowy plovers are known to be on site in the beach areas periodically, both in the winter season and with the establishment of several nests over the last few years during nesting season (see baseline assessment above). Conservation measures for this species will be important for any activities (i.e., implementation, scientific monitoring, and site maintenance). Additionally, work will be restricted in plover nesting season if plovers are present, and care will be taken to avoid all plovers during all work and scientific monitoring. If plovers are present, restoration activities will not occur where they are present.

Pre-restoration biological surveys will be conducted to identify any sensitive animal species present within the project site, including, but not limited to, the western snowy plover, California least tern, ESB, southern California legless lizard (*Anniella stebbinsi*), and coast horned lizard (*Phrynosoma blainvillii*).

The California least tern is both state and federally listed as endangered and are known to be occasionally present on or adjacent to the project site, though no nesting activity has been documented (USFWS 1970, USFWS 2020, CNRA 2021, Ryan et al. 2019 to 2021, Appendix 3). These migratory birds are present in California during nesting season, primarily between May and August, before departing for wintering grounds along the coast of mainland Mexico (Massey and Atwood 1981, USFWS 2020). There will be no restoration activities during California least tern nesting season when terns are present and pre-restoration surveys will be conducted to minimize disturbance in roosting season. The ESB is endemic to coastal sand dunes that support its obligate host plant, seacliff buckwheat. Although ESBs are present in LA County and have been observed south of the project site at Dockweiler State Beach and LAX dunes, there have been no sighting at the project site (USFWS 1998, USFWS 2008, USFWS 2019, Appendix 3). The southern California legless lizard and coast horned lizard are designated as species of Special Concern by CDFW (Thomson et al. 2016). Although presence of both lizards is possible on site, none have been observed to date (Appendix 3). To avoid impacts to sensitive animal species potentially associated with existing vegetation on site, invasive vegetation species will be removed carefully.

Lastly, care will be taken to avoid erosion once iceplant is removed. Seeding and planting will happen within one week of iceplant removal, sooner if possible. Additionally, erosion control measures, such as jute matting, straw wattle, and straw mulch will be installed in unstable areas.

Adaptive Management

Adaptive management is a tool for achieving success where there is uncertainty as to what actions will be needed to accomplish specific goals. As systems like coastal beaches are inherently dynamic, with high levels of visitation and changing management strategies, an adaptive management approach will lead to better outcomes in the long-term. Adaptive management may be implemented based on the success of the project as interpreted by TBF, beach managers, LACDBH, and LA City. The monitoring components and resulting data will be integral in determining the success of the project both from a socio-economic and ecological perspective. Scientific monitoring will also serve to inform progress towards restoration objectives and success criteria.

TBF, with the help of our existing volunteer internship program, will also undertake a hands-on, community-level maintenance strategy without the use of mechanized equipment, including trash removal and invasive species removal throughout the implementation of the project and for a duration of no less than five years afterwards. Subsequent site maintenance, if needed, will be conducted by TBF, volunteers, LACDBH, or other partners and project supporters. Evaluation of the project will occur annually via an annual report for five years post-restoration. The report will be provided to LACDBH and California Coastal Commission and will be made publicly available on TBF's website.

Scientific Monitoring

Accurate and robust scientific monitoring is a vital part of any restoration project. Monitoring includes observations of post-implementation site condition which will assess plant installation as well as other restoration components (e.g., sand fencing). Monitoring also informs adaptive management actions (e.g., non-native plant cover that may need to be controlled), tracks the project towards meeting success criteria over time, and compares the site to 'control' conditions in adjacent areas that have had no restoration actions. Lastly, opportunistic research will be conducted in partnership with CRI and other universities.

Monitoring is used to assess successful project implementation; for example, in this project, monitoring will allow a topographic assessment of dune growth to combat sea level rise. TBF will be implementing a biological, physical, and human use monitoring plan before the restoration to collect baseline data, for the duration of the restoration project, and several years afterwards to assess success. Additional "control" data in unrestored adjacent beach areas will be collected as part of a before-after-control-impact ecological assessment monitoring program. Specialist ecological and restoration scientists are partners and advisors for this project, and their expertise will be used to advise both the monitoring program and its evaluation. Data will be collected for up to five years to evaluate the ecological health of the created dune ecosystem and its potential for long-term adaptation to accelerated rates of sea level rise.

A rigorous scientific monitoring plan will allow for the evaluation of completed restoration activities. Table 10 summarizes the monitoring sampling design. It lists nine major parameters, the primary protocol(s) which will be implemented for each parameter, and the frequency of implementation. It should be noted that the frequency of implementation of each protocol listed in Table 10 is the minimum. Opportunistic additions of surveys will be conducted when possible and if future funding permits. TBF has a long history of partnership with Loyola Marymount University and other universities that helps facilitate cost-effective data collection. All data collected by TBF and their partners will have results summarized and reported in Annual Reports that will be made publicly available on TBF's website: www.santamonicabay.org.

Pre-restoration baseline monitoring will occur prior to the implementation of the restoration project to allow a comparison of the pre- and post-project conditions of the area (Figure 39, Figure 40). Ongoing implementation monitoring will occur throughout the duration of the restoration activities to adaptively manage and avoid impacts to any existing native plant and wildlife species. Post-restoration monitoring will occur after restoration activities are concluded and will allow a scientific evaluation of the successes and challenges of the implementation strategies. Additionally, post-restoration data will contribute meaningful information towards adaptively implementing re-vegetation activities. It will allow for a thorough scientific evaluation of restoration efforts. When possible, additional data will be collected and partnerships with universities and other entities will be undertaken to supplement research efforts and obtain more frequent datasets. Results will be disseminated in public annual reports, scientific presentations and conferences, potential future manuscripts, to local communities via presentations and speaking to Malibu City Council, and via webinars.

Figure 39. Baseline monitoring of vegetation cover within the bluff restoration area conducted in July 2020 using fixed quadrats along a transect.

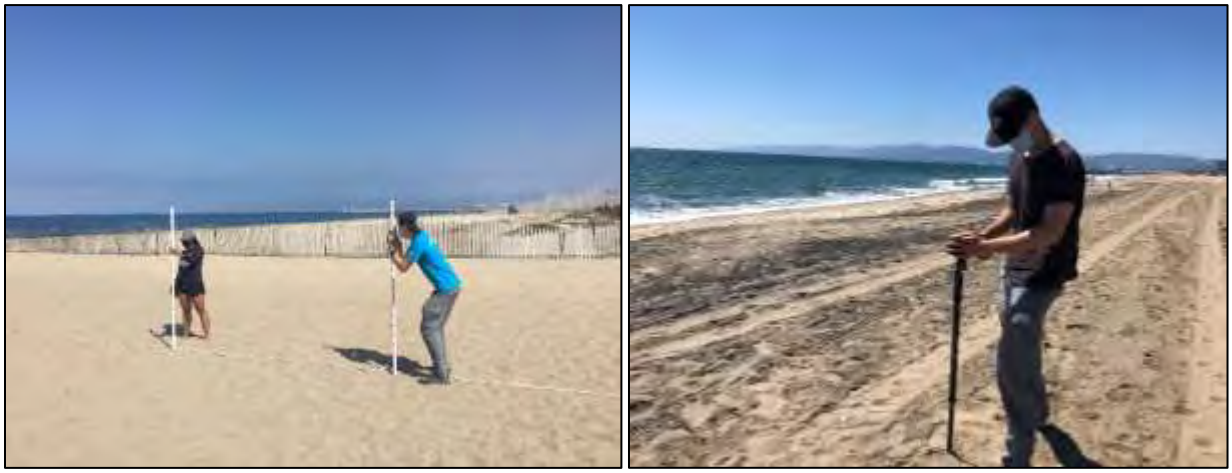


Figure 40. Baseline monitoring elevation profile surveys conducted along a beach transect in July 2020 using elevation poles (left) and GPS Trimble (right).

Table 10. Description of protocols to be implemented during pre-restoration baseline monitoring, post-restoration evaluation monitoring, and their minimum frequency of occurrence.

Parameter	Protocol	Minimum Frequency
Photo Point	Fixed geospatial and bearing photo locations throughout sites	Semi-annually
Wrack Cover	Percent cover, composition by species, average depth	Semi-annually
Vegetation Cover and Seedling Density (if present)	Selective mapping, fixed cover class quadrats along t-sects; fixed quadrat density counts for seedlings	Semi-annually
Avifauna (+ pollinator presence)	Visual presence / behavior surveys; TBD if plover nesting	Semi-annually, with increased frequency if snowy plovers are present
Physical Characteristics	Elevation profiles and cross-sections, beach width, beach slope	Semi-annually
Weather Conditions	Air temperature, precipitation, wind, and tide gauge data (NOAA)	As publicly available data sets are posted online
Human Use, Volunteer Data, and Site Checklist	Visual presence / activity checklist; date and metrics of events and tours; site checklist; sign check and maintenance	Semi-annually

Individual Protocol Details

Each of the following subsections summarizes an individual protocol to be implemented as part of the monitoring program. For in depth details on objectives, equipment, field preparation, field methods, quality control check procedures, and datasheets, refer to the individual Standard Operating Procedures listed below within the California Estuarine Wetland Monitoring Manual, publicly available for free download: http://www.santamonicabay.org/california-estuarine-wetlands-monitoring-manual-level-3/. Additionally, some protocols were adopted from Dugan et al. 2015 Final Report: Baseline Characterization of Sandy Beach Ecosystems along the South Coast of California.

Photo-Point

Photo point monitoring will occur to identify major site changes or project-level changes as a result of the restoration activities with a semi-annual frequency (e.g., native vegetation growth, plant hummock formation). Survey methods are described in detail in SOP 7.2 Level 2 Photo Point (TBF 2015a). A minimum of six permanent photo point locations will be established during baseline monitoring and the locations recorded using a GPS. Photographs can be used as qualitative assessments of broad-scale changes following restoration activities and dune development over time.

Wrack Cover

Wrack, or plants and algae that have washed ashore, surveys will be conducted to determine the percent cover, composition by species, and average depth of macrophyte wrack in the wash zone area directly in front of the restoration site and control site. A total of four line-intercept transects will be

surveyed, consisting of two transects in the wash zone directly in front of the restoration site and two transects in the wash zone of the control areas (outside the project area). These transects will also record any trash, tar, driftwood, or other detritus in a similar manner. Surveys will occur prior to restoration implementation and will be continued semi-annually for a period no less than five years. The wash zone is a dynamic area, therefore, exact transect locations may vary over surveys. As beach topography varies considerably between summer and winter weather conditions, semi-annual surveys will be timed at minimum during those seasons.

Vegetation Cover

Vegetation cover surveys can be used to provide a wide range of information and data, including: summarizing the prevalence of native and non-native plant cover, determining species cover, relative species richness and diversity, and assessing canopy height. The primary objective of the transect- and quadrat-level cover surveys for this project is to assess the approximate cover of native coastal strand vegetation semi-annually over time. A minimum of six transects and two transects outside, but adjacent to, the project area (control transects) will be surveyed.

The transect survey methods are described, along with field data sheets, in SOP 3.2 Vegetation Cover Surveys (TBF 2015b). Line-Intercept Transects document every species observed directly below the transect tape where the vegetation crosses a minimum of 0.01 m (or 1 cm). This transect survey method is useful when collecting vegetation cover data in patchy habitats or those with a significant amount of bare ground (or sand). Line-intercept data will be summed by species and divided by the total length of transect to determine percent cover for each transect. Cover Class Quadrat surveys will be conducted using 1 m^2 PVC quadrats subdivided into 16 sub-quadrats. Ten fixed-location quadrats will be surveyed along each transect. Seedling density will be speciated if possible and quantified along a subset of transects and quadrats. This quantitative assessment method will allow for a post-restoration evaluation of germination success of native coastal strand and foredune plant species. Cover class species data will be analyzed using the median of each Daubenmire cover category and averaged to determine percent cover within each transect with variability represented as standard deviation or error (TBF 2015b). Photographs of a subset of quadrats will also be collected concurrently. Additional visual estimates of cover in mapped areas may also be conducted.

Avifauna (and Pollinator Presence)

The presence and distribution of avifauna within an ecosystem is often used as an index of habitat quality due to their diet and vulnerability to environmental conditions (Conway 2008). Avifauna data are useful to characterize representative avian assemblages and spatial distributions within a particular area. Bird survey methods are described in detail, along with field data sheets, in SOP 5.1 Bird Abundance-Activity (TBF 2015d). The primary purpose of avifauna surveys for this project is to provide a general understanding of the bird community and activity in the restoration area. It is not intended to provide statistical results; rather, its goal is to generally characterize bird species utilizing the site.

Bird surveys will be conducted semi-annually and will include observational species presence and activity/behavior. Additionally, breeding or nesting activity of birds will be recorded and, if present, will require the immediate postponement of any restoration activities within the project area. Specific attention will be paid to federally threatened western snowy plovers, and their data will also be shared

with Audubon Society and USFWS. Lastly, presence of various species of pollinators such as butterflies or bees will also be recorded as part of these surveys.

Physical Characteristics

Physical characteristics will be collected using techniques described in detail in Dugan et al. 2015. To physically characterize the beach, surf, and swash zones, measurements will be taken along a transect of the beach width from the inland edge at a fixed location such as a parking lot edge to the lowest intertidal level exposed by swash, locations of the water table outcrop (WTO) and high tide strand line (HTS). Elevation profiles will also be conducted along these transects. A high-resolution Trimble GPS (or equivalent) will be used to calculate GPS location and approximate elevation at several points along each transect for reference. These measurements will be collected along at least one transect perpendicular to the ocean at each beach, and along two transects outside the project area.

Weather Conditions

Average air temperature and precipitation data will be downloaded annually for Dockweiler Beach from NOAA weather, if available (closest weather station is Los Angeles International Airport). Precipitation data from LA County Department of Public Works are also available, though the Malibu Fire Station is the closest station and may not completely accurately reflect the site-specific precipitation total values (https://dpw.lacounty.gov/wrd/rainfall/). Additional data from variables such as humidity or barometric pressure may also be accessed and summarized in Annual Reports, if available.

Human Use, Volunteer Event Data, Site Checklist

Volunteer event data will be collected for all public restoration events or tours, including the date of the event, the number of participants, hours worked, and any incidental useful supplemental information such as the school and age group, zip code if possible, other demographics, etc. Human use and activity of the site and surrounding areas will be recorded at a minimum of semi-annually. These data may also be supplemented by other metrics such as LACDBH or County lifeguard visitor count data.

In addition, any vehicle tracks on the beach, including grooming marks and other tracks such as footprints or animal tracks will be noted. The physical characteristic surveys will also include a "site checklist" which will collect data on things like interpretive sign condition, trash presence and type, etc. As beach topography varies considerably between summer and winter weather conditions, semi-annual surveys will be timed at minimum during those seasons.

Additional Studies

In addition to the protocols and surveys listed above, TBF and their partners will pursue supplemental funding for additional specialized surveys such as invertebrates, grunion, sand deposition studies, or more frequent implementation of the above protocols.

Success Criteria

Setting appropriate performance criteria for restoration projects, and assuring those criteria are met, helps assure that the ecological benefits of the project are realized. Performance criteria should focus on

measuring the extent to which appropriate physical and biological ecosystem processes have been restored in the short-term and how they might be expected to be self-sustaining in the long-term. Additionally, performance criteria should be sufficient for measuring whether or not the project goals have been achieved. Performance criteria should be quantitative and measurable.

Restoration success criteria are intended to support the project goals and assist in information sharing throughout California and beyond for living shoreline projects. Additionally, criteria can inform the need for adaptive management. The following table summarizes the restoration success criteria associated with this project over time (Table 11). Note that the plover area target maximum cover is based on input from LA Audubon and USFWS and plover preferences from existing conditions. Vegetation that becomes too dense may not be preferable for the birds.

Table 11. Success criteria for the LA Living Shoreline Project.

Criteria Parameter	Quantifiable Metric	5-Year Target	Plover Area Target
Non-native vegetation	Absolute cover as assessed along transects within the restoration areas and compared to the controls	Reduced (or absent) non-native cover within restoration area compared to baseline and controls (<15% absolute cover non-natives; <5% absolute cover of highly invasive non-natives as determined by CalIPC)	Same
Native vegetation	Absolute cover as assessed along transects within the restoration areas and compared to the controls; species richness	Increase in native cover and species richness (total) within restoration areas compared to baseline and controls; minimum absolute native cover of 10-15% (coastal strand and foredune) and 30% (bluff)	Maximum absolute native cover of 25% in plover area; no minimum
Native / Non-native ratio	Relative cover as assessed along transects within the restoration areas	Minimum of 85/15% ratio of native to non-native relative plant cover	Same
Topography change	Change in elevation profiles and dune heights along restoration transects	Stable dune system over time without substantial erosion (incorporating seasonal change)	None
Community participation	Number of volunteers (and hours worked) annually during restoration or outreach events and public meeting participation	Minimum of 50 people directly engaged annually for five years (> 250 total)	None

Maintenance

Site visits will be conducted semi-annually (at minimum) for a period of no less than five years to visually assess the restoration progress and evaluate the need for maintenance activities. Additional site visits or monitoring will be conducted opportunistically, or if additional funding is identified. Additionally, adaptive management considerations may require more frequent site visits which will be undertaken by TBF or partners. TBF is resolutely committed to the long-term health of the site.

The overall condition of the restoration areas will be noted, along with detailed observations including presence of invasive species re-growth or environmental stressors (e.g., prolonged dry periods). Photographic documentation of any observations of concern will occur. If invasive vegetation is found in a restored area, adaptive management steps such as weed removal by hand may need to be taken. Additionally, if cover becomes too dense in the plover area, it may need to be thinned or relocated to other parts of the project area. Similarly, litter or trash collection and removal from site will be conducted at least semi-annually.

Reporting

Collected data will be entered into excel (or equivalent) datasheets, and quality control checks will be performed by a different qualified individual. A publicly available annual report will be compiled and produced at the culmination of each year of work, in accordance with the final issued permits. Reporting will help track monitoring data over time and inform adaptive management actions (e.g., non-native plant cover that may need to be controlled). Additionally, reporting will track the project towards meeting defined success criteria over time and compare the site to 'control' conditions in adjacent areas that have had no restoration actions.

The Annual Reports will be published on The Bay Foundation's website: www.santamonicabay.org, and submitted to Coastal Commission, Coastal Conservancy and LACDBH. Each Annual Report will contain summary details on restoration activities (Year 1 only) and monitoring results (all years) as well as photographs documenting the site over time. Annual reports will be published for a minimum of five years after implementation.

Literature Cited

CNRA (California Natural Resources Agency). 2021. State and federally listed endangered and threatened animals of California. Department of Fish and Wildlife Biogeographic Data Branch, California Natural Diversity Database (CNDDB).

CA State Parks (California State Parks). 2020. Sea level rise adaptation strategy. 20 pp.

Conway, C. 2008. "Standardized North American Marsh Bird Monitoring Protocols." Arizona Cooperative Fish and Wildlife Research Unit, Wildlife Research Report 01.

Defeo, O., McLachlan, A., Schoeman, D.S., Schlacher, T., Dugan, J., Jones, A., Lastra, M., Felicita, S. 2008. Threats to sandy beach ecosystems: A review. Estuarine, Costal and Shelf Science. 1-12.

Dugan, J.E., D.M. Hubbard, and G. E. Davis. 1990. Sand Beach and Coastal Lagoon Monitoring Handbook. Channel Islands National Park California. Prepared for the National Park Service, Ventura, California. 50 pp.

Dugan, J.E., D.M. Hubbard, M. McCrary, M. Pierson. 2003. "The response of macrofauna communities and shorebirds to macrophyte wrack subsidies on exposed sandy beaches of southern California." Estuarine, Coastal and Shelf Science 58S: 25-40.

Dugan, J.E., Hubbard, D.M., Rodil, I.F., Revell, D.L., and Schroeter, S. 2008. Ecological effects of coastal armoring on sandy beaches. 2008. Marine Ecology. 29(1): 160-170

Dugan, J.E., D.M. Hubbard. 2010. "Loss of coastal strand habitat in southern California: the role of beach grooming." Estuaries and Coasts, 33(1): 67-77.

Dugan, J.E., D.M. Hubbard, K.J. Nielsen, J. Altstatt, and J. Bursek. 2015. Final Report: Baseline Characterization of Sandy Beach Ecosystems along the South Coast of California. Prepared for the South Coast Marine Protected Area Baseline Program. 134 pp.

Flick, R. E. 1993. The myth and reality of southern California beaches. Shore & Beach. 61(3): 3-13.

Gilburn, A.S. 2012. "Mechanical grooming and beach award status are associated with low strandline biodiversity in Scotland." Estuarine, Coastal and Shelf Science. 107:81-88

Grifman, P.M., J.F. Hart, J. Ladwig, A.G. Newton Mann, M. Schulhof. 2013. "Sea Level Rise Vulnerability Study for the City of Los Angeles." USCSG-TR-05-2013.

Griggs, G. and K. Patsch. 2018. Natural changes and human impacts on the sand budgets and beach widths of the Zuma and Santa Monica littoral cells, Southern California. Shore and Beach 86(1): 1-14.

Goossens, D. Z. Offer, and G. London. 2000. Wind tunnel and field calibration of five aeolian sand traps. Geomorphology 35: 233-252.

Hapke, C. J., Reid, D., Richmond, B. M., Ruggiero, P., and List, J. 2006. National Assessment of Shoreline Change Part 3: Historical Shoreline Change and Associated Coastal Land Loss Along Sandy Shorelines of the California Coast. United States Geological Survey Open-file Report 2006-1219.

Hubbard, D.M., J.E. Dugan, N.K. Schooler, S.M. Viola. 2013. Local extirpations and regional declines of endemic upper beach invertebrates in southern California. http://dx.doi.org/10.1016/j.ecss.2013.06.017

Johnston, K.K., Medel, I.D., Anderson, S., Stein, E., Whitcraft, C., and Crooks, J. 2015b. California Estuarine Wetland Monitoring Manual (Level 3). Prepared by The Bay Foundation for the United States Environmental Protection Agency. pp 297.

Johnston, K.K., Grubbs, M., Abbott, R. 2017. Santa monica beach restoration pilot project: year 1 annual report. Report prepared by The Bay Foundation for city of Santa Monica, California Coastal commission, Metabolic Studio, US environmental Protection Agency, and California Department of Parks and Recreation. 68 pp.

LACDBH (Los Angeles County Department of Beaches and Harbors). 2016. Final report: Los Angels county public beach facilities sea level rise vulnerability assessment. Prepared by Noble consultants-G.E.C., Inc. 117 pp.

Martin, K. 2006. Introduction to Grunion Biology. www.grunion.org. 4 pp.

Massey, B.W. and J.L. Atwood. 1981. Second wave nesting of the California Least Tern: age composition and reproductive success. Auk 98: 598–599.

National Oceanic and Atmospheric Administration Coastal Services Center, 2012. Incorporating Sea Level Change Scenarios at the Local Level, a companion report for Technical Considerations for Use of Geospatial Data in Sea Level Change Mapping and Assessment.

Nordstrom, K.F., Jackson, N.L., and Korotky, K.H. 2011. “Aeolian transport across beach wrack.” Journal of Coastal Research. 1(59):211-217

Nordstrom, K.F., Jackson, N.L., Korotky, K.H., and Puleo, J. 2011. “Aeolian transport rates across raked and unraked beaches on a developed coast.” Earth Surfaces, Processes, and Landforms. 36:779-789

Nordstrom, K.F., Jackson, N.L., Freestone, A.L., Korotky, K.H., and Puleo, J. 2012. “Effects of beach raking and sand fences on dune dimensions and morphology.” Geomorphology. 179:106-115

Orme, A.R., G.B. Griggs, D.L. Revell, J.G. Zoulas, C.C. Grandy, and J. Koo, 2011. Beach changes along the southern California coast during the twentieth century: A comparison of natural and human forcing factors. Shore & Beach, 79(4): 38-50.

Page, G.W. and Stenzel L.E. 1981 the breeding status of the snowy plover in California. Western Birds. 12(1): 1-40.

Page, G.W., Stenzel, L.E., Warriner, J.S., Warriner, J.C., Paton, P.W. 2009. Snowy plover (Charadrius alexandrines), The Birds of North America Online (A. Poole, Ed.) Ithaca: cornell Lab of Ornithology; Retrieved from the Birds of North America Online:http:bna.birds.cornell.edu/bna/species/154

Powell, A. N. 1995. Western snowy plover use of state-managed lands in southern California, 1995. Bird and Mammal conservation Program Report 96-03. Prepared for California Department of Fish and Game. 14 pp.

Powell, A.N., J.M. Terp, C.L. Collier, and B.L. Peterson. 1997. The status of western snowy plovers (Charadrius alexandrinus nivosus) in San Diego County, 1997. Report to the California Department of

Fish and Game, Sacramento, CA, and U.S. Fish and Wildlife Service, Carlsbad, CA, and Portland, OR. 34 pp.

Raby, K.M and Colwell, M.A. 2020. Habitat restoration improves western snowy plover nest survival. Wader Study 127(2): 130-140.

Rios Clemente Hale Studios and Coastal Restoration Consultants. August 2019. Draft Restoration Plan for Zuma Lagoon and Point Dume Beach in Malibu, CA. Final Concept Package and Restoration Plans for Malibu Living Shoreline Project.

Ryan, T. P., S. Vigallon, L. Plauzoles, C. Almdale, R. Montijo, and S. Magier. 2010. The Western Snowy Plover in Los Angeles County, California. Prepared for the California Department of Fish and Game, Sacramento, CA. Prepared by Ryan Ecological Consulting, Pasadena, CA. 56 pp + appendices.

Ryan, T. P., S. Vigallon, and C. Egger. 2015. Annual Report: The Western Snowy Plover in Los Angeles and Orange Counties, California: July 2014 to June 2015. Prepared for the California Department of Fish and Wildlife, San Diego, CA. Prepared by Los Angeles Audubon, Los Angeles, CA

Ryan, T. P., S. Vigallon, L. Plauzoles, C. Egger, S. Sheakley, R. Griswold, and B. Eastman. 2017. The Western Snowy Plover in Los Angeles and Orange Counties, California: September 2014 to February 2017. California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report, 2017. Sacramento, CA. 55 pp + appendices.

Ryan, T. P., S. Vigallon, D.S. Cooper, C. Dellith, K. Johnston, L. Nguyen. 2019. Return of beach-nesting snowy plovers to Los Angeles County following 68-year absence. Western Birds. 50:16-25.

Ryan, T. P. and Vigallon, S. Los Angeles and Orange County Western Snowy Plover Monthly Reports for January 2019 through April 2021. Produced by Tom Ryan Consulting and LA Audubon Society.

Schlacher, T.A., Schoeman, D.S., Dugan, J., Lastra, M., Jones, A. Marine Ecology. 29 (Suppl. 1): 70-90.

Schlacher, T.A, Dugan, J., Schoeman, D.S., Lastra, M., Jones, A., Scapini, F., McLachlan, A., and Defeo, O. 2007. “Sandy beaches on the brink.” Diversity and Distributions. 13:556-560

Shuford, D.W. and Gardali, T. 2008. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Talbot, D. 2010. News from Los Angeles County Department of Beaches and Harbors: Protective fencing for snowy plovers installed at Dockweiler Beach. 1 pp.

TBF. 2015a. Level 2 Photo Point Standard Operating Procedures (SOP 7.2). Unpublished protocols. The Bay Foundation, Los Angeles, CA. 30 June 2015.

TBF. 2015b. Vegetation Cover Surveys Standard Operating Procedures (SOP 3.2). Unpublished protocols. The Bay Foundation, Los Angeles, CA. 30 June 2015.

TBF. 2015c. Vegetation Seed Bank Standard Operating Procedures (SOP 3.4). Unpublished protocols. The Bay Foundation, Los Angeles, CA. 30 June 2015.

TBF. 2015d. Bird Abundance and Activity Standard Operating Procedures (SOP 5.1). Unpublished protocols. The Bay Foundation, Los Angeles, CA. 30 June 2015.

Thomas, R. C., Wright, A. N., and Shaffer, H. B. 2016. California amphibian and reptile species of special concern. 186-191 and 218-224 pp.

(USFWS) U.S. Fish and Wildlife Service. 1970. Conservation of endangered species and other fish or wildlife. Federal Register 35(106):8491-8498.

(USFWS) U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; determination of threatened status for the Pacific coast population of the western snowy plover; final rule. Federal Register 58(42):12864-12874.

(USFWS) U.S. Fish and Wildlife Service. 1998. Recovery plan for the El Segundo blue butterfly (Euhpilotes battoides allyni). Portland, Oregon. 67 pp.

(USFWS) U.S. Fish and Wildlife Service. 2005. Endangered and threatened wildlife and plants; Designation of critical habitat for the Pacific coast population of the western snowy plover. Federal Register 70:56970-57018. September 29, 2005.

(USFWS) U.S. Fish and Wildlife Service. 2006. California least tern (*Sternula antillarum browni*) 5-year review and evaluation. 35 pp.

(USFWS) U.S. Fish and Wildlife Service. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). In 2 volumes. Sacramento, California. xiv + 751 pages.

(USFWS) U.S. Fish and Service. 2008. El Segundo blue butterfly (Euhpilotes battoides allyni) 5-year review: summary and evaluation. 39 pp.

(USFWS) U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; Revised Designation of critical habitat for the Pacific coast population of the western snowy plover. Federal Register 77(118):36728-36869. June 19, 2012.

(USFWS) U.S. Fish and Wildlife Service. 2019. Recovery plan amendment: Recovery plan for El Segundo blue butterfly (Euhpilotes battoides allyni). 17 pp.

(USFWS) U.S. Fish and Wildlife Service. 2020. California least tern (Sternula antillarum browni) 5-year review: summary and evaluation.

(USFWS) U.S. Fish and Wildlife Service. 2020. California Least Tern. Accessed May 2020. https://www.fws.gov/sacramento/es_species/Accounts/Birds/ca_least_tern/

Vigallon, S. 2013. Dockweiler beach snowy plover enclosure report. Prepared for United States Fish and Wildlife Service. 7 pp.

Warriner, J.S., J.C. Warriner, G.W. Page, and L.E. Stenzel. 1986. Mating system and reproductive success of a small population of polygamous snowy plovers. Wilson Bulletin 98(1):15-37.

Wiegel, R.L., 1994. Ocean beach nourishment on the USA Pacific coast. Shore & Beach. 62(1): 11-16.

LIST OF APPENDICES

Appendix 1. Plant List

Appendix 2. Photo Point

Appendix 3. California Natural Diversity Database List

Appendix 4. Interpretive Signage

Appendix 1 – Plant Species List for Beach and Bluff Habitats

Native Plants	Common name	Beach	Bluff
Abronia maritima	Red sand verbena	X	
Ambrosia chamissonis	Beach bur	X	
Atriplex lentiformis	Beach saltbush	X	
Camissoniopsis cheiranthifolia	Beach evening-primrose	X	X
Croton californicus	California croton		X
Datura wrightii	Jimsonweed		X
Heterotheca grandiflora	Telegraph weed		X

Non-Native Plants	Common Name	Beach	Bluff
Avena spp	Wild oat		X
Bromus diandrus	Brome grass		X
Brassica spp	Mustard		X
Carpobrotus edulis	Iceplant		X
Cakile maritima	Sea rocket	X	X
Lactua serriola	Prickly lettuce		X
Mesembryanthemum crystallinum	Common iceplant		X
Raphanus sativus	Radish		X
Salsola tragus	Russian thistle		X
Sonchus oleraceus	Common sowthistle		X

Appendix 2 – Photo Point

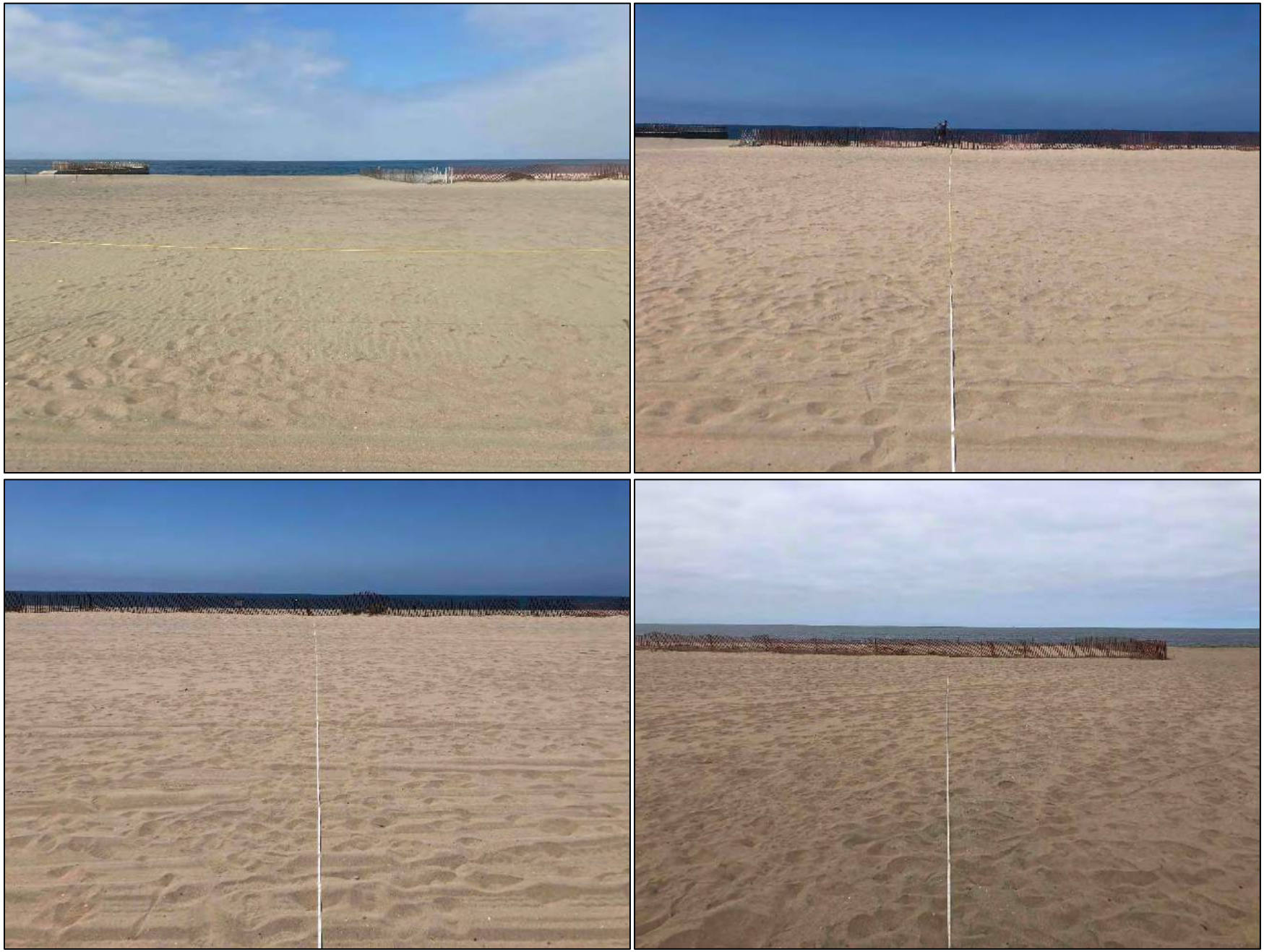


Photo Point T1 Beach (top, left), T2 Beach (top, right), T3 Beach (bottom, left), and T4 Beach (bottom, right). Photos were taken on 15 and 17 July 2020.

Appendix 2 – Photo Point

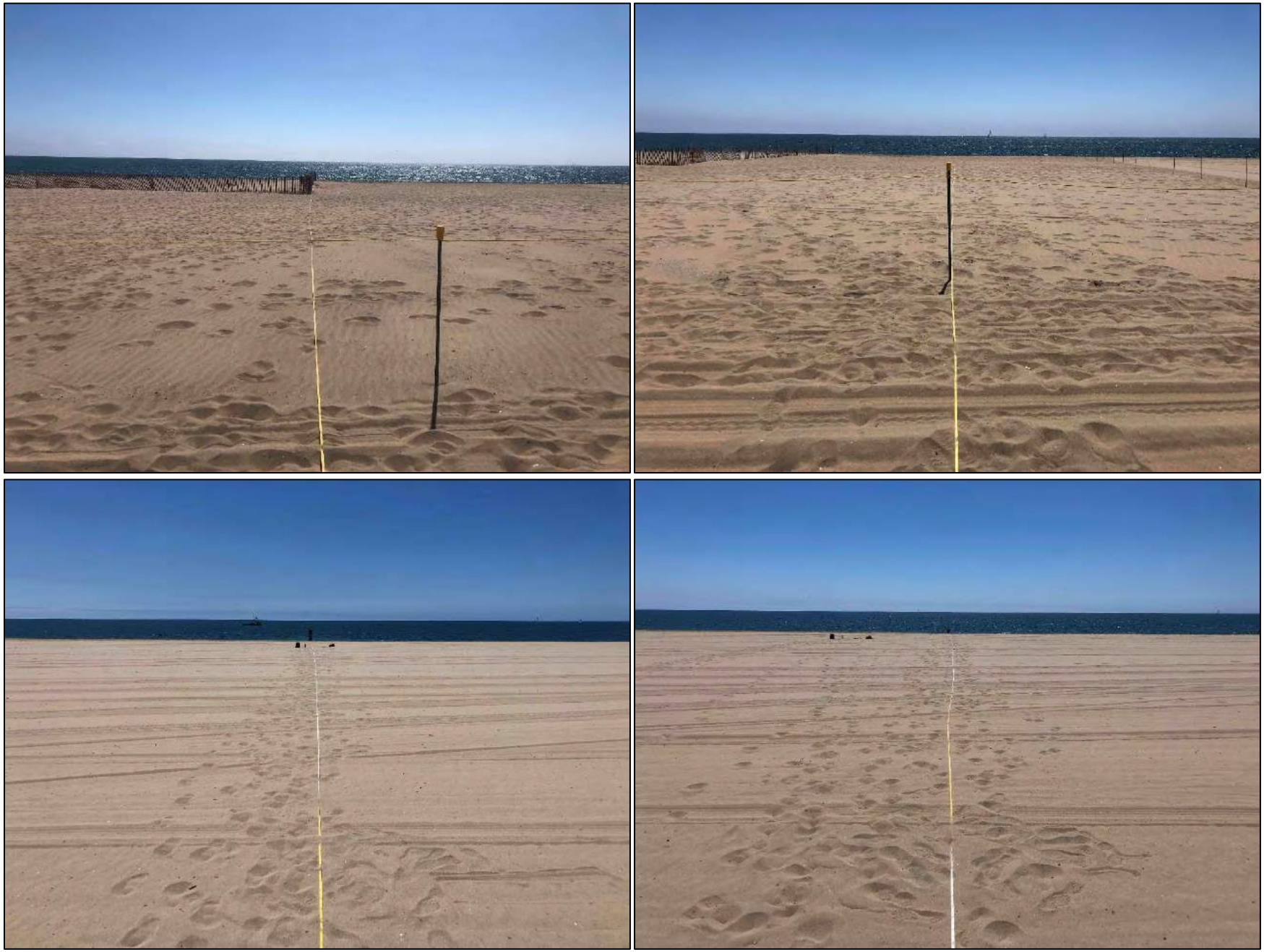


Photo Point T5 Beach (top, left), T6 Beach (top, right), C1 Beach (bottom, left), and C2 Beach (bottom, right). Photos were taken on 15 and 17 July 2020.

Appendix 2 – Photo Point

Photo Point T1 Bluff (top, left), T2 Bluff (top, right), T3 Bluff (bottom, left), and T4 Bluff (bottom, right). Photos were taken on 15 and 17 July 2020.

Appendix 2 – Photo Point

Photo Point C1 Bluff (left) and C2 Bluff (right). Photos were taken on 15 and 17 July 2020.

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Amphibians	*Taricha torosa*	Coast Range newt	None	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Amphibians	*Spea hammondii*	western spadefoot	None	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Arachnids	*Socalchemmis gertschi*	Gertsch's socalchemmis spider	None	None	-	-	information unavailable	Careful hand removal of invasive vegetation
Birds	*Accipiter cooperii*	Cooper's hawk	None	None	WL	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Accipiter striatus*	sharp-shinned hawk	None	None	WL	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Aquila chrysaetos*	golden eagle	None	None	FP; WL	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Buteo regalis*	ferruginous hawk	None	None	WL	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Buteo swainsoni*	Swainson's hawk	None	Threatened	-	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Circus hudsonius*	northern harrier	None	None	SSC	-	possible forage, no nesting habitat	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Elanus leucurus*	white-tailed kite	None	None	FP	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Eremophila alpestris actia*	California horned lark	None	None	WL	-	possible nesting habitat	Pre-restoration bird survey
Birds	*Aythya americana*	redhead	None	None	SSC	-	possible flyover	Pre-restoration bird survey
Birds	*Branta bernicla*	brant	None	None	SSC	-	possible flyover	Pre-restoration bird survey
Birds	*Dendrocygna bicolor*	fulvous whistling-duck	None	None	SSC	-	possible flyover	Pre-restoration bird survey
Birds	*Chaetura vauxi*	Vaux's swift	None	None	SSC	-	possible flyover	Pre-restoration bird survey
Birds	*Ardea alba*	great egret	None	None	-	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Ardea herodias*	great blue heron	None	None	-	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Botaurus lentiginosus*	American bittern	None	None	-	-	not appropriate habitat	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Egretta thula*	snowy egret	None	None	-	-	possible on or adjacent to habitat	Pre-restoration bird survey
Birds	*Ixobrychus exilis*	least bittern	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Nycticorax nycticorax*	black-crowned night heron	None	None	-	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Piranga rubra*	summer tanager	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Gymnogyps californianus*	California condor	Endangered	Endangered	FP	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Charadrius alexandrinus nivosus*	western snowy plover	Threatened	None	SSC	-	present on site; foraging and nesting in beach area	* See Conservation Measure Narrative; no activities in nesting season; minimize disturbance in roosting season
Birds	*Charadrius montanus*	mountain plover	None	None	SSC	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Mycteria americana*	wood stork	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Coccyzus americanus occidentalis*	western yellow-billed cuckoo	Threatened	Endangered	-	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Falco columbarius*	merlin	None	None	WL	-	possible flyover	Pre-restoration bird survey
Birds	*Falco mexicanus*	prairie falcon	None	None	WL	-	possible flyover	Pre-restoration bird survey
Birds	*Falco peregrinus anatum*	American peregrine falcon	Delisted	Delisted	FP	-	possible flyover	Pre-restoration bird survey
Birds	Spinus lawrencei	Lawrence's goldfinch	None	None	-	-	possible flyover; sightings in Marina del Rey and El Porto	Pre-restoration bird survey
Birds	*Gavia immer*	common loon	None	None	SSC	-	possible flyover	Pre-restoration bird survey
Birds	*Antigone canadensis canadensis*	lesser sandhill crane	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Antigone canadensis tabida*	greater sandhill crane	None	Threatened	FP	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Riparia riparia*	bank swallow	None	Threatened	-	-	possible flyover; records at Ballona	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Agelaius tricolor*	tricolored blackbird	None	Threatened	SSC	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Xanthocephalus xanthocephalus*	yellow-headed blackbird	None	None	SSC	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Icteria virens*	yellow-breasted chat	None	None	SSC	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Lanius ludovicianus*	loggerhead shrike	None	None	SSC	-	possible forage, no nesting habitat; historic records on site	Pre-restoration bird survey
Birds	*Chlidonias niger*	black tern	None	None	SSC	-	possible flyover and/or roost	Pre-restoration bird survey
Birds	*Hydroprogne caspia*	Caspian tern	None	None	-	-	possible flyover and/or roost	Pre-restoration bird survey
Birds	*Larus californicus*	California gull	None	None	WL	-	possible flyover and/or roost	Pre-restoration bird survey
Birds	*Sternula antillarum browni*	California least tern	Endangered	Endangered	FP	-	occasionally present on or adjacent to site; no nesting activity	* See Conservation Measure Narrative; no activities in nesting season; minimize disturbance in roosting season

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Thalasseus elegans*	elegant tern	None	None	WL	-	possible flyover and/or roost	Pre-restoration bird survey
Birds	*Pandion haliaetus*	osprey	None	None	WL	-	possible forage, no nesting habitat	Pre-restoration bird survey
Birds	*Baeolophus inornatus*	oak titmouse	None	None	-	-	possible flyover; not preferred habitat	Pre-restoration bird survey
Birds	*Setophaga petechia*	yellow warbler	None	None	SSC	-	possible flyover; records at Ballona and LAX Dunes	Pre-restoration bird survey
Birds	*Aimophila ruficeps canescens*	southern California rufous-crowned sparrow	None	None	WL	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Ammodramus savannarum*	grasshopper sparrow	None	None	SSC	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Passerculus sandwichensis beldingi*	Belding's savannah sparrow	None	Endangered	-	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Passerculus sandwichensis rostratus*	large-billed savannah sparrow	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Spizella breweri*	Brewer's sparrow	None	None	-	-	possible flyover; records at Ballona	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Pelecanus occidentalis californicus*	California brown pelican	Delisted	Delisted	FP	-	possible flyover and/or roost; records at Ballona	Pre-restoration bird survey
Birds	*Phalacrocorax auritus*	double-crested cormorant	None	None	WL	-	possible flyover and/or roost; records at Ballona	Pre-restoration bird survey
Birds	*Sphyrapicus ruber*	red-breasted sapsucker	None	None	-	-	possible flyover; sightings in Ballona	Pre-restoration bird survey
Birds	*Polioptila californica californica*	coastal California gnatcatcher	Threatened	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Coturnicops noveboracensis*	yellow rail	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Laterallus jamaicensis coturniculus*	California black rail	None	Threatened	FP	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Rallus obsoletus levipes*	light-footed Ridgway's rail	Endangered	Endangered	FP	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Rallus obsoletus obsoletus*	California Ridgway's rail	Endangered	Endangered	FP	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Numenius americanus*	long-billed curlew	None	None	WL	-	foraging along shoreline (possible)	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Athene cunicularia*	burrowing owl	None	None	SSC	-	historical records in area; none identified on site	Pre-restoration bird survey
Birds	*Plegadis chihi*	white-faced ibis	None	None	WL	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Calypte costae*	Costa's hummingbird	None	None	-	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Selasphorus rufus*	rufous hummingbird	None	None	-	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Campylorhynchus brunneicapillus sandiegensis*	coastal cactus wren	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Cistothorus palustris clarkae*	Clark's marsh wren	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Contopus cooperi*	olive-sided flycatcher	None	None	SSC	-	possible flyover; records at LAX Dunes	Pre-restoration bird survey
Birds	*Empidonax traillii*	willow flycatcher	None	Endangered	-	-	possible flyover; records at Ballona	Pre-restoration bird survey
Birds	*Empidonax traillii extimus*	southwestern willow flycatcher	Endangered	Endangered	-	-	not appropriate habitat	Pre-restoration bird survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Birds	*Pyrocephalus rubinus*	vermilion flycatcher	None	None	SSC	-	not appropriate habitat	Pre-restoration bird survey
Birds	*Vireo bellii pusillus*	least Bell's vireo	Endangered	Endangered	-	-	not appropriate habitat	Pre-restoration bird survey
Crustaceans	*Streptocephalus woottoni*	Riverside fairy shrimp	Endangered	None	-	-	no appropriate aquatic habitat	No measures required
Fish	*Gila orcuttii*	arroyo chub	None	None	SSC	-	no appropriate aquatic habitat	No measures required
Fish	*Siphateles bicolor mohavensis*	Mohave tui chub	Endangered	Endangered	FP	-	no appropriate aquatic habitat	No measures required
Fish	*Eucyclogobius newberryi*	tidewater goby	Endangered	None	SSC	-	no appropriate aquatic habitat	No measures required
Fish	*Oncorhynchus mykiss irideus pop. 10*	steelhead - southern California DPS	Endangered	None	-	-	no appropriate aquatic habitat	No measures required
Insects	*Bombus crotchii*	Crotch bumble bee	None	Candidate Endangered	-	-	observed in nearby locations in Ballona and Manhattan Beach	Careful hand removal of invasive vegetation
Insects	*Cicindela gabbii*	western tidal-flat tiger beetle	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Insects	*Cicindela hirticollis gravida*	sandy beach tiger beetle	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Cicindela senilis frosti*	senile tiger beetle	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Carolella busckana*	Busck's gallmoth	None	None	-	-	no information available	Careful hand removal of invasive vegetation
Insects	*Onychobaris langei*	Lange's El Segundo Dune weevil	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Trigonoscuta dorothea dorothea*	Dorothy's El Segundo Dune weevil	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Panoquina errans*	wandering skipper	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Euphilotes battoides allyni*	El Segundo blue butterfly	Endangered	None	-	-	obligate to coast buckwheat; none currently on site, but identified in south Dockweiler and LAX Dunes	* See Conservation Measure Narrative; careful removal of invasive vegetation
Insects	*Glaucopsyche lygdamus palosverdesensis*	Palos Verdes blue butterfly	Endangered	None	-	-	no sightings, but habitat may be appropriate; observations in Palos Verdes	Careful hand removal of invasive vegetation

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Insects	*Rhaphiomidas terminatus terminatus*	El Segundo flower-loving fly	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Danaus plexippus pop. 1*	monarch - California overwintering population	None	None	-	-	not appropriate habitat	Careful hand removal of invasive vegetation
Insects	*Brennania belkini*	Belkin's dune tabanid fly	None	None	-	-	no sightings, but habitat may be appropriate	Careful hand removal of invasive vegetation
Insects	*Coelus globosus*	globose dune beetle	None	None	-	-	populations appear to avoid LA area	Careful hand removal of invasive vegetation
Insects	*Aglaothorax longipennis*	Santa Monica shieldback katydid	None	None	-	-	not sufficient information; unlikely to occur	Careful hand removal of invasive vegetation
Insects	*Eucosma hennei*	Henne's eucosman moth	None	None	-	-	not sufficient information; unlikely to occur	Careful hand removal of invasive vegetation
Mammals	*Perognathus longimembris pacificus*	Pacific pocket mouse	Endangered	None	SSC	-	no sightings, but habitat may be appropriate	Pre-restoration wildlife survey
Mammals	*Lepus californicus bennettii*	San Diego black-tailed jackrabbit	None	None	SSC	-	no sightings, but habitat may be appropriate	Pre-restoration wildlife survey
Mammals	*Eumops perotis californicus*	western mastiff bat	None	None	SSC	-	site within range of species	Pre-restoration wildlife survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Mammals	*Nyctinomops femorosaccus*	pocketed free-tailed bat	None	None	SSC	-	range is further south	Pre-restoration wildlife survey
Mammals	*Nyctinomops macrotis*	big free-tailed bat	None	None	SSC	-	potential migratory flyover	Pre-restoration wildlife survey
Mammals	*Microtus californicus stephensi*	south coast marsh vole	None	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Mammals	*Neotoma lepida intermedia*	San Diego desert woodrat	None	None	SSC	-	habitat does not appear appropriate	Pre-restoration wildlife survey
Mammals	*Taxidea taxus*	American badger	None	None	SSC	-	not appropriate habitat	Pre-restoration wildlife survey
Mammals	*Sorex ornatus salicornicus*	southern California saltmarsh shrew	None	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Mammals	*Antrozous pallidus*	pallid bat	None	None	SSC	-	potential flyover	Pre-restoration wildlife survey
Mammals	*Lasionycteris noctivagans*	silver-haired bat	None	None	-	-	not within range	Pre-restoration wildlife survey
Mammals	*Lasiurus cinereus*	hoary bat	None	None	-	-	possible flyover	Pre-restoration wildlife survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Mollusks	*Tryonia imitator*	mimic tryonia (California brackishwater snail)	None	None	-	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Reptiles	*Anniella stebbinsi*	southern California legless lizard	None	None	SSC	-	none seen on site, but presence possible	* See Conservation Measure Narrative; careful removal of invasive vegetation
Reptiles	*Diadophis punctatus modestus*	San Bernardino ringneck snake	None	None	-	-	site within range of species; unlikely to occur	Pre-restoration wildlife survey
Reptiles	*Emys marmorata*	western pond turtle	None	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Reptiles	*Thamnophis hammondii*	two-striped gartersnake	None	None	SSC	-	site within range of species; unlikely to occur	Pre-restoration wildlife survey
Reptiles	*Thamnophis sirtalis pop. 1*	south coast gartersnake	None	None	SSC	-	site within range of species; unlikely to occur	Pre-restoration wildlife survey
Reptiles	*Phrynosoma blainvillii*	coast horned lizard	None	None	SSC	-	none seen on site, but presence possible	* See Conservation Measure Narrative; careful removal of invasive vegetation
Reptiles	*Aspidoscelis tigris stejnegeri*	coastal whiptail	None	None	SSC	-	site within range of species; unlikely to occur	Pre-restoration wildlife survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Terrestrial Community	*California Walnut Woodland*	California Walnut Woodland	None	None	-	-	none identified on site	No measures needed
Terrestrial Community	*Southern Coast Live Oak Riparian Forest*	Southern Coast Live Oak Riparian Forest	None	None	-	-	none identified on site	No measures needed
Terrestrial Community	*Southern Coastal Bluff Scrub*	Southern Coastal Bluff Scrub	None	None	-	-	none identified on site	
Terrestrial Community	*Southern Coastal Salt Marsh*	Southern Coastal Salt Marsh	None	None	-	-	none identified on site	No measures needed
Terrestrial Community	*Southern Dune Scrub*	Southern Dune Scrub	None	None	-	-	none identified on site	
Terrestrial Community	*Southern Sycamore Alder Riparian Woodland*	Southern Sycamore Alder Riparian Woodland	None	None	-	-	none identified on site	No measures needed
Vascular Plant	Eryngium aristulatum var. parishii	San Diego button-celery	Endangered	Endangered	-	1B.1	potentially appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Spermolepis lateriflora*	western bristly scaleseed	None	None	-	2A	site not within extant california range	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Centromadia parryi ssp. australis*	southern tarplant	None	None	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Centromadia pungens ssp. laevis*	smooth tarplant	None	None	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Chaenactis glabriuscula var. orcuttiana*	Orcutt's pincushion	None	None	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Deinandra minthornii*	Santa Susana tarplant	None	Rare	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Deinandra paniculata*	paniculate tarplant	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Helianthus nuttallii ssp. parishii*	Los Angeles sunflower	None	None	-	1A	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Isocoma menziesiiis var. decumbens*	decumbent goldenbush	None	None	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Lasthenia glabrata ssp. coulteri*	Coulter's goldfields	None	None	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Pentachaeta lyonii*	Lyon's pentachaeta	Endangered	Endangered	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Pseudognaphalium leucocephalum*	white rabbit-tobacco	None	None	-	2B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Symphyotrichum defoliatum*	San Bernardino aster	None	None	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Symphyotrichum greatae*	Greata's aster	None	None	-	1B.3	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Berberis nevinii*	Nevin's barberry	Endangered	Endangered	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Dithyrea maritima*	beach spectaclepod	None	Threatened	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Erysimum insulare*	island wallflower	None	None	-	1B.3	potentially appropriate habitat; none identified on site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Erysimum suffrutescens*	suffrutescent wallflower	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Nasturtium gambelii*	Gambel's water cress	Endangered	Threatened	-	1B.1	no extant communities near site	Pre-restoration plant survey
Vascular Plant	*Arenaria paludicola*	marsh sandwort	Endangered	Endangered	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Aphanisma blitoides*	aphanisma	None	None	-	1B.2	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Atriplex coulteri*	Coulter's saltbush	None	None	-	1B.2	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Atriplex pacifica*	south coast saltscale	None	None	-	1B.2	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Atriplex parishii*	Parish’s brittlescale	None	None	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Atriplex serenana var. davidsonii*	Davidson’s saltscale	None	None	-	1B.2	presumed extirpated	Pre-restoration plant survey
Vascular Plant	*Chenopodium littoreum*	coastal goosefoot	None	None	-	1B.2	no extant communities near site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Suaeda esteroa*	estuary seablite	None	None	-	1B.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Suaeda taxifolia*	woolly seablite	None	None	-	4.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Calystegia felix*	lucky morning-glory	None	None	-	1B.1	presumed extirpated	Pre-restoration plant survey
Vascular Plant	*Calystegia peirsonii*	Peirson's morning-glory	None	None	-	4.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Convolvulus simulans*	small-flowered morning-glory	None	None	-	4.2	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Dichondra occidentalis*	western dichondra	None	None	-	4.2	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Dudleya resum ssp. Ovatifolia*	Santa Monica dudleya	Threatened	None	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Dudleya multicaulis*	many-stemmed dudleya	None	None	-	1B.2	appropriate habitat; none identified on site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Dudleya virens ssp. Insularis*	island green dudleya	None	None	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Astragalus brauntonii*	Braunton's milk-vetch	Endangered	None	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Astragalus pycnostachyus var. lanosissimus*	Ventura Marsh milk-vetch	Endangered	Endangered	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Astragalus tener var. titi*	coastal dunes milk-vetch	Endangered	Endangered	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Quercus dumosa*	Nuttall's scrub oak	None	None	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Phacelia hubbyi*	Hubby's phacelia	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Phacelia ramosissima var. austrolitoralis*	south coast branching phacelia	None	None	-	3.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Phacelia stellaris*	Brand's star phacelia	None	None	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Juglans californica*	southern California black walnut	None	None	-	4.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Juncus acutus ssp. Leopoldii*	southwestern spiny rush	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Lepechinia fragrans*	fragrant pitcher sage	None	None	-	4.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Monardella hypoleuca ssp. Hypoleuca*	white-veined monardella	None	None	-	1B.3	presumed extirpated	Pre-restoration plant survey
Vascular Plant	*Calochortus catalinae*	Catalina mariposa-lily	None	None	-	4.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Calochortus clavatus var. gracilis*	slender mariposa-lily	None	None	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Calochortus plummerae*	Plummer's mariposa-lily	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Sidalcea neomexicana*	salt spring checkerbloom	None	None	-	2B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Calandrinia breweri*	Brewer's calandrinia	None	None	-	4.2	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Cistanthe maritima*	seaside cistanthe	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Nama stenocarpa*	mud nama	None	None	-	2B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Abronia maritima*	red sand-verbena	None	None	-	4.2	confirmed present on site	* See Conservation Measure Narrative; pre-restoration plant survey; no removal of verbena where present
Vascular Plant	*Camissoniopsis lewisii*	Lewis' evening-primrose	None	None	-	3	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Chloropyron maritimum ssp. maritimum*	salt marsh bird's-beak	Endangered	Endangered	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Hordeum intercedens*	vernal barley	None	None	-	3.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Orcuttia californica*	California Orcutt grass	Endangered	Endangered	-	1B.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Navarretia fossalis*	spreading navarretia	Threatened	None	-	1B.1	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Navarretia prostrata*	prostrate vernal pool navarretia	None	None	-	1B.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Chorizanthe parryi var. fernandina*	San Fernando Valley spineflower	Proposed Threatened	Endangered	-	1B.1	presumed extirpated	Pre-restoration plant survey
Vascular Plant	*Cercocarpus betuloides var. blancheae*	island mountain-mahogany	None	None	-	4.3	not appropriate habitat	Pre-restoration plant survey
Vascular Plant	*Horkelia cuneata var. puberula*	mesa horkelia	None	None	-	1B.1	appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Potentilla multijuga*	Ballona cinquefoil	None	None	-	1A	presumed extirpated	Pre-restoration plant survey
Vascular Plant	*Galium cliftonsmithii*	Santa Barbara bedstraw	None	None	-	4.3	not appropriate habitat	Pre-restoration plant survey

Appendix 3 – CNDDB List for Venice Quad with Additional Observation and Conservation Measures

Category	Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Project Site Notes	Conservation Measures
Amphibians	*Rana draytonii*	California red-legged frog	Threatened	None	SSC	-	no appropriate aquatic habitat	Pre-restoration wildlife survey
Vascular Plant	*Lycium brevipes var. hassei*	Santa Catalina Island desert-thorn	None	None	-	3.1	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Lycium californicum*	California box-thorn	None	None	-	4.2	potentially appropriate habitat; none identified on site	Pre-restoration plant survey
Vascular Plant	*Thelypteris puberula var. sonorensis*	Sonoran maiden fern	None	None	-	2B.2	not appropriate habitat	Pre-restoration plant survey

Appendix 4 – Interpretive Signage

WELCOME TO THE LOS ANGELES Living Shoreline Project

Proyecto de costa viviente

What is a Living Shoreline?

A living shoreline uses natural processes to provide protection from storms and sea level rise while creating habitats for plants and wildlife. Healthy beach habitats depend on the waves, winds, and connections between the ocean and the coast. A living shoreline approach reduces the need for costly 'hard' shoreline protection such as seawalls.

¿Qué es una costa viviente?

Una costa viviente utiliza procesos naturales para brindar protección contra las tormentas y el aumento del nivel del mar mientras crea hábitats para las plantas nativas y la vida silvestre. Los hábitats de playas saludables dependen de las olas, los vientos, y las conexiones entre el océano y la costa. Un enfoque de la costa viviente reduce la necesidad de protecciones costosas y "duras" como los rompeolas.

Development and beach management practices have altered or removed most of the natural dune and coastal bluff habitats along Santa Monica Bay.

Sand plays an important role in creating the beaches and dunes you see before you. Some sand moved by ocean currents is captured by offshore vegetation, while other sand is moved by waves and wind to be deposited on the beach to form sand dunes.

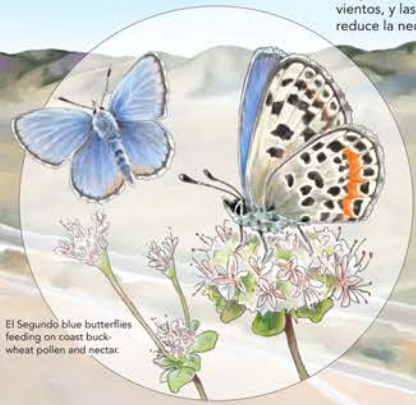
This discovery path is designed to reconnect you to our historic coastal habitats and demonstrate a natural approach for improving resilience to coastal storms and sea level rise.

Las prácticas de desarrollo y manejo de playas han alterado o eliminado la mayoría de las dunas y los hábitats de acantilados costeros naturales a lo largo de la bahia de Santa Mónica.

La arena juega un papel importante en la creación de las playas y dunas ante usted. Parte de la arena movida por las corrientes oceánicas es capturada por la vegetación de la costa, mientras que otra arena es movida por las olas y el viento para depositarse en la playa y formar dunas de arena.

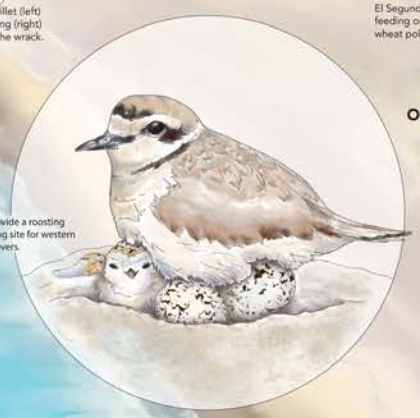
Esta ruta de descubrimiento está diseñada para reconectarse con nuestros hábitats costeros históricos y demostrar un enfoque natural para mejorar la resistencia a las tormentas costeras y al aumento del nivel del mar.

A western willet (left) and sanderling (right) foraging in the wrack.



El Segundo blue butterflies feeding on coast buckwheat pollen and nectar.

A bat ray (top), California spiny lobster (left), kelp bass (right), and California halibut (bottom), in the eelgrass.



Dunes provide a roosting and nesting site for western snowy plovers.

One Project, Three Sites:

Offshore, eelgrass beds stabilize sand, capture carbon, and provide valuable habitat for marine species.

Onshore, beach wrack supports the sandy beach ecosystem, captures sand transported by wind, and creates sand dunes. As dune vegetation grows, plants trap windblown sand and grow in height providing a natural defense from coastal storms and rising sea levels.

At the back of the beach, a coastal bluff restored with native vegetation provides habitat for wildlife, stabilizes the soil to reduce erosion, and improves storm protection.

Rains wash sand from the hills above the Santa Monica Bay down river channels, while ocean currents, tides, and wave action move this sand along the coast and our beaches.

Eelgrass Beds

Wrack Zone

Beach Restoration

Bluff Restoration

You Are Here
Estás aquí

Note: This profile is not to scale

Funding from California Coastal Conservancy's Climate Ready Program
Design By: Integral Consulting & Lucas Illustration & Design

LOS ANGELES Living Shoreline Project

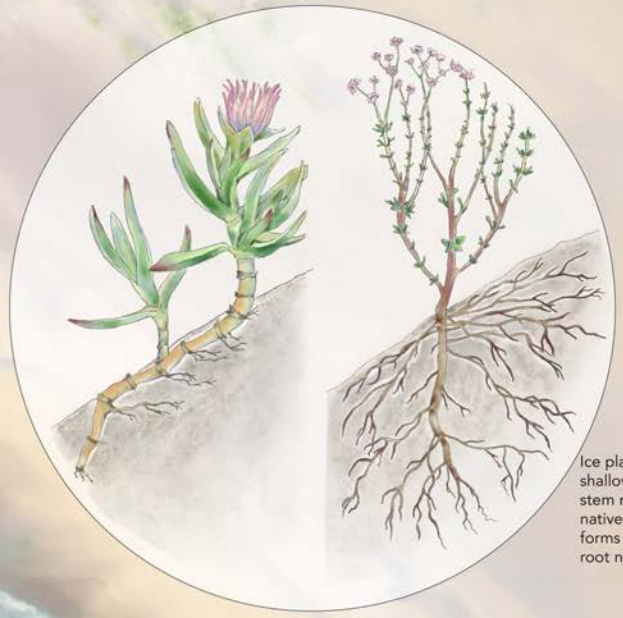
Proyecto de costa viviente

Restored Coastal Bluff Habitat

The coastal bluff before you is vegetated by native plants, such as seacliff buckwheat, which form deep roots that help stabilize slopes and provide habitat for a wide variety of birds, reptiles, small mammals, butterflies, and other insects, including the El Segundo Blue Butterfly.

Previously, portions of this bluff were vegetated by ice plant, which is a non-native, invasive species found along many of California's roadsides. Ice plant forms dense mats that exclude native plants and animals, alter soil conditions, cause erosion, and support invasive species such as black rats that prey on native species. With native plants, the bluff area supports higher biodiversity, reduced erosion, and a return to the beauty of a historical landscape and culture.

El Segundo blue butterflies feed on coast buckwheat pollen and nectar. This butterfly is found in just a few places along the Southern California Coast.



Ice plant (left) with a shallow root and stem network. A native shrub (right) forms a much deeper root network.

Hábitat de acantilados costeros restaurados

El acantilado costero que se encuentra frente a usted está cubierto de plantas nativas, como el trigo sarraceno del acantilado, que forman raíces profundas que ayudan a estabilizar las laderas y proporcionan hábitat para una amplia variedad de aves, reptiles, pequeños mamíferos, mariposas, y otros insectos, incluyendo la mariposa azul de El Segundo.

Anteriormente, porciones de este acantilado estaba vegetada por la planta de hielo, que es una especie invasora que se encuentra a lo largo de muchas carreteras de California. La planta de hielo forma esteras densas que excluyen a las plantas y animales nativos alteran las condiciones del suelo, causan erosión, y dan soporte a especies invasoras como las ratas negras que se alimentan de especies nativas. Con plantas nativas, el área del acantilado brinda a la playa una biodiversidad más alta, reduce la erosión, y regresa la belleza del paisaje y la cultura histórica.

Project Area

You Are Here

Estás aquí

Note: This profile is not to scale

Funding from California Coastal Conservancy's Climate Ready Program
Design By: Integral Consulting & Luczo Illustration & Design

LOS ANGELES Living Shoreline Project

Proyecto de costa viviente

Restored Dune Habitat

Dunes are storage places for sand, topped with vegetation that is specially adapted to withstand the hot sun, relentless wind, and limited nutrients and water. Dunes are formed when plant seeds deposited on the beach start to grow and begin trapping more sand, with time adding elevation to the dunes.

Vegetated dunes provide an important habitat for many animals. They naturally erode sand in the winter and build sand up in the summer. These seasonal changes increase the beach's resilience to storm waves and sea level rise with little need for human intervention.

Dunes provide a roosting and nesting site for western snowy plovers, as well as habitat for other native birds, plants, and animals.

Hábitat de las dunas restauradas

Las dunas son lugares de almacenamiento para arena, cubiertos con vegetación especialmente adaptada para resistir el sol caliente, el viento implacable, y nutrientes y agua limitados. Las dunas se forman cuando las semillas de plantas depositadas en la playa comienzan a crecer y atrapar más arena, con el tiempo agregando elevación a las dunas.

Las dunas con vegetación proporcionan un hábitat importante para muchos animales. Erosionan naturalmente la arena en el invierno y acumulan arena en el verano. Estos cambios estacionales aumentan la resistencia de la playa a las olas de tormenta y al aumento del nivel del mar con poca necesidad de intervención humana.

Project Area

You Are Here

Estás aquí

Note: This profile is not to scale

Funding from California Coastal Conservancy's Climate Ready Program
Design By: Integral Consulting & Luczo Illustration & Design

LOS ANGELES Living Shoreline Project

Proyecto de costa viviente

The stem, or rhizome, of the eelgrass plant grows just below the surface. Roots emerge to take in nutrients and help anchor the plant. In the foreground (right), a wavy turban snail.

Restored Eelgrass Habitat

Santa Monica Bay's sandy bottom, calm wave conditions, and mild ocean temperatures are ideal growing conditions for a type of eelgrass known as *Zostera pacifica*. This eelgrass grows in meadows, creating spawning and nursery habitat for fish as well as a variety of snails, crabs, sand dollars, anemones, and clams.

Eelgrass, like land plants, have roots which anchor the plant to the seafloor. Sand and nutrients are trapped as they drift by, stabilizing the seafloor and protecting animals during times of strong waves and currents.

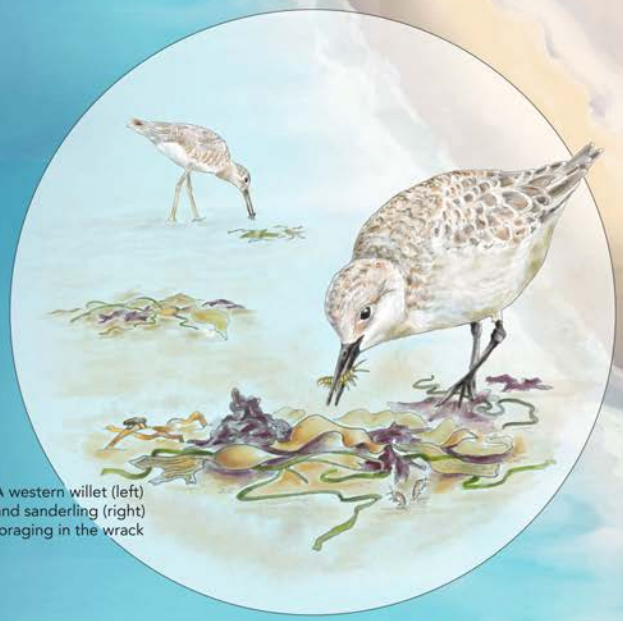
When eelgrass detaches from the seafloor, it washes onto the beach providing important food for the sandy beach ecosystem. Washed up eelgrass and other drifting material, called wrack, helps to form sand dunes and feeds small animals such as beach hoppers, which are food for shore birds such as western snowy plovers, sanderlings, and willets.

Hábitat de *Zostera pacífica* restaurada

El fondo arenoso de la bahía de Santa Mónica, las condiciones de las olas tranquilas, y las temperaturas suaves del océano son condiciones ideales para el crecimiento de un tipo de hierba marina conocida como *Zostera pacífica*. Esta Zostera crece en prados, creando un hábitat de desove y vivero para peces, así como a una variedad de caracoles, cangrejos, dólares de arena, anémonas, y almejas.

Z. pacífica, al igual que las plantas de tierra firme, tienen raíces que anclan la planta al fondo marino. La arena y los nutrientes quedan atrapados a medida que pasan, estabilizando el fondo marino y protegiendo a los animales en épocas de fuertes olas y corrientes.

Cuando la *Z. pacífica* se desprende del fondo marino, es arrastrada a la playa y proporciona un alimento importante para el ecosistema de la playa arenosa. La *Z. pacífica* arrastrada y otro material a la deriva, llamado wrack, ayuda a formar dunas de arena y alimenta a los animales pequeños como las pulgas de arena, que son alimento para las aves costeras como los chorlitos nevados occidentales, correlimos, y willets.



A western willet (left) and sanderling (right) foraging in the wrack

Project Area

Wrack Zone

You Are Here

Estás aquí

Note: This profile is not to scale

Funding from California Coastal Conservancy's Climate Ready Program
Design By: Integral Consulting & Luczo Illustration & Design